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IDH COFFEE FARMER INCOME RESILIENCE PROGRAM: BASELINE REPORT

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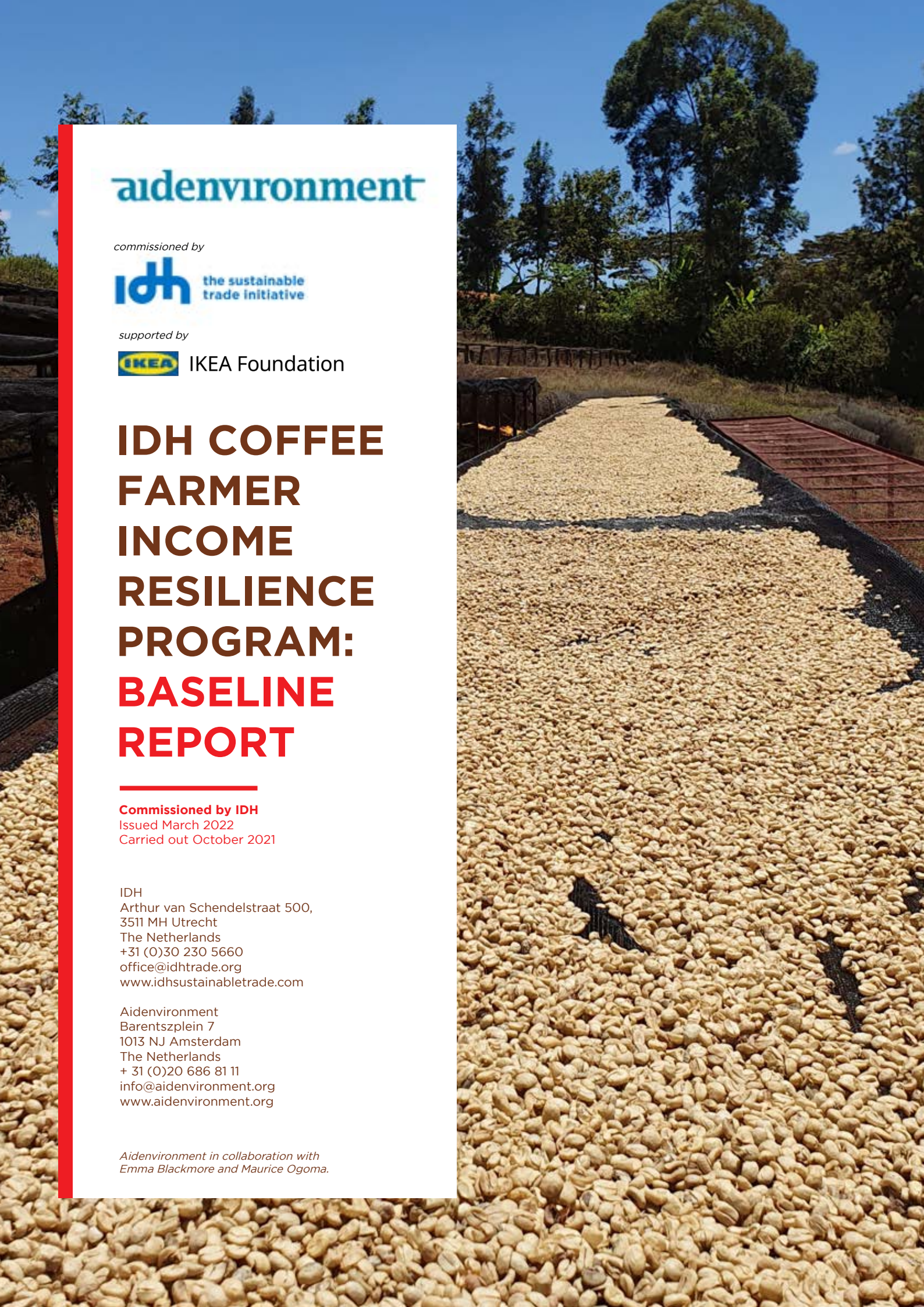

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Executive Summary

The Coffee Farmer Income Resilience Program (CFIRP)

The CFIRP is a new partnership between the IKEA Foundation ("IKF") and IDH, working on income resilience and regenerative agriculture. Its mission is to expand IDH's service delivery model approach in the coffee sector to develop a robust proof of concept for blending coffee-specific services with services for other non-coffee farm produce. Through this program IDH will co-develop sustainable and economically viable service delivery systems that integrate a stepwise approach to achieving income resilience for farmers while transitioning farm systems to regenerative agriculture.

Baseline methods

IDH wishes to obtain baseline data to allow for the impact of its program to be measured over time. The aim of the baseline is to identify the starting point of the target groups, so IDH can further improve their program strategies and are able to follow up on the effectiveness of the program interventions. This report presents the results from the baseline study, conducted in September and October 2021 in three regions in Kenya and three regions in Uganda. It applied a theory of change-based mixed-method approach which included 474 surveys, 232 soil health checks and 15 focus group discussion (FGDs) with farmers targeted by the program. In addition, we conducted 49 key informant interviews with relevant stakeholders at national and local level.

Baseline results

Farmer and farm characteristics

The targeted coffee farmers in both countries are predominantly male and above 50 years old. They have diverse farming systems and typically grow three to four crops in addition to coffee. Almost all farmers keep some form of livestock. Farmers in Uganda have on average larger total farm sizes and coffee plots than in Kenya. There is great variety in coffee tree densities, linked to different practices in intercropping and planting of shade trees. This supports the relevance of blended service delivery for coffee and other crops in the project intervention areas.

Final outcomes: income and soil health

Farm income is the primary source of income for the farmer households surveyed in Kenya and Uganda with coffee being the main income generator. Coffee represents approximately half of the total farm income for Arabica farmers in both countries, while this is almost three quarters for Robusta farmers in Uganda. Kenyan farmers invest more money in their coffee farm than Ugandan farmers and are also more profitable. Most farmers do not incur production costs for their other crops which generally represent only a small proportion of the total farm income and are used for subsistence purposes.

Almost all farmers have hungry months and months of low cash flow. Farmers with savings and access to loans have fewer hungry months and months of cash flow shortages. Farmers in Uganda are more likely to have experienced income shocks over the last two years than Kenyan farmers (due predominantly to drought and COVID). In terms of strategies adopted to respond to shocks, the most common strategy for farmers in both Kenya and Uganda was to use their savings.

Soil health is generally good for the majority of farmers on their main coffee plots, though there is some variation and context specific improvements are welcome. The soil tests found some imbalances which could be improved though simple measures (liming, application of manure and crop residues and diligent application of blended fertilizers with micronutrients depending on the needs of specific soils). Both key informants and farmers did highlight the risk that continuous unsustainable practices (e.g. the wrong or overuse of chemical fertilizers, in part driven by a lack of knowledge of the soils) could lead to deterioration in soil conditions.

Intermediate outcomes: productivity, farming practices, household decision-making and child labour

Farmers in Kenya have significantly higher coffee yields than farmers in Uganda. Trends in production volumes of coffee over the past two years are mixed. FGDs and KIIs revealed that where farmers have experienced decreases in production, this can be predominantly linked to weather changes and pest and disease outbreaks. Farmer reported stable volumes for most other crops.

Farmers adopt many farming practices that are relevant to regenerative agriculture, but there is significant room for optimization. While most farmers adopt practices relevant to plant diversity or managing soil organic matter (e.g. intercropping, shade trees, mulching) they are not necessarily applied in the best way. This is also valid for example for pest and disease management practices (most farmers face mild to severe problems with pests and diseases on their coffee plots) and soil erosion and water management practices. There is much room for improvement on individual practices and how they can be combined in a holistic way.

In regards to household decision-making, most farmers in both countries stated that decisions are made equally by both men and women, though in Uganda a far higher proportion of farmers responded that the man decides unilaterally as compared to Kenya. Men typically take decisions on to when or where to sell coffee, while women are more involved in other crops. For other household decisions (e.g. savings or schooling) the majority of the households had equal decision-making, followed by more male dominated decision-making.

We found no instances of child labour in Kenya. In Uganda, children can be involved in work on the farm during school time and may do hazardous work – the closure of schools due to the Covid pandemic likely exacerbated this situation and the observations of the research team of child labour on the sampled farms. In both countries measures to protect against child labour are in place, but in Uganda they are less effective.

Outputs: access to services

Service provision at the moment is patchy in regards to availability, relevance and tailoring to regenerative agriculture. There is room for improvement in both access, quality/satisfaction and relevance to regenerative agriculture. While some bundling of services takes place through cooperatives or farmer groups, most services target coffee only. As farmers divert inputs destined for coffee to other crops (e.g. fertilizers), there is the opportunity for more blended service delivery targeted to specific non-coffee crops.

Considerations for blended service delivery

From a farmer perspective it makes sense to have blended and bundled service provision based upon the principles of regenerative practices as long as services are relevant, of quality and fairly delivered. Special attention needs to be paid to whether additional investments in non-coffee crops will increase the financial vulnerability of farmers. For service providers, blended and bundled service delivery can offer opportunities to ensure security of supply and deliver market benefits, though it may also introduce new challenges and requirements/investments in terms of expertise, resources and partnership management. We found few examples of blended service delivery in the project context. Where they exist, they are often project-based and not build upon long-term commercial strategies. We did notice an increasing attention to regenerative agriculture particularly within development projects. Market dynamics and policy context are key influencing factors that need to be considered when promoting blended and bundled service provision. The presence of community-based or landscape management processes may also be a condition to ensure the presence of ecosystem services or to address child labour.

Recommendations

This baseline shows that there are plenty of farming practices to improve upon and plenty of service gaps to be filled. While site-specific soil health enhancement practices are welcome, soils found on major coffee growing plots are generally moderate to good. This may mean that a focus on improving soil health alone won't be sufficient to make notable improvements to farmer income. Income improvements will require a more holistic approach of farm diversification and sustainable intensification, in which good farming practices and the use of organic and inorganic inputs are combined in such way that they increase farm profitability while maintaining soil health in the long-term. Such a strategy can promote both farmer livelihoods and food security.

Offering blended and bundled services based upon regenerative agriculture principles can support farmer livelihoods and food security while creating the agro-ecological conditions which allow benefits to be sustained over time. It is, however, important to base the service offer on a careful assessment of the costs, benefits and risks of various RA practices and wherever possible to tailor to specific farmer realities. Service provision may also need to be segmented according to farmer type. Some potential relevant criteria include: existing crops/products, farm size, coffee tree density, purchasing power, household needs (e.g. cash or subsistence) and farmer age and willingness to change. An additional point of attention is that services, and particularly technical assistance, needs to be practical and inclusive. Service providers will also need to mitigate the risks that additional farmer investments (e.g. in enhancing production of non-coffee crops for market) will increase farmer's financial vulnerability. Therefore, offering reliable and remunerative market access is a key success factor in promoting long-term investments in additional crops.

Service providers will also need to adopt some risk mitigation strategies for their own operations. One thing will be to deal with possible new challenges in terms of expertise, resources and partnership management. Particularly when working with companies marketing non-coffee commodities or cooperatives and farmer groups to distribute services, it will be important that all actors are aligned and have the right capacities and aligned incentives. There is also still much to be learned with regards to regenerative agriculture and bundled service provision. IDH can play an important role in promoting knowledge development and sharing among the CFIRP partners and the other coffee and agricultural stakeholders in both countries.

At a local level, there is also a need to manage the risk of conflicting advice from other sources of information. Not all service providers promote practices which fit the principles of regenerative agriculture. This can confuse farmers and may undermine efforts to implement RA practices. To reduce these risks, IDH can and should promote coalition-building and alignment between stakeholders. This could ensure future sustainability and scaling. Relevant actors include the governments of Kenya (including local government) and Uganda, other coffee companies, companies from non-coffee industries, input suppliers/ service providers, NGOs, development projects, donors, financial institutions and voluntary standards.

Introduction

The Coffee Farmer Income Resilience Program (CFIRP) is a new partnership between the IKEA Foundation ("IKF") and IDH working on income resilience and regenerative agriculture. Its mission is to expand IDH's service delivery model approach in the coffee sector to develop a robust proof of concept for blending coffee-specific services with services for other non-coffee farm produce. Through this program IDH will co-develop sustainable and economically viable service delivery systems that integrate a stepwise approach to achieving income resilience for farmers while transitioning farm systems to regenerative agriculture.

IDH wishes to obtain baseline data to allow for the impact of its program to be measured over time. The aim of the baseline is to identify the starting point of the target groups, so IDH can further improve their program strategies and are able to follow up on the effectiveness of the programme interventions.

This report presents the results from the baseline study, conducted in September and October 2021 in three regions in Kenya and three regions in Uganda. We applied a theory of change-based mixed-method approach which included 474 surveys, 232 soil health checks and focus group discussion (FGDs) with farmers targeted by the program. It also included mini-surveys and focus groups discussions with non-targeted farmers, which should allow for more plausible conclusions in future contribution analysis as well as the identification of possible spill-over effects. In addition, we conducted key informant interviews with relevant stakeholders at national and local level. The findings in the main body of this report are based upon the key informant interviews and focus group discussions and surveys with intervention group farmers. The results of the comparison group analysis can be found in Appendix IV. See Appendix II for further information on the research methodology.

The report is structured as follows. Chapter 1 provides a brief introduction of the program Chapter 2 provides the general farmer and farm characteristics of the intervention group farmers. This is followed by several chapters which present the baseline findings following the program's theory of change: it starts with the intended final outcomes on income and soil health (chapter 3), followed by the intermediate outcomes on productivity, agricultural practices, household-decision making and child labour (chapter 4). Chapter 5 provides the data on the current access to services of the intervention group farmers. Chapter 6 provides more background information on the services landscape in the program context as well as some considerations on the advantages and disadvantages of blended service delivery. The report ends with conclusions and some recommendations for the program and its partners.

The appendices include more information on the research methodology (Appendix II) and the comparison group analysis (Appendix IV).

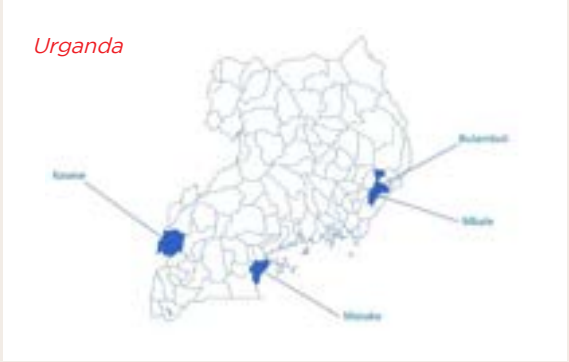
1. Program context

Program strategy

The Coffee Farmer Income Resilience Program (CFIRP) runs from 2021 till 2025. Its intended impact is to improve the livelihoods and income resilience of 20,000 coffee farming families in Kenya and Uganda. It pursues this by convening, co-designing and co-investing in blended service delivery models which support coffee farmers' progress towards regenerative agriculture, in close collaboration with 6 service providers, or consortia of service providers, which operate in 7 counties in Kenya and 5 districts in Uganda. The service providers are coffee companies being CMS, SMS and Kenyacof in Kenya and Mountain Harvest, Touton and Ugacof in Uganda.

Figure 1: the programmes intervention areas

Kenya



Urganda

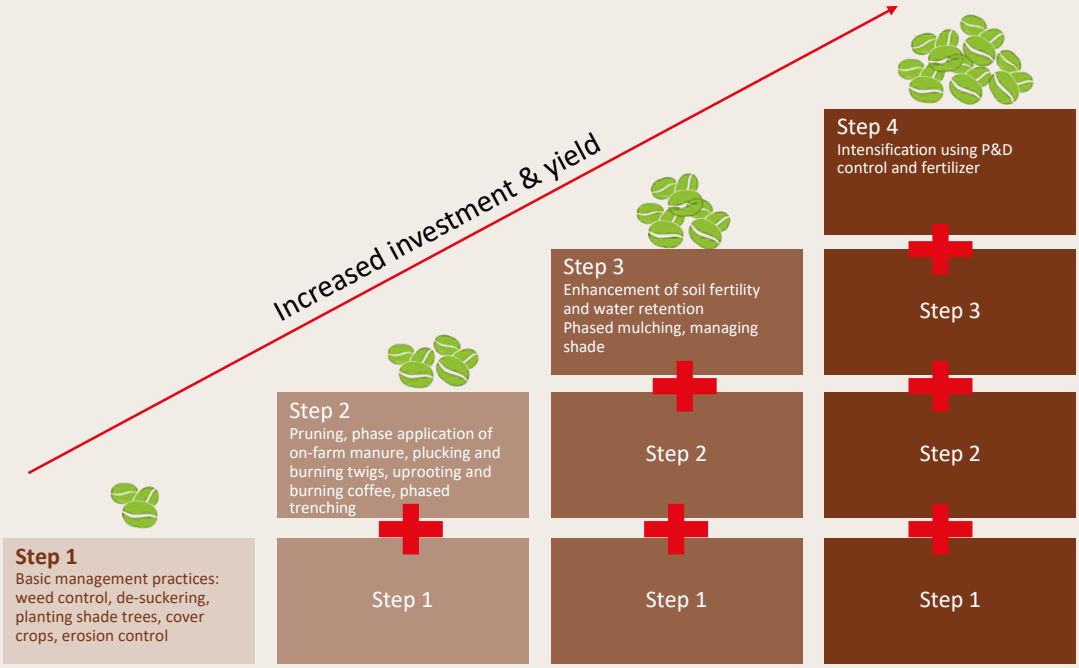
The service delivery models that are being co-designed and co-invested in comprise of potentially six services: a) Training on regenerative agriculture, b) Access to inputs, c) Access to markets, d) Access to finance, e) Access to information services, and f) Training on household decision-making. The services should contribute to the following outcomes: 1) improved soil health, 2) more income, and 3) more stable income.

Beyond the direct engagement with the service providers, IDH also plays a convening role in order to facilitate continuous learning and sharing between the service providers, as well with the larger coffee and regenerative agriculture community. The program's Theory of Change (ToC) can be found in Appendix I.

Regenerative agriculture

The program supports farmers to progress towards regenerative agriculture. Regenerative agriculture is a holistic approach to agricultural production that sustains, or if needed restores, ecosystems to a healthy and resilient state by improving the soil while providing sufficient economic return to build up impact in different dimensions towards sustainability (environment, income, jobs). This contributes to resilient environmental and socio-economic systems. Regenerative agriculture is not a "tick-box" approach and is highly context dependent. Whereas the exact practices can differ in each specific farm context, key components include improving plant functional diversity, soil organic matter management and appropriate inorganic and fertilizer use. Typical practices contributing to regenerative systems include intercropping, crop rotation, agroforestry, low till, use of cover crops and integrated soil fertility management, including the use of manure and compost (NewForesight and CIAT, 2020).

Figure 2: a step-wise approach towards regenerative agricultural practices



Source: NewForesight, CIAT (2020), Deepdive: Regenerative Systems in Kenya and Uganda

Blended service delivery

As regenerative agriculture involves combining different crops (e.g. by intercropping or rotation), agroforestry or the integration of livestock, farmers will need services which do not only focus on a single crop. Consequently, the program focusses on developing blended service delivery models with services targeting coffee and non-coffee crops. Each service provider, or coalition of service providers, will provide services for both coffee and non-coffee crops. In addition, the project focusses on bundling services. An example of bundled services is combining training, inputs, finance and market access in one package of services.

Project context

Kenya and Uganda are major coffee producing countries. Kenya produces Arabica, while Uganda produces both Arabica and Robusta. Farmers in both countries are typically diversified in their farm production. In Kenya, most of the farmers have coffee plots with trees in the boundary, and lately coffee agroforestry systems are becoming more prevalent. In Uganda, intercropping systems are more common, with banana trees and other agroforestry trees also used for shade management and additional sources of food and income (NewForesight and CIAT, 2020).

Earlier research found that competing demands for resources among household needs lead to high variability in soil fertility on a farm scale. In addition to this, erosion and landslides on steep slopes and nutrient mining have led to severe soil degradation. This degradation, together with the poor management practices and resource allocation decisions on the farm, can push farmers into a vicious cycle of low income, lack of resources to improve farm management practices, and thus further degradation in soil fertility (NewForesight and CIAT, 2020).

The two countries have different governance mechanisms for the marketing of coffee. In Kenya, marketing is heavily regulated. Farmers are required by law to be a member of a cooperative in order to sell their coffee. Annual contracts are signed between cooperatives and coffee companies (e.g. marketing agents, millers or exporters). The coffee companies are responsible for ensuring preparation of coffee in the auction, preparation of the auction catalogue, setting of reserve prices, and the selection of an auctioneer. These include CMS, SMS and Kenyacof, who are all part of the CFIRP. In Uganda, the sector is more liberalized. Unlike Kenya, farmers are not required by law to be part of a formal cooperative, though many are members of more informal groups. In terms of market channels, some farmers sell to small middlemen while others sell directly to coffee companies such as Mountain Harvest, Touton and Ugacof who are part of the CFIRP.

2. Farmer and farm characteristics

Key messages: The targeted coffee farmers in both countries are predominantly male and above 50 years old. They have diverse farming systems and typically grow three to four crops in addition to coffee. Almost all farmers keep some form of livestock. Farmers in Uganda have on average larger total farm sizes and coffee plots than in Kenya. There is great variety in coffee tree densities, linked to different practices in intercropping and planting of shade trees. This supports the relevance of blended service delivery for coffee and other crops in the project intervention areas.

Farmer characteristics

The intervention group farmers are predominantly male, older than 50, married, and live with 6.5 people in the household. Women make up 31% of the surveyed farmers, while 69% were men. Twenty per cent of the surveyed farmers were female household heads, the majority of which still state they are married (55%) despite being the household head, or are widowed (28%), divorced or single (17%). Seventy-seven per cent of respondents are male household heads. In the remaining 3% of the sample, the gender of the household head was not properly identified.

Farmers are aging: only 8% of the intervention group farmers were younger than 35 years, almost half of the farmers were in the age category of 35 till 54 and 42% were 55 or older. Farmers in Kenya were on average older. 88% of the farmers were married and 7% was widowed. The average household size is 7 people, with Ugandan households being higher than in Kenya (8 vs. 5). The farmers have on average 3 children (4 in Uganda vs. 2 in Kenya).

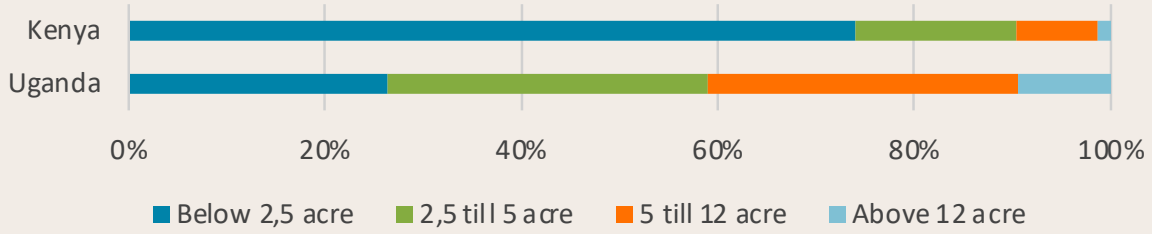
Farmers in Kenya are better educated than farmers in Uganda. Almost 30% of the farmers have completed secondary or tertiary education, whilst 25% finished only primary school. Education levels are higher in Kenya than in Uganda. In Uganda, 54% of the farmers had no education at all, or dropped out of primary school (vs. 19% in Kenya).

Farmer characteristics

Most farmers are experienced, own their land and are members of a farmer group. Most farmers (72%) have over 15 years of farming experience and only 6% have less than 5 years. All farmers in Kenya and 98% of the farmers in Uganda are members of a farmer group, association or cooperative as is dictated by law. In Uganda these groups are typically less formal than those in Kenya and include groups that are linked to the project partners. In Kenya, all farmers own their farmland apart from one farmer who rents all the land. In Uganda, 96% of farmers own their farmland, followed by 3% who own some and rent some, and one farmer who rents all of the land. However, in the FGDs in Uganda some farmers reported that they use all the land they own for coffee farming but hire additional land in the low land for other non-coffee crops. We suspect that while the options in the questionnaire did allow for this additional complexity in land ownership to be captured, farmers may not have fully understood the relevant question and possible answer options and may have been influenced by earlier questions on farm size which referred to 'your farm'.

Farmers in Uganda have on average total farm sizes that are larger than in Kenya. The average total farm size of the farmers across both countries is 3.9 acres. In Kenya, the average farm size is 2.2 acres with a median of 1.3 acres. Farmers in Bungoma (the Western

Figure 3: division of total farms size in four categories (n=470)



part of the country) have the largest average farm sizes at 3.0 acres, followed by farmers in Kirinyaga (Central) who have an average farm size of 2.2 acres. Farmers in Embu (Eastern) have the smallest average farm sizes at 1.3 acres. In comparison, WUR (2021) reported average farm sizes of 1.5 acre in Kirinyaga and 2.2 acre in Embu. Ugandan farmers have on average over double the farm size compared to Kenyan farmers, at an average of 5.7 acres (with a median of 3.0 acres). Farm sizes in Central Uganda are on average the largest at 10.2 acres, followed by farms in Elgon (3.8 acres) and Rwenzori (3.1 acres). An important reason on why the average farm size in Central is larger, is because the applicable service provider has targeted farmers based upon a minimum farm size of 5 acres.

In Kenya, female and male-headed household have similar farm sizes. In Uganda, there is a more significant differences between gender, with average farm sizes being over 2 acres larger when the household head is a man rather than a woman.

Farming system

Farmers typically grow three to four crops in addition to coffee. Despite the on average smaller farm sizes, Kenya shows slightly higher numbers of additional crops than farmers in Uganda. The average number of crops are comparable for female and male-headed households. There is no clear statistical correlation between number of crops grown and farm sizes. Using the above-mentioned farm size categories (see figure 2), the average number of crops are comparable for each category, except for farms above 12 acre which have on average fewer additional crops.

The most popular crops in Kenya are banana (on average 92% of farmers grow bananas), followed by avocado and macadamia nuts (both 61%), and maize (53%) and beans (38% of all farmers). The most popular crops in Uganda are bananas (91%), beans (72%), maize (43%) and avocado (34%), vanilla (33%) and cocoa (25%). Some crops are typical for a region. For example, in Kenya, maize and beans are particularly popular in Bungoma, while in Uganda vanilla and cocoa production is typically unique to the Rwenzori region and cabbages to the Elgon region.

Almost all farmers keep livestock. 93% have some livestock on their farms, with chicken being the most popular (71% of farmers have these), followed by cattle (57%), goats (40%) and pigs (24%). Other livestock held include sheep, ducks and rabbits. In Kenya, the most popular choice of livestock are cattle and chickens with this preference being standard across the regions. In Uganda, cattle are a less popular choice when compared to Kenya, apart from in the Elgon region. Goats and pigs are a more popular choice of livestock in Uganda, particularly in the Rwenzori region.

More Kenyan farmers produce alternative products, such as timber, firewood and honey compared to Ugandan farmers. In Kenya, 83% of farmers produce these, compared to 35% in Uganda. In both countries firewood is most produced (48% across both countries), followed by timber (38%) and honey (9%).

Table 1: proportion of farmers growing the additional crops targeted by the project partners in their respective target regions

Project partner	Target crops other than coffee and % of surveyed farmers growing them
SMS	Dairy (82%), avocado (64%) macadamia (27%)
Kenyacof	Macadamia nut (95%), bananas (94%), dairy (67%), avocado (59%)
Touton	Vanilla (91%), cocoa (72%), Bird's Eye chili pepper (20%)
Mountain Harvest	Bananas (99%), beans (96%), avocado (56%), pigs (23%), honey (15%)
Ugacof	Bananas (100%), beans (77%), cattle (27%), honey (6%), tree products (30%)

Coffee farm

Coffee plots in Uganda are considerable larger than in Kenya. The average size of the coffee plots per farmer across both countries is 2.2 acre. In Kenya, female and male-headed household have similar coffee plot sizes, while in Uganda male-headed households have almost 75% larger coffee plots than female-headed households. In line with the total farm size, the coffee plots in Uganda are on average considerably larger than in Kenya (with averages of 3.6 vs 0.8 acres and medians of 2.0 vs 0.5 acres). These figures are larger than that found in other studies. The averages in Uganda are not necessarily representative of the typical coffee farmer in the country, due to the inclusion of larger farmers in the program in Central, as previously mentioned. All farmers in Kenya produce Arabica coffee. In Uganda, one third of the sampled farmers produce Robusta. Within the sampled farmers, all Robusta growers can be found in Central region while Arabica is grown by farmers in Elgon and Rwenzori regions. Due to the selection of farmers linked to project partners in certain regions, there is a high percentage of Arabica coffee growers in the Uganda sample which is not representative of the dominant coffee type being grown in the country (i.e. Robusta). The Robusta farmers in this sample have considerably larger coffee plots than Arabica farmers (7.0 vs 2.0 acre), which corresponds with the larger farm sizes found among farmers who are growing Robusta coffee in Central Uganda. Nonetheless, Arabica farmers in Uganda have considerably larger plots than Arabica farmers in Kenya (2.0 vs 0.8 acre). This is consistent with overall farm sizes being larger in Uganda than in Kenya.

Of all farmers, 55% of the total farm size is dedicated to coffee. In Kenya this figure is 44% and in Uganda 67%. Farmers in Uganda with Robusta dedicate a slightly larger proportion of their farm to coffee than those of Arabica (72% dedicated to coffee vs 65%). This supports the relevance of blended service delivery for coffee and other crops in the project intervention areas.

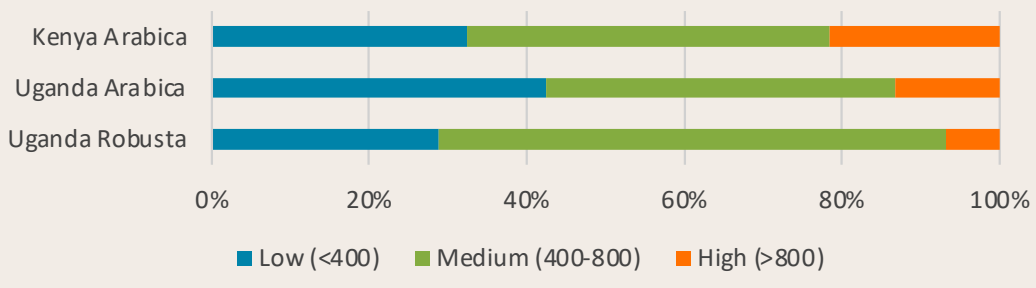
Table 2: average farm size and coffee plot size categories

	Kenya - Arabica	Uganda - Arabica	Uganda – Robusta	Total
Farm size	2.2	3.4	10.2	3.9
Coffee plot size	0.8	2.0	6.9	2.2
Coffee trees/acre	553	443	434	489

Multiple coffee species are grown among the intervention group farmers. In Kenya, the most popular Arabica species are Ruiru 11 (most popular in Bungoma), with 74% of farmers growing that species, followed by SL28 (53% of farmers grow that, with it being most popular in Kirinyaga) and Batian (39%). A few farmers grow SL34. Most farmers in Kenya (57%) grow 2 or 3 coffee species. In Uganda, a quarter of the farmers were not aware which species they cultivated, while 14% indicated they had planted more than one species (mostly 2). Of all Arabica farmers, most used SL14 (32%), followed by Nyasaland (20%), SL28 (13%) and Bigusi (3%). The most frequently used Robusta species were Clonal and Nganda (56% and 57% of the Robusta farmers had planted these respectively) followed by Erecta (10%).

Coffee tree density varies greatly and is highest in Kenya. We judge this data to be less reliable due to difficulties of farmers in estimating these numbers correctly. On average, farmers have 941 coffee trees each on total on their farms (an average of 1559 trees per farmer in Uganda and 341 per farmer in Kenya). There is great variety in densities, ranging from 20 to 1400 trees per acre. Responses showed that farmers in Kenya have on average 611 coffee trees per acre and in Uganda 477 trees (545 on average for all farmers). Robusta farmers in Uganda have slightly more trees per acre than Arabica farmers (510 vs 461 trees/acre). Whereas recommended trees per acre for classical varieties in both countries are between 400 and 800 trees, newer varieties are often promoted at densities above 800 trees an acre. Three segmentation categories are therefore relevant: low density (1-400 trees), medium density (400-800 trees), and high density (above 800 trees/acre). Almost half of the farmers surveyed have between 400 and 800 trees per acre, which makes sense in light of later insights on the tendency for intercropping with coffee. Relatively more farmers in Kenya have a plant density of 800 per acre or more compared to Uganda (22% vs 11%), while for the low density (below 400 plants per acre), the difference is less pronounced (38% in Uganda and 32% in Kenya). However, Arabica farmers in Uganda typically have a lower density of coffee trees than Robusta farmers. Arabica farmers are also more likely to intercrop than Robusta farmers.

Figure 4: distribution of farmers across coffee tree density per acre categories (N=455)



3. Final outcomes: income and soil health

3.1 More farm income

Key messages: Farm income is the primary source of income for the farmer households surveyed in Kenya and Uganda, with coffee being the main income generator. Coffee represents approximately half of the total farm income for Arabica farmers in both countries, while this is almost three quarters for Robusta farmers in Uganda. Kenyan farmers invest more money in their coffee farm than Ugandan farmers and are also more profitable. Most farmers do not incur production costs for their other crops which generally represent only a small proportion of the total farm income and are used for subsistence purposes.

3.1.1 Composition of household and farm income

Farm income is the primary source of income for the farmer households surveyed in Kenya and Uganda. Farmers estimate the average contribution of farm income to the total household income to be approximately three quarters. Only 12% have higher non-farm income than farm income. There is no difference between female and male headed household. During FGDs, farmers stated that they are primarily farmers. However, a number of off-farm activities can provide important contributions to the household income, including small-scale businesses (e.g. grocery, shop keeping, brick laying, *bodaboda* driving) and paid employment (e.g. causal rural labour, teachers, factory employees, and in Rwenzori mining sand and stone quarrying). It was noted that despite the increase in prices of various commodities, the daily wage has remained at the same level for several years which affects farmers – particularly younger farmers – who engage in casual labour on other farms to increase household incomes.

Farmers were asked how satisfied they are with the contribution that farm income makes to total household income, as an indication of farm performance and income sources. Results show a mixed picture (41% are satisfied and 37% are not satisfied), though farmers in Uganda are on average more satisfied than in Kenya. Female-headed households are on average slightly less satisfied with the contribution of the farm income to total household income than male-headed ones.

Coffee is the main income generator. Coffee is mentioned by most farmers as main household income generator, followed by other non-coffee crops and then livestock. Coffee represents approximately half of the total farm income for Arabica farmers in both Kenya and Uganda, while this is almost three quarters for Robusta farmers in Uganda. This is in line with other studies that state that Kenyan smallholders are still relatively diversified, with farmers growing a variety of crops for both cash crops as well for food (e.g. WUR, 2021 & Cordes et al., 2021). There is no dominant picture as to trends in the contribution that coffee makes to farm income – a similar number of farmers say its contribution has either increased or decreased, while 19% of farmers stated that its contribution remained stable over the past two years.

Table 3 presents the most frequently mentioned crops that farmers report as their first, second and third income earning crops in addition to coffee. Other less frequently mentioned crops included arrow roots (Kenya) and cocoa (Uganda) and tomatoes (both countries). Most farmers did not have a third highest earning crop, implying that any additional crops are for subsistence. For example, the focus group participants in Bungoma noted that dairy farming is practiced but for subsistence purposes.

The non-coffee crops that are targeted by the project partners generally generate only a small proportion of farmers' total farm income. Close to 30% of the farmers producing target crops, did not sell any of their produce in the last year either because of home consumption, lack of market access or because the product was not yet marketable. For most farmers, crops like avocado, bananas, beans, macadamia nut and dairy contribute less than 20% of the total farm income. Cocoa and vanilla typically provide a larger proportion of the farm income. The contribution to farm income of most crops has been stable over the last two years. However, for beans, macadamia nuts, and vanilla most farmers saw a decline in its contribution to household income. For coffee, most farmers saw either an increase or a decline in the trend

Table 3: first, second and third highest income earning crops after coffee (n=474)

	Kenya	Uganda
1st highest income earning crop	Macadamia (46%), bananas (21%), tea (8%)	Bananas (37%), vanilla (18%), beans (10%)
2st highest income earning crop	Bananas (33%), macadamia (9%), avocado (8%)	Beans (31%), bananas (14%), onions (10%)
3st highest income earning crop	Bananas (12%), maize (10%), avocado (7%)	Beans (14%), maize (12%), bananas & avocado (10%)

Table 4: proportion of target crops in total farm income and dominant trend in this proportion (% of farmers who grow these crops)

	0%	1-19%	20-39%	40-59%	60-79%	80-100%	Dominant trend as % of farm income
Coffee (n=474)		10%	16%	31%	22%	20%	Mixed
Avocado (n=155)	29%	61%	5%	4%	1%	1%	Stable
Bananas (n=230)	23%	48%	18%	8%	3%		Stable
Beans (n=122)	11%	63%	20%	4%	1%	1%	Decrease
Cocoa (n=48)	35%	21%	19%	13%	6%	6%	Stable
Macadamia nut (n=104)		69%	24%	5%	1%	1%	Decrease
Vanilla (n=67)	18%	30%	13%	13%	12%	13%	Decrease
Chili pepper (n=9)	33%	33%	22%	11%			Stable
Dairy/cattle (n=126)	20%	44%	23%	3%	5%	6%	Stable
Piggery (n=5)		100%					Decrease
Honey (n=7)		86%		14%			Stable
Tree products (n=22)	41%	32%	27%				Stable

3.1.2 Total farm income

Farmers' gross annual farm income is on average 1,526 USD. Intervention group farmers in both countries were asked to estimate their overall gross farm income (i.e. total gross revenues, without any consideration of production costs, combining coffee and non-coffee crops). As explained in the limitations section in Appendix II, we have doubts about the reliability of the income figures based on a perception by the research team that participants were either reluctant to answer the question (the reasons for which were unclear) or struggled to recall a specific or accurate figure.

Nonetheless, using the figures we have, we see that farmers in Kenya have a higher income per acre than farmers in Uganda, but earn less than Robusta farmers in Uganda overall in terms of total gross farm income. This is due to the much larger farm sizes of Robusta farmers in this sample. Arabica farmers in Uganda have both the lowest total gross farm income and income per acre. The figure for Ugandan Arabica farmers is more or less in line with those provided by Hochberg and Bare (2021) who report a net farm income of below 500 USD for Ugandan coffee farmers (we only looked at gross). This also suggests that that the Robusta farmers in this sample have higher farm incomes than the average Ugandan coffee farmer.

Gross farm income per acre seems to correlate with the gender of household head, farm size, number of crops grown and some soil health variables. The regression analysis showed a statistically significant difference between male and female household heads in terms of gross farm income, while male headed-households reporting a higher income than female headed ones. Smaller farms generate a higher gross farm income per acre than larger farms: the regression analysis identified a negative correlation between gross income/acre and farm size. Of the four farm size categories identified in the previous chapter, farmers with less than 2,5 acres have on average a considerably higher income per acre than the other categories (with the above 12-acre category showing the lowest values). The regression analysis also correlated income positively with the number of crops grown, and positively with growing avocado, but negatively with growing cocoa (but not with other crops or livestock, however). No correlation was found between gross farm income per acre and the number of RA practices. We found some positive relations between income and soil health. Farmers with better phosphorus, organic matter and pH values reported a higher gross farm income per acre. The other soil health variables show no correlation. In FGDs some farmers also linked declining farm income to exhausted soils.

Trends in farm income are mixed: 41% of farmers state that farm income has increased over the last 2 years, while 40% state that it has decreased. The figures for both countries look similar. Female-headed households experience more commonly a negative trend, while farmers with larger farms experience a more positive trend. In FGDs in Kenya, farmers referred to decreasing off-farm activities due to the poor performance of the economy related typically to COVID. In Uganda, there is some strong regional difference, with those in Central stating overwhelmingly in the survey that farm incomes have increased, as compared to those in Elgon who typically state that farm income has decreased.

During focus group discussion farmers mentioned many factors which influence their farm income. They referred to changes in productivity (mainly linked to weather or pest and diseases), prices volatility, changing costs of inputs (generally increasing), poor infrastructure (impeding market access) and declining farm sizes (because of selling, donating or sharing with children or changing land use such as to real estate in Kenya).

Table 5: Total farm income in the last 12 months

	Kenya – Arabica (n=238)	Uganda - Arabica (=150)	Uganda – Robusta (n=72)	Total (n=460)
Farm income USD	1,597	735	2,939	1,526
Farm size (acre)	2.2	3.4	10.2	3.9
Gross farm income / acre USD	1,196	270	371	765

3.1.3 Product specific costs and revenues

Coffee

Kenyan farmers invest more money in their coffee farm than Uganda farmers. Of all farmers, 77% reported costs for their coffee production in the last 12 months (n=364). This does not mean that 23% did not incur any production costs, however, as approximately half of these reported earlier in the survey to have used chemical fertilizers or pesticides. There are likely multiple explanations for these gaps: farmers may not have wanted to report on costs, could not recall them, did not account for them as they got inputs on credits and repaid them with coffee delivery, or farmers bought these products before the 12-month period referred to the in the survey. However, many more farmers in Kenya reported costs compared to Uganda, particularly on chemical fertilizers and pesticides. This confirms insights on practices (see section 4.2) that Kenyan farmers have more intensive coffee production systems than farmers in Uganda. In Uganda, relatively more Robusta farmers reported costs than Arabica farmers.

Most farmers incur costs for labour, followed by chemical inputs. Of those who reported costs, most referred to paid labour costs (73% of farmers who listed costs gave information on labour costs), followed by chemical fertilizers (57%), chemical pesticides (54%) and organic fertilizers (24%). There was little mention of other costs. Harvesting and weeding are the most mentioned activities for which farmer uses paid labour, followed by fertilizing, pest and disease management and transporting. The survey data contradicts to some extent what came out of the FGDs. In both Kenya and Uganda, participants stated that mostly family labour is used on the farm. In Uganda only larger farmers will pay for labour. In Kenya, farmers noted that some of them will use paid labour, but it is regarded as something that most farmers cannot afford. Farmers do refer to age as important factor, saying older farmers will rely more on paid labour for activities like pruning, weeding, harvesting and transportation. Survey data confirms this: 89% of the farmers above 65 years report to pay for labour, while this percentage is 10% to 20% lower for younger age categories.

The figures provided by farmers on the actual costs of coffee farming show a great variety, ranging from a few US dollars to more than 2,000 USD per acre for the last 12 months. When we combine the cost figures with the gross revenue figures, this also gives a wide range of net profit, with some farmers making large losses or profit. It is difficult to determine where farmers have overstated or understated their costs, revenues, or coffee plot size, but we judge there has been challenges in farmer recall on a number of indicators. Using the figures we have, however, we see that the production costs paid per acre in Uganda are considerably less than in Kenya. Again, this is consistent with the picture of Ugandan farmers having less intensive coffee production systems. Of the 329 farmers who provided data on costs and revenues, 15% made a loss last year.

The following table presents the ranges of costs mentioned by farmers for coffee production for specific cost items, per acre in USD. The n-number refers to how many farmers reported a cost under this item. Farmers with unrealistically high yield per acre figures or coffee prices have been removed from the revenue analysis.

Table 6: coffee production costs and revenues as reported over past 12 months by farmers who reported costs (in USD/ acre)

Cost item	Kenya – Arabica	Uganda – Arabica	Uganda – Robusta	Total
Paid labour	173 (n=144)	20 (n=63)	42 (n=59)	109 (n=266)
Organic fertilizers	111 (n=48)	37 (n=10)	34 (n=16)	84 (n=74)
Chemical fertilizers	169 (n=153)	36 (n=10)	56 (n=44)	139 (n=207)
Chemical pesticides	144 (n=164)	12 (n=15)	18 (n=19)	121 (n=198)
Seedlings	60 (n=56)	11 (n=7)	14 (n=25)	13 (n=88)
Other	10 (n=2)	5 (n=7)	-	7 (n=9)
Total costs	**381** (n=218)	**33** (n=81)	**93** (n=65)	**60** (n=364)
Revenue*	(n=191)	(n=78)	(n=60)	(n=329)
Total gross coffee revenue	**1126**	**316**	**463**	**830**
Net coffee revenue	**757**	**282**	**374**	**574**

** For the gross and net revenue farmers we have excluded farmers with unrealistically high yield figures (see productivity section 4.1).*

Table 7: Gross coffee revenue as reported by all farmers over the past 12 months (including those who did not report any costs)

	Kenya – Arabica (n=235)	Uganda - Arabica (=153)	Uganda – Robusta (n=76)	Total (n=464)
Gross coffee revenue USD	731	394	2,894	1,193
Coffee plot size (acre)	0.8	2.0	6.9	2.2
Gross coffee revenue / acre USD	1,087	229	414	675

The table above includes the gross coffee revenue figures for all farmers (including those who did not report any costs). The Robusta farmers in Uganda earn most from their coffee, but this is because they have much larger farms. Per acre, the Kenyan farmers earn significantly more than the Ugandan ones.

Other Kenyan sources report lower income figures. The GCP (2017) publication referred to production costs of 200 USD / acre in Kenya while the gross income is reported to be 395 USD / acre. The more recent WUR (2021) study reports a gross income of 334 USD per acre and 130 USD / acre of net coffee income. For Uganda, Cordes et al. (2021) refers production costs of 0,62 USD per kg of green beans for Uganda, which would translate into a considerably higher costs per farmer than we found (134 USD for the average Arabica farmer and 944 USD for the average Robusta farmers in our sample size). However, the coffee net revenue reported in the same publication is closer to what we found with a 287 USD per acre in the 2018-2019 period in Uganda (though it is not clear whether this is for Arabica or Robusta or both). The costs Ugandan farmers reported are significantly lower than the UCDA (2019) recommends, signifying a significant underinvestment.

When looking at coffee plot size categories, the average gross coffee revenue per acre is highest for the smallest category of coffee plot and lowest for the largest categories. (i.e. the smallest coffee plot sizes have the highest revenues per acre). However, the regression analysis does not find a statistically significant correlation between coffee plot size and gross or net coffee revenue per acre. This is interesting to consider alongside the identified negative correlation between overall farm size and gross farm incomes per acre (meaning that smaller farms typically earn more gross income per acre than larger farms). A possible explanation is that that intercropping contributes to a higher proportion of total gross farm income on smaller farms. The regression analysis also shows that those farmers who have higher production costs per acre also have higher gross revenues per acre. However, same relation is not found with net revenues, which may indicate that investments are not always profitable. Section 4.1 discusses the relation between coffee productivity and soil health.

Trends in coffee profitability are mixed. A slight majority of the farmers surveyed (52%) report an increase in coffee profitability in the last 2 years, while 40% report a decrease. These figures are similar for both countries. Of those who experienced an increase in profitability, the majority linked this to improved market circumstances (55%), followed by productivity improvements (26%) and changes in farm practices (15%). Most farmers (61%) with a decrease in farm profitability mentioned productivity related issues as main cause (e.g. weather or pest and disease), followed by market factors (21%) and changes in farm practices (12%). Although prices for coffee were seen to have increased over the last two years, farmers complain of volatile prices which makes it hard to plan. Illness and the Covid-19 pandemic were only mentioned by a few in the survey, but the latter was highlighted as a main challenge in FGDs. The pandemic has increased the cost of living and led to inflation in both Kenya and Uganda, while in Uganda farmers also refer to its negative impact on prices for crops and their access to inputs. Other factors identified include increasing input prices, particularly fertilizers, lack of consistent markets to sell farm produce which leads to a reliance on brokers who pay unreasonable prices and high loan interests for farmers. In Uganda, FGDs and KIIs also referred to the poor quality of coffee sold caused by poor post-harvesting practices and early harvesting because of urgent cash needs or fear of theft.

The satisfaction with the profitability of coffee shows a similar mixed picture to trends in profitability with 44% being satisfied and 40% not satisfied (in which there are 12% which are very unsatisfied). In Uganda, farmers are slightly more satisfied than in Kenya.

Non-coffee crops

Most farmers do not incur production costs for their other crops. In regards to the other crops targeted by the project partners, 70% of farmers did not report any production cost. While in some cases farmers may not have been able to recall costs, we believe that the majority of these farmers did not incur costs. This is more or less comparable across most crops, with the highest proportion of farmers reporting costs for chili peppers (70%) and beans (59%) and the lowest proportion in cocoa (30%). Of the farmers who report production costs, 54% referred to labour costs, 20% to seedlings and 14%-15% to organic or chemical fertilizers or pesticides. Only a small number of farmers provided specific figures on actual costs. As acreage for these crops are poorly estimated (particularly because of tree crops being intercropped), it is not possible to provide figures per acre. Production cost data for crops with more than 15 responses were 40 USD in Kenya and 20 USD in Uganda for avocado per farmer, 45 USD in Kenya and 47 USD in Uganda for bananas per farmer, 21 USD for macadamia nuts in Kenya and 55 USD for beans in Uganda (42 USD in Elgon and 85 USD in Central).

More data exists on revenues for non-coffee crops, and for a wider variety of crops than production data was given for. For similar reasons mentioned earlier, e.g. accuracy of recall, willingness to share information, reliability of the data is an issue. The following table nevertheless shows average gross revenues for the different crops, per farmer.

Data shows that selling milk products (relevant to Kenya) or keeping cattle (relevant to Uganda, either meat or milk) can provide significant income, assuming that most of these farmers do not pay any or very few costs (as the data suggests). In Uganda, harvesting trees can also deliver substantial income, but it can take years before the trees are mature. Most farmers do not experience significant change in productivity of their crops, except for macadamia and vanilla, for which farmers reported a decrease in profitability. Many farmers (43%) are neither satisfied nor unsatisfied with the profitability of the target crops, 33% is not satisfied and 24% is satisfied. The highest proportion of farmers being positive about profitability is among dairy/cattle farmers. Farmers growing bananas, beans and vanilla were more negative. Other crops show mixed satisfaction figures (macadamia, pigs, tree products, chilli pepper).

In Kenya, farmers mentioned that productivity for macadamia has been constant, but prices have been volatile, similarly for milk. Bananas similarly have constant production yields, but low prices, other than in Bungoma where disease has affected production.

Table 8: Gross revenue per farmer and trends and satisfaction on profitability on the non-coffee products target within the project over the past 12 months

Product	Gross revenue per farmer in USD		Trend in profitability	Satisfaction on profitability
	Kenya	Uganda		
Avocado	114 (n=56)	71 (n=31)	Stable	Neutral
Bananas	154 (n=61)	301 (n=87)	Stable	Neutral to negative
Beans		149 (n=101)	Decrease	Neutral to negative
Cocoa		69 (n=27)	Stable	Neutral
Macadamia nut	175 (n=100)		Decrease	Mixed
Vanilla		513 (n=51)	Decrease	Negative
Chili pepper		63 (n=4)	Stable	Mixed
Dairy/cattle	1232 (n=70)	1168 (n=7)	Stable	Neutral to positive
Piggery		828 (n=3)	Stable	Mixed
Honey			Stable	Mixed
Tree products		2820 (n=13)	Stable	Mixed

** The n-values are only applicable to the gross revenue values, for the trend and satisfaction figures more responses were available.*

3.2 Stable farm income

Key messages: Almost all farmers have hungry months and months of low cash flow. Farmers with savings and access to loans have fewer hungry months and months of cash flow shortages. Farmers in Uganda are more likely to have experienced income shocks over the last two years than Kenyan farmers. In terms of strategies adopted to respond to shocks, the most common strategy for farmers in both Kenya and Uganda was to use their savings.

3.2.1 Hungry months and months with cash flow shortages

Almost all farmers have hungry months and months with cash flow shortages, with Kenyan farmers doing better than Ugandan farmers (see summary table below). This makes sense in light of the larger incomes generated for Kenyan farmers through coffee production and larger overall gross farm incomes in Kenya for the majority of Kenyan farmers as compared to Ugandan, excluding Robusta growers. Farmers mentioned during FGDs that months of food shortages normally correlate with a lack of income from coffee and significant expenditure on farm inputs, or that staple crops are not available (e.g. bananas). Farmers who implemented RA practices during FGDs, mentioned that a key benefit of these is achieving a regular flow of income. Looking at secondary sources, Kilimo Trust (2020) reports that coffee producers in Kenya faced negative cashflow for at least 3 months a year. WUR (2021) conclude that Kirinyaga and Embu are relatively food secure, but identifies pockets within the same counties with a high prevalence of food insecurity.

However, Kenyan farmers are more likely to be indebted for school fees and healthcare costs (and with higher debt amounts) and are less likely to have savings than Ugandan farmers. In both countries, levels of indebtedness are increasing, but savings levels are also increasing or remaining stable.

Key informants in Kenya mentioned that a number of farmers are over-dependent on loaning and credit schemes for resilience. These farmers survive by 'digging a hole to fill a hole' i.e. borrowing from one institution to pay the other institution and the cycle continues. In Uganda, farmers mentioned that they typically take loans when planting happens and when schools start (February and July were mentioned).

Farmers have significant cash needs in both countries, for food and other basic expenses. Many farmers in Kenya are taking out loans to cover healthcare costs despite having medical insurance (a government scheme). Immediate cash payments, an important consideration when farmers make marketing choices (this is relevant in Uganda where farmers can choose between marketing options), and crop choices can be important in determining regularity of income.

Farmers with savings and access to loans have fewer hungry months and months of cash flow shortages. This comes out of the regression analysis. Those households with a higher share of farm income in their total household income or a higher education of the household head also have on average fewer hungry months. Farmers with more crops have slightly fewer hungry months. The regression analysis showed that farmers in Kenya who implement more RA practices have fewer hungry months and fewer low cash flow months, while in Uganda the opposite is true. It is not possible to provide a definitive explanation of the reasons for these differences. We saw no relations between number of hungry months or months with cash flow shortages and gross farm income, farm size, soil health, number of crops, gender of household head, household size, access to health insurance.

Table 9: Summary table of stability of income indicators across Kenya and Uganda

	Kenya	Uganda
Months of low cash flow from crops	93% have months with low cash flow 2.3 months on average January, April, May and June	98% have months with low cash flow 2.8 months April, May, June, July
Months of hunger	49% have months of hunger 1.2 months on average January, May and June	92% have months of hunger 2.5 average months July, June, January
Insufficient cash for other needs	83% face months of insufficient cash 2.1 months on average January and November	93% face months of insufficient cash 2.25 months on average January, July, June
Debt levels	28% have debts (414 USD average amount) Increasing trend or staying stable	32% have debts (286 USD average amount) Most state it is increasing
Savings levels	33% have savings 423 USD average amount Increasing or remaining stable	53% have savings 241 USD average amount Increasing or remaining stable
Loans for schooling	59% need a loan for some or all children	48% need a loan for some or all children
Loans for healthcare	73% require a loan or all or some healthcare costs	50% need a loan for some or all healthcare costs

3.2.2 Coping strategies

Farmers in Uganda are more likely to have experienced income shocks over the last two years than Kenyan farmers (31% of Kenyan farmers have experienced shocks, as compared to 50% in Uganda). Shocks were defined as unforeseen events that challenged the household's financial status. There is not a significant difference between regions in Kenya. In Uganda, farmers in Central region were much more likely to have experienced income shocks than farmers in Elgon and Rwenzori, this could be attributed to extended periods of drought. In addition, the impact of Covid 19 was more significantly felt in Central compared to the other two regions.

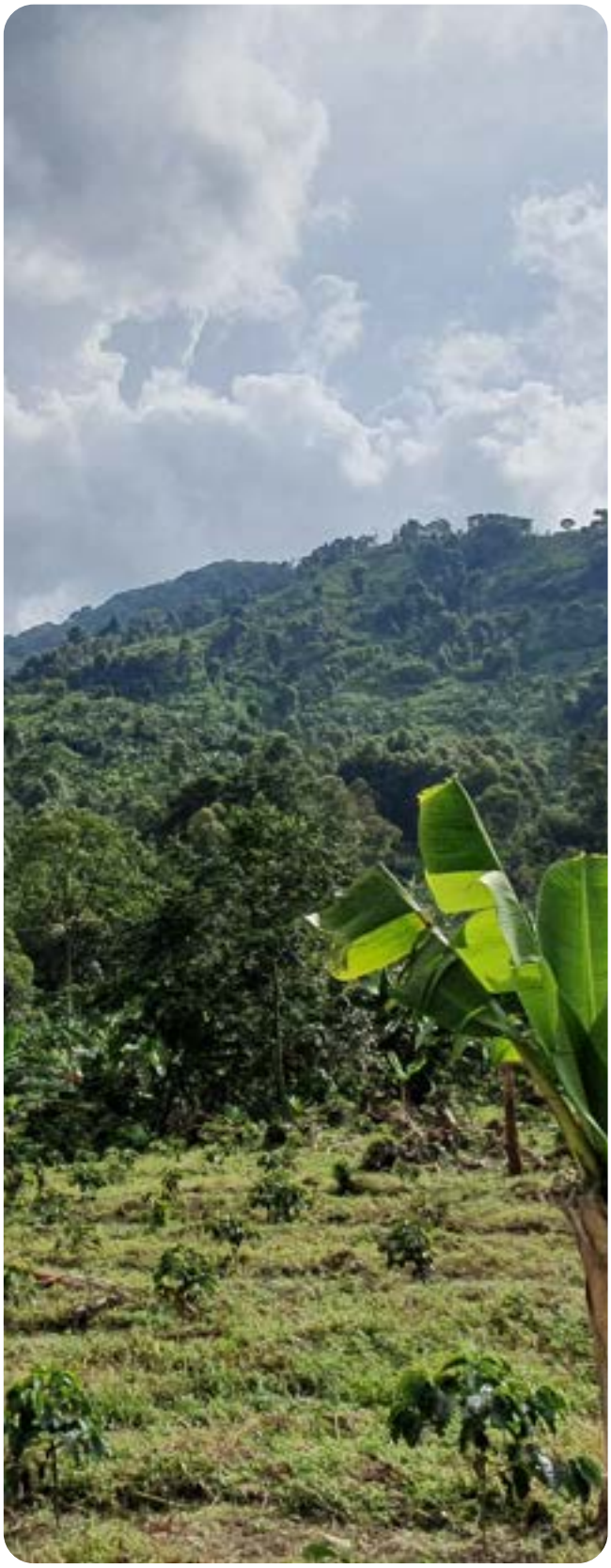
In Kenya, the most significant cause of shocks was unforeseen medical events, followed by the epidemic. Drought was mentioned very infrequently as compared to Uganda, as a cause of household shocks. In FGDs, farmers mentioned pests and diseases as a key shock to income. In Uganda, the most commonly mentioned cause of household shocks was drought (40% of all responses), followed by the COVID epidemic and unforeseen medical issues.

In terms of strategies adopted to respond to shocks, the most common strategy for farmers in both Kenya and Uganda was to use their savings. In Kenya, the second most common strategy was to sell off various assets, followed by taking a loan. In Uganda, farmers' second most common strategy was to sell livestock or take a loan. The third most common strategy was to take a loan, or to sell off livestock. In the worst cases, farmers mentioned in FGDs that they are forced to sell land. Some also try to find jobs – like working in cotton – to try and find alternative sources of income. During FGDs, a number of farmers in Kenya mentioned accessing small loans via mobile money services (e.g. Fuliza or M-shwari, via M-PESA, owned by Safaricom), but they typically only qualified for small amounts which they will use to settle small urgent personal expenses.

In Kenya, most farmers (70%) who had experienced shocks in the past two years have still not recovered, whereas most farmers in Uganda had recovered (31% have still not recovered), or recovered within a few months (35%).

Farmers' overall financial status and access to financial services determines their ability to respond to shocks. For example, in FGDs, farmers reported that those with savings are better placed to absorb shocks, as are those with access to insurance services or loans. The ability to access loans can be dependent on production capacity (for example in Kenya), and the size of interest rates can be determinants of how quickly farmers can recover from the shock experienced. How diversified the farming system is – specifically whether livestock are available to sell – can also be a determinant of the ability to respond to shocks. Farmers and key informants also mentioned that farming practices that enhance resilience – such as RA practices (planting trees, for example), soil conservation, drought-resistant crops, or are able to manage pests and diseases effectively, can also be an important determinant in their ability to respond to shocks.

Farmers in both countries mentioned a number of services available them to help absorb or manage shocks, typically accessing loans, making emergency sales of coffee and other crops to access cash quickly. Farmers mentioned in FGDs that weather information, when accurate, can help them prepare production more effectively or be prepared for extreme weather. There are also a number of NGOs or government agencies offering support to farmers in cases of extreme weather events (for example, Ugandan farmers mentioned that The Office of the Prime Minister and UN agencies support landslide victims, alongside a number of NGOs). It is important to note that many of these are regarded as ineffective in building resilience and can be classified as services that offer short-term solutions to shock, rather than building farmers' ability to resist shocks in the future. Many Kenyan farmers can access government run-health insurance services (53% of Kenyan farmers mentioning accessing these services – see analysis on services in section 5.4.3). These have some resilience-building potential where healthcare services avoid more severe health problems later on, but the level of support/access to healthcare is clearly insufficient, as evidenced by the fact that medical emergencies are still the major cause of income shocks in Kenya.



3.3 Soil health

Key messages: Soil health is generally good for the majority of farmers on their main coffee plot, though there is some variation and context specific improvements are welcome. The soil tests found some imbalances which could be improved though simple measures (liming, application of manure and crop residues and in some cases the application of blended fertilizers with micronutrients depending on the needs of specific soils). Both key informants and farmers did highlight the risk that continuous unsustainable practices (e.g. the wrong or overuse of chemical fertilizers, in part driven by a lack of knowledge of the specific soils) could lead to deterioration in soil conditions.

3.3.1 Methods

Soil health tests were conducted at every second farmer in the sample (113 in Kenya and 119 in Uganda, with an equal spread across the regions sampled for the survey: Elgon, Central and Rwenzori in Uganda, and Bungoma, Embu and Kirinyaga in Kenya). Soil health tests consisted of a visual assessment and lab tests. Visual assessments were done using a scorecard developed by CropNuts, a soil testing specialist based in Kenya. It looked at, for example, compaction, colour and macro-fauna. The visual observations were each converted into a separate numerical score per indicator and then combined to create a final score for soil health on each sampled farm. The lab-based testing involved a starter Soil Scan to measure pH, Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Organic Matter (OM), Total Nitrogen (N) and Reactive Carbon. All samples were transported to, and analysed in, the lab of CropNuts (Nairobi, Kenya). Specific enumerators in both countries were trained by CropNuts on how to take physical soil samples and how to conduct visual assessments of the soil. In addition, farmers were asked during the socio-economic household survey to rank their perceptions of the quality of their soils in terms of its contribution to coffee productivity. Regression analyses were run on the data obtained across both countries and all regions. See Appendix III for more information on soil health variables and methods used.

3.3.2 Laboratory data on soil health

The laboratory data presented below has been summarized using the median values of each country and county/region. Information on soil health at village level is also available in Appendix III.

Samples were taken from several spots (5-7, in a zig-zag fashion at a depth of 20 CM (topsoil) on the farmers' main coffee plots), mixed together and then 0.5kg was taken as a sample and transported from all field sites to the CropNuts laboratory in Nairobi, Kenya. The data does therefore not highlight variability in soil fertility within farms (i.e. across different plots), which has been identified as a key challenge for farm productivity in previous studies (NewForesight and CIAT, 2020). The following table presents the summarized data by country:

Table 10: Chemical soil health on sampled farms (main coffee plot) in Uganda and Kenya

Country	no. farms	pH	P	K	Ca	Mg	K	Ca	Mg	Ca:Mg	N	OM	C.N	Reactive Carbon
			ppm	*ppm*			*%*				*%*			*%*
Uganda	119	6.20	Low	350	1900	320	5.6	60.2	16.5	3.64	0.16	4.2	14.9	0.074
Kenya	113	5.80	Optimal	420	1700	250	6.8	52.5	12.9	4.08	0.20	5.0	15.0	0.100

At a country-level the sampled soils can be considered to be generally healthy and have sufficient levels of nutrients, bar the low phosphorus levels in Uganda which could be easily corrected. Applications of the nutrient in the form of Diammonium Phosphate (DAP) or Triple Super Phosphate (TSP) or other available forms will be beneficial in improving soil health and, subsequently, crop yields.

In regards to other nutrients there is a minor imbalance of calcium in Kenyan soils. Imbalances between calcium and magnesium may result in soils that are hard and would therefore pose a higher resistance to root growth and water infiltration. As such, application of calcitic lime would be beneficial in Kenyan soils as it would increase calcium levels and improve the levels of pH.

Overall, the use of blended fertilizers with micronutrients and liming effect could enhance crop performance. However, more in-depth soil mapping, with more samples and with wet chemistry analysis so as to identify micronutrient deficiencies and specific Phosphorus levels would likely be necessary.

Organic matter levels are above 4% in both countries on the respective coffee plots, an indicator of good soil health. This is to be expected on coffee plots since they typically have much less soil disturbance (which burns off OM) and more leaf litter (which adds OM) than other crop plots (e.g. maize).

In Kenya the levels are slightly higher than in Uganda, which is also reflected in the percentage of Reactive Carbon (0.1%, or 1000ppm). Reactive carbon is the fraction of the carbon in the organic matter that is most readily degradable by microorganism, thus availing the crops with the nutrients present in the organic matter. Reactive carbon is therefore significantly related to the number of microorganisms in the soil, hence an indicator of soil health: more microorganisms translate to better soil health. In both countries, maintenance of organic matter – even where soils already have OM above 3 or 4% - via applications of manure, compost and/or mulching (e.g. via applications of residues such as from agroforestry) would sustain and improve the health of the soils with positive effects on reactive carbon and other soil properties such as improved water infiltration, aggregate stability, water holding capacity and microbial activity – all factors contributing to a better soil health. Manure lasts longer in the soil and are release nutrients more slowly, delivering better long-term soil health than the use of chemical fertilizers.

The median soils in the three sampled regions of Uganda seem to be healthier than the median soils in the three sampled counties of Kenya, however, there is more variation within regions. As expected, the variability of the soils increases at the regional then the subcounty and further still at the village level. Levels of pH in Uganda are optimal except for Elgon which has a pH which is only just below optimality (pH of 6). In this region, lime applications would improve both pH and the levels of calcium. Liming seems to be necessary in Embu and Kirinyaga counties, where the levels of pH are suboptimal to low. Liming would improve the levels of pH and calcium in the soils and would have a beneficial effect on the soil health. The levels of phosphorus are variable and require improvement through the application of the nutrient in the Central region of Uganda and in Embu and Kirinyaga in Kenya. Despite these overall relatively good figures, a more detailed view at village level shows more variation. This means that more tailored soil health improvement measures are nevertheless needed and would be beneficial (see Appendix III).

Figure 5: Organic matter levels (% OM) against Reactive carbon levels (%) in the sampled Ugandan and Kenyan soils

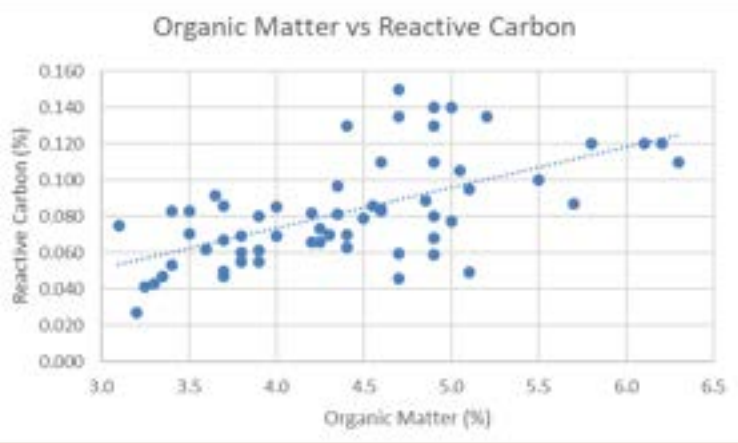


Table 11: Chemical soil health on sampled farms (main coffee plot) in specific regions

	Central	no. farms	pH	P	K	Ca	Mg	K	Ca	Mg	Ca:Mg	N	OM	C.N	Reactive Carbon
				ppm	ppm			%				%			%
Uganda	Central	40	6.20	Low	215	1500	250	4.4	60.5	16.5	3.66	0.15	3.8	14.9	0.061
	Elgon	40	5.95	Optimal	585	2300	375	6.2	54.4	15.2	3.57	0.18	4.5	12.7	0.098
	Rwenzori	39	6.40	Optimal	350	2000	330	6.2	61.5	17.4	3.53	0.16	4.4	15.8	0.074
Kenya	Bungoma	36	6.25	Optimal	450	2150	325	7.5	61.8	15.4	4.01	0.20	4.6	13.5	0.110
	Embu	39	5.60	Low	400	1600	230	6.5	49.5	12.2	4.06	0.20	5.1	15.5	0.091
	Kirinyaga	38	5.45	Sub-Opt	415	1400	230	6.5	43.8	11.5	3.80	0.19	5.3	15.5	0.099

For more data on soil scores, including the ranges of scores at regional level – and how many farmers sit below and above the ideal threshold for a number of indicators, please see Appendix III.

Table 12: soil health scores summarized by country using the median score

Country	no. farms	Total Score	% Score
Uganda	119	19	67.9
Kenya	113	22	78.6

	Region	no. farms	Total	% Score
Uganda	Central	40	17	60.7
	Elgon	40	22.5	80.4
	Rwenzori	39	21	75.0
Kenya	Bungoma	36	21	75.0
	Embu	39	22	78.6
	Kirinyaga	38	22	78.6

Legend

Soil Score (%)	Colour Code
40-50	Very Low
50-60	Low
60-70	Okay
70-80	Good
80-90	Great
90-100	Excellent

4.1.3 Visual assessments of soil health

Soil samples for visual tests were taken from the central point of the farmers' main coffee plot, which could be deemed an average location based on typical soil slope of the coffee plot, at a depth of 100 cm.

In terms of soil health score, the soils in Uganda are ranked lower than those in Kenya. In Uganda, the soils are ok, whereas in Kenya they can be considered good. It is worth noting that some of the soil health parameters identified through the visual assessment are physical parameters and as such not easy, if at all, to change. Texture, soil depth and colour for example are fixed physical properties. Improvements of soil structure through correct soil balancing (i.e. addition of lime) can make soil conditions more favourable or healthy: improved drainage, infiltration and aeration. Other parameters such as soil smell, macrofauna and vegetation can in theory be improved indirectly through applications of organic matter, improved crop rotations on the farm and improved agronomic practices in general (including agroforestry).

The physical health, as determined by the visual assessment and the chemical health as determined by the laboratory analysis, should be consistent with those parameters mentioned above, that have a direct bearing on the soil chemistry such as the presence of salts, the soil smell (linked to levels of organic matter and reactive carbon) and the level of soil compaction (Ca:Mg ratio).

Regionally, Elgon, in Uganda, seems to have the healthiest soils followed closely by Embu and Kirinyaga, in Kenya. The least healthy soils are found in Central, Uganda.

3.3.3 Qualitative assessments of soil health, as ranked by farmers

Most farmers in both Kenya and Uganda rank the quality of their soil in terms of its contribution to coffee productivity as moderate or good. In Kenya most farmers rated their soil's contribution to coffee productivity as moderate (44%) or good (31%). Only 3% and 2% of farmers respectively would rate their soils as either very good or very poor. Embu was most likely to have soils rated by farmers as good and Bungoma was the only region with a number of ratings of 'very good' by farmers – these high qualitative ratings in Bungoma reflect the quantitative data from lab testing, where all chemical scores were good or very good, but do not reflect the reality on the ground in Embu.

Similarly to Kenya, the majority of farmers in Uganda would rate their soils as moderate (52% of all farmers), followed by those who rate their soil as good (25%). Few farmers rated their soils as very poor (1%) or very good (7%). Ratings were similar across regions, though farmers were more likely to rate their soils as very good in Elgon, as compared to other regions. This is also reflected in chemical scores from the independent lab tests.

Farmers and KIIs refer to natural factors and poor agricultural practices as reasons for a decline in soil quality. Most farmers (56%) in Kenya were not sure of the reasons for their inadequate soils, though some mentioned a lack of certain nutrients in the soil or having grown coffee for too long. In Uganda, 95% of farmers think they know the cause of their moderate or poor quality soils, with most of them attributing inadequate soils to a lack of certain nutrients with the soils, the soils suffering from soil erosion, or coffee having been grown on the coffee plots for too long. KIIs in Kenya suggest that poor farming practices including lack of soil erosion control, inadequate trainings on soil management, and a lack of soil testing could be causes of poor quality soils. Enumerators noted during visual assessments that the soil profile (rock or hard pans just below the top soil) could also be a factor.

The regression analysis found that the application of manure correlated positively with N, K, OM, and the visual soil health score. This makes sense in light of the nutrient balance in manure and its slow-release properties, meaning the likelihood of those nutrients still being found in the soil at the time of sampling is higher as compared to when chemical fertilizers are used. It also makes sense in light of manure's ability to improve soil structure (and hence visual soil health).

Chemical fertilizer use (typically the use of NPK: 17:17:17, as reported by farmers or CAN) has a negative correlation with P, K, OM and soil health scores, however. Possible reasons include that: 1) not enough fertilizers are being applied to replenish the crop off-take; 2) the fertilizers are not in the correct balance according to the soil type and crop off-take (for example, chemical fertilizers may increase acidity, locking up P in the soil, rendering it unavailable for crops); and 3) incorrect timing or application technique of the fertilizers (possibly due to knowledge constraints, linked to a lack of guidance). In addition, chemical fertilizers supply readily available nutrients which can be used quickly or easily leached from the soil. Fewer nutrients are retained in the soil beyond a season, as compared to manure. Unless crop residues are returned to the soil a fertilizer system can end up having a negative nutrient balance. We found that the practice of crop rotation is positively correlated with Ca.

4. Intermediate outcomes

Key messages: Farmers in Kenya have significant higher coffee yields than farmers in Uganda. Trends in production volumes of coffee over the past two years are mixed. FGDs and KIIs revealed that negative trends can be predominantly linked to weather changes and pest and disease outbreaks. Farmers reported stable volumes for most non-coffee crops.

4.1 Farm productivity

Before presenting the productivity data, it is important to note that farmers had difficulties in estimating their coffee plot size, the number of coffee trees or to recall their coffee production or sales data in the past 12 months. There were also multiple farmers who did not answer one or more questions related to this topic. By applying some simple data cleaning rules we have removed the biggest outliers in the data.

As mentioned in chapter 2, coffee plant density is higher in Kenya than in Uganda. As would be expected, Robusta plants are the highest yielding (3,1 kg per plant) though Arabica plants in Kenya are significantly more productive than Arabica plants in Uganda (2,9 kg vs 1,0 kg per plant). More than half of all farmers (55%) reported a yield per tree of less than 2kg. Almost a quarter (23%) reported a yield per tree between 2kg and 4 kg and 10% between 4 kg and 6 kg, and 11% above 6 kg.

Arabica yields per acre are significantly higher in Kenya compared to arabica in Uganda, while they are similar to Robusta in Uganda. In line with yield per tree, the figures on yield per acre show comparable figures between Robusta farmers in Uganda and Arabica farmers in Kenya. This indicates an underperformance of Uganda Robusta farmers as one would expect Robusta to deliver higher yields than Arabica. This underperformance of Ugandan farmers is confirmed by a significantly lower yield per acre for Arabica farmers in Uganda compared to farmers in Kenya.

Looking at some other sources, then the WUR (2021) reports an average yield of 1190 kg per acre in Kenya, Cordes et al. (2021) 1012 kg per acre for Uganda.

Trends in production volumes of coffee over the past two years are mixed, with 65% of farmers stating that production volumes have decreased and 37% who state it has increased. There are some regional differences: farmers in Kirinyaga are more likely to report increased coffee volumes than farmers in Embu and Bungoma. In Uganda, in Central Region most farmers refer to an increase, while in Elgon Region most refer to a decrease. In Rwenzori this picture is more mixed.

FGDs and KIIs revealed that these trends can be predominantly linked to weather changes and pest and disease outbreaks. For example, conditions of very cold weather and long periods of dry spell/drought has reduced production of

Table 13: Coffee productivity

	Arabica Kenya	Arabica Uganda	Robusta Uganda
Plants per acre	536	455	434
Yield per plant (fresh cherry) (KG)	2,9	1,8	3,1
Yield per acre (fresh cherry, KG)	1365	773	1440
Coffee volume per farmer (fresh cherry, KG)	926	1357	9521

coffee and made coffee vulnerable to pests and diseases. In Bungoma, Kenya, hailstones destroy the berries while the berries fail to mature during dry spells. In Uganda, unpredictable rains constrain productivity, as do droughts and an increase in pests and diseases due to weather (see below). FGDs in Bungoma Kenya also revealed that farmers are unable to invest what they would like to in coffee production (i.e. in inorganic fertilizers), are disappointed with coffee output, and therefore concentrate efforts on other crops, particularly maize, which means that little attention is given to coffee.

The regression analysis shows little correlation between coffee productivity and individual soil health variables, which is contrary to the expectation of soil health experts. There is only a positive relation between yield/acre and nitrogen levels. Similarly to coffee income, there appears not to be a correlation between farm size and yield per acre or yield per tree. The regression analysis between productivity and agricultural practices found however positive correlations between productivity and total cost of production as well as chemical fertilizer use. Despite correlations being tested for other practices relevant to regenerative agriculture we found no correlation with other variables such as the total number of RA practices, P&D pressure, cost of production, access to weather of market information.

Volumes trends in other crops

Farmer reported stable volumes for most other crops. When looking at the production volume of non-coffee products targeted by the service providers, half of the farmers reported that they remained stable in the past two years, while 27% report a decrease and 22% an increase. Dairy was mentioned more frequently to have increased in terms of productivity, alongside macadamia nuts (around one third of the farmers growing these crops reported an increase in production). However, the data on macadamia presents a rather mixed picture in terms of productivity, since 45% of farmers growing them also mentioned production volumes decreasing (this mixed picture exists in both Embu and Kirinyaga). Other crops which were mentioned more frequently to have decreased in terms of production volumes are beans (47%), and vanilla (43%).

In Kenya, farmers in FGDs noted that changes to weather and climate (particularly very cold weather and dry-spells), have affected productivity, and therefore farm income of several crops. Nonetheless, farmers in Embu and Kirinyaga noted that productivity has improved in the recent past for most cash crops (macadamia, avocado, milk) due to the use of farmyard manure on most farms and the continuous application of inorganic fertilizer (though this had led to increased production costs).

Table 14: Trends in production volume in last two years

Trend	Product
Stable or increasing	Dairy, honey*
Stable	Bananas, avocado, chili pepper*, cocoa, tree products
Stable or decreasing	Beans, vanilla, piggery*
Increasing or decreasing	Macadamia nuts

** these products had few responses (n=3-11), while the others have at least 33*

4.2 Adoption of RA practices

Key messages: Farmers adopt many farming practices that are relevant to regenerative agriculture, but there is significant room for optimization. While most farmers adopt practices relevant to plant diversity or managing soil organic matter (e.g. intercropping, shade trees, mulching) they are not necessarily applied in the best way. This is also valid for example for pest and disease management (most farmers face mild to severe problems with pests and diseases on their coffee plots) and soil erosion and water management. There is much room for improvement on individual practices and how they can be combined in a holistic way.

4.2.1 Plant diversity

Most farmers in Kenya and Uganda are implementing RA practices relevant to plant diversity. In Kenya, 94% of farmers surveyed are implementing practices related to plant diversity on their coffee plots, and in Uganda 98% of farmers are implementing some plant-diversity practices. On average, in both countries, farmers implement 1.75 practices. Most farmers reported benefits from these practices, including improving yields and retaining nutrients in the soil (Kenya) and nutrient recycling, achieving a regular flow of income and reducing soil erosion (Uganda).

The most common practices in Kenya are planting shade trees and intercropping. Planting cover crops and rotating crops are far less common on coffee plots (see Table 15 below). The overall likelihood of farmers implementing plant diversity practices on non-coffee plots is marginally higher compared to those implemented on coffee plots (97% are implementing plant diversity practices on non-coffee plots, versus 94% on coffee plots). On non-coffee plots intercropping is slightly more common than planting shade trees. However, farmers are more likely to implement a large number or range of plant diversity practices on their coffee plots than on their non-coffee plots.

The most common practice in Uganda is intercropping coffee with other crops followed by planting shade trees. Intercropping is far less common in Central region, possibly linked to the larger farms surveyed and intended as programme participants in that region. Crop rotation is more commonly done on non-coffee plots than coffee plots, in Uganda. Arabica farmers are more likely to intercrop than Robusta farmers, while the reverse is true for practicing crop rotation.

Table 15: number of mentions of different RA practices implemented, relevant to plant diversity on coffee plots (% of farmers who mention implementing the practice)

Plant diversity practice	Kenya (coffee plot) n=238	Kenya (non-coffee) n=207	Uganda (coffee plot) n=236	Uganda (non-coffee plot) n=172
Intercropping	79%	76%	79%	76%
Planting shade trees	79%	71%	53%	28%
Planting cover crops	13%	21%	30%	32%
Rotating crops	5%	8%	14%	33%

While intercropping contributes to food security and income, in excessive forms it can lead to competition for nutrients. In Uganda, 76% of farmers with a non-coffee crop intercrop on their non-coffee plot, while 32% plant cover crops and 28% plant shade trees on their non-coffee plots. Qualitative insights demonstrate the importance of intercropping for small plots of land for food security and income. This is similar to the findings of NewForesight and CIAT (2020), who found that, particularly in Uganda, intercropping systems are more frequent, especially with banana trees and other agroforestry trees for shade management. However, in some cases (Rwenzori) the diversity of plants/crops could be regarded as excessive to the extent that it leads to competition between crops for nutrients, water and light hence affecting production of coffee, harbours pests and diseases like Antestia stink bug and leaf rust.

4.2.2 Soil organic matter management

Almost all farmers (99% in Kenya and 91% in Uganda) take measures to manage their soils' organic matter. Ugandan farmers tend to take fewer measures to improve their soils' organic matter (three in Kenya versus two on average in Uganda) and are more likely to apply these measures in some places, rather than everywhere, as compared to Kenyan farmers. This is also reflected in the slightly higher organic matter scores shown in all regions in Kenya in the soil testing as compared to those in Uganda.

Most farmers practice mulching (83%) and two third applies manure. Coffee prunings are the most popular sources for mulching in both countries, followed by applying shade tree litter in Kenya and unwanted suckers and banana pseudostems in Uganda. The regression analysis showed that farmers who have cattle are more likely to use manure than those who don't and those who have issues in accessing chemical fertilizers are more likely to mulch. For Uganda, the regression analysis also shows a correlation between farm size and manure, with manure more frequently applied on smaller coffee plots. Mulching is a more constant practice across the four categories of coffee plot size. KIIs indicated that farmers with smaller land sizes are less likely to embrace efforts to manage soil organic matter (though this clearly does not apply for applications of manure). The FGDs also revealed that farmers with hilly farms use more organic matter as they are confronted with more erosion of top soil and loss of organic matter.

Overall, farmers are less likely to apply organic matter to their soils on non-coffee plots than they are on their coffee plots. In particular, applying shade tree litter, coffee pulp, coffee prunings and coffee litter is far less common on non-coffee plots (which could reflect the lower use of shade trees on non-coffee plots and the absence of coffee trees). This likely reflects farmers' decisions to invest more in plots and agricultural practices linked to their main cash crop. Of all measures taken on non-coffee growing plots, applying manure is the most popular followed by applying unwanted suckers and pseudostems.

Farmers refer to the following benefits of implementing measures to improve soil organic matter: manure lasting longer than chemical fertilizers meaning soil fertility benefits last longer; lower cost of manure for farmers (likely those that have their own available – farmers who do not, and live in remote areas, found it more expensive); health benefits of applying organic matter rather than inorganic inputs; improvements in soil texture and fertility.

Chemical fertilizers are applied by most farmers in Kenya, but far less in Uganda. Of those who do apply fertilizers in both countries, they are most commonly applied twice a year, followed by those who apply it once a year. NPK: 17:17:17, and CAN are most popular across both countries. In both countries, farmers apply these fertilizers less often to non-coffee plots. A higher proportion of Ugandan farmers with coffee plots above 5 acre use chemical fertilizers than those below (while the reverse is true for manure application: larger farmers in Uganda are less likely to use manure than smaller farmers). In Kenya, there are very few farmers with coffee plots larger than 5 acres. The regression analysis showed that male-headed households and those who received training on soil fertility management are more likely to use chemical fertilizers (and earlier regressions show the positive relationship between use of chemical fertilizers and yields).

FDG and KIIs in both countries revealed that it is quite common that farmers apply fertilizers procured for coffee on other plots and crops. To mitigate this risk, one cooperative in Kenya has technical staff which applies the chemical inputs on the farms on behalf of farmers. The diversion of inputs to non-coffee plots suggests that blended services could better meet the needs of farmers than services provided to coffee only and could ensure that coffee output isn't affected as a result of this diversion.

Table 16: number of mentions of different RA practices implemented, relevant to soil organic matter on coffee plots and non-coffee plots (% of farmers)

Soil organic matter practice	Kenya coffee plot n=238	Kenya non-coffee plot n=207	Uganda coffee plot n=236	Uganda non-coffee plot n=174
Manure	87%	83%	47%	45%
Coffee prunings	62%	15%	43%	9%
Shade tree litter	49%	25%	18%	9%
Unwanted suckers & banana pseudostems & corms	26%	19%	25%	20%
Shade tree pruning	32%	21%	13%	6%
Coffee pulp	13%	7%	17%	3%
Coffee litter	24%	10%	7%	2%
Other	0%	0%	3%	4%

4.2.3 Pests and diseases management

Most farmers in both Kenya and Uganda face problems with pests and diseases on their coffee plots (79% in Kenya and 83% in Uganda). In both countries most farmers rank the pest and disease issue as mild, followed by severe. Most farmers in Kenya and Uganda state that pests and diseases have been getting better rather than worse, when compared to the year before.

Farmers in Uganda mention a larger diversity of pests and diseases than in Kenya, with coffee twig borer, aphids, black ants, coffee wilt and red blister being unique to Uganda. Local key informants in Kenya noted that there has been a marked increase in coffee diseases in Kirinyaga and Embu Counties particularly on the old (SL) variety of coffee, as compared to new and grafted varieties like Ruiru11 and Batian.

Weather is a significant determinant of pests and diseases. During cold/wet weather coffee diseases tend to increase, whereas pests tend to increase during warm or dry weather. Coffee Berry Disease has been lower in 2021 due to favourable weather conditions. Climate change is seen to be a major driver of pests and diseases, including the emergence of new ones. Large volumes of coffee (up to 15%) can be lost due to pests and diseases. The regression analysis did not find any correlation between perceived P&D pressure and for example training, number of RA practices, specific P&D practices or soil health.

Almost all farmers treat pests and diseases on their coffee plots, with organic methods being more popular in Uganda than in Kenya. The tendency to use chemicals is far higher in Kenya (which may be due to their greater accessibility as compared to Uganda – see later insights on access to inputs) where farmers tend to use insecticides and apply fungicides. In Uganda, pruning or keeping trees open, followed by mulching and weeding are the most popular approaches to manage pests and diseases (there are also high rates of pruning in Kenya, see below, but not as a deliberate approach to manage pests and diseases). A number of farmers also apply 'other' methods to treat pests and diseases in Uganda. According to FGDs, one of the most popular alternative methods among farmers to treat pests and diseases is using red pepper and/or ash, and applying that to the affected areas, applying organic manure or stumping affected trees. Survey data also revealed a number of farmers (9% of Ugandan farmers) using ash and pepper as 'other' approaches to treating pests and diseases. The regression analysis showed that farmers who received training on pests and diseases management are more likely to use chemical pesticides. This relation does not exist for the use of non-chemical pest control measures. This could indicate that current training is heavily focused on chemical measures.

Whereas surveys show that farmers practice predominantly organic methods of treating pests and diseases in Uganda, due to the ease of accessibility, the experts in the KIIs recommend different practices. For instance,

Table 17: number of mentions of different practices implemented to manage pests and disease management on coffee plots (% of farmers)

Practice	Kenya coffee plot (n=238)	Uganda coffee plot (n=236)
Spray insecticides	61%	17%
Prune or keep trees open	18%	55%
Spray fungicides	34%	3%
Mulching and weeding to keep the tree healthy	6%	21%
Planting with resistant varieties (e.g. R11 or Batian)	8%	2%
Grafting with resistant varieties (e.g. R11)	4%	0%
Other (e.g. homemade methods)	0%	16%
Squash Antestia bugs or eggs when I see them	0%	1%
Have beneficial insects like spiders, praying mantis, chameleons in the farm	0%	1%
Feed the tree to keep the tree healthy	1%	2%

the District Agricultural Officer for Bulambili and Kasese (both in the Rwenzori region) confirmed that the most effective way to control pests and diseases is through using hybrid of organic and chemical methods. This was confirmed through a KII with a researcher at NaCORI, who stated that the different concoctions used by farmers to control pests have been found to be ineffective, especially for pests such as stem/berry/twig borers. He confirmed that almost all copper-based fungicides and pesticides are very effective especially for the Antestia bug, stem borer, and mealybugs. Coffee wilt disease, in the other hand, can only be treated by uprooting and burning the affected plant onsite. Other approaches are to maintain soil fertility and manage coffee plants (pruning, stumping). These have been found to be effective for leaf rust, Antesia bug, red blister and twig borer.

4.2.4 Other good agricultural practices

In both countries, **all farmers practice weeding,** normally using hand tools or by hand, with some limited herbicides. **Almost all farmers in Kenya prune (99%) as a general practice, slightly less in Uganda do so (92%)**. 71% of farmers in Kenya stump their coffee trees, and 58% of farmers in Uganda. Farmers reported several benefits of pruning and stumping such as improved productivity and coffee quality, eliminating disease and building resistance to climate change. Some farmers are fearful of stumping for the short-term loss of income.

Table 18: number of mentions of different practices implemented, relevant to soil erosion and water control (% of farmers) in Kenya and Uganda

Practice related to soil erosion and water control	Flat or gently sloping		Undulating, hilly		Steep, over 40% slope	
	Kenya (83% of sample)	Uganda (41%)	Kenya (12%)	Uganda (31%)	Kenya (5%)	Uganda (28%)
Trenches	11%	92%	14%	77%	33%	77%
Use of stabilizing grasses (e.g. vetiver or napier grass)	47%	21%	66%	24%	33%	20%
Terraces	17%	23%	83%	23%	75%	32%
Tree planting/agroforestry	31%	10%	10%	20%	25%	8%
Minimal tillage	2%	8%	3%	30%	17%	15%
Contour ploughing	3%	2%	0%	4%	58%	0%
Crop residue/trash bands	1%	3%	0%	3%	8%	5%
Check dams	0%	0%	3%	3%	0%	2%
Physical barriers (e.g. rocks)	0%	2%	3%	0%	0%	2%

4.2.5 Erosion and water control practices

Farmers in Uganda are more likely to have steeply sloping or hilly farms than farmers in Kenya. They are also more likely to implement more measures to control soil erosion or retain water. In Kenya, 17% of farmers have undulating/hilly or steep – over 40% slope, as compared to 59% in Uganda; 96% of farmers in Uganda implement practices to control soil erosion versus 73% in Kenya. In Kenya, terraces are the most popular approach, particularly on hilly or steeply sloped farms, followed by use of stabilizing grasses, which are also popular on flat or gently sloping farms. Gently sloping farms are also likely to have trees in place to control soil erosion. In Uganda, trenches and terraces are the most popular approach, regardless of the slope of the farm. Trenches are the most popular approach overall, and particularly on steep or hilly plots. Use of stabilizing grasses is the second most popular approach to control soil erosion, particularly on flat/gently sloping or undulating plots (see Table 18, below). There are still important gaps in these practices, however. For example, KIIs in Uganda noted that some farmers are still practicing methods that are not appropriate for their slope e.g. stone bunds and trenches in the highlands in Bududa (Elgon region) which may lead to landslides.

In regards to water management techniques, farmers in Uganda mentioned use of retention trenches, mulching and bench terraces. In Kenya, farmers mentioned water retention measures only where soil erosion is a challenge. Bench terraces (with planted fodder, e.g. napier grass), were reported in some areas of Kirinyaga and Bungoma. Mulching was a common practice in Bungoma where remains from maize were used. In Kirinyaga and Embu some farmers reporting mulching with pruned coffee leaves.

Farmers reported several benefits to erosion control and water retention practices such as the prevention of soil loss, improved water retention for crops and improved productivity as well as the production of fodder for livestock and firewood. Drought has forced some farmers to implement measures. Small land sizes can incentivise farmers to intercrop and use shade trees which can prevent against soil erosion.

4.2.6 Challenges and risks to farmers in adopting RA practices

The FGDs and KIIs referred to many challenges and risks related to the uptake of regenerative agricultural farming practices.

An important challenge is the lack of knowledge and fixed mindsets. Farmers may lack the knowledge on what to do and how. A number of practices require specialist advice or guidance to be done effectively. It is not always clear to farmers what practices to follow. For example, some farmers highlight the importance of keeping a good shade cover, while others refer to the risk that shade trees can exacerbate or expose other crops to pests and diseases, by acting as hosts. As discussed in the next chapter, many farmers do not have access to training. When they do get training, the training is not always of good quality. Some farmers also receive conflicting advice. For example, in Kimilili subcounty in Western Kenya, the planting of Bananas in coffee farms is advocated against by extension officers since they drain water and nutrients from the soil, while other service providers do advocate for this. The lack of knowledge creates also important risks in relation to the use of fertilizers. Farmers do not have access to soil testing and do not know the specific needs of their soils. Particular chemical fertilizers require more consistent application and there is very little scope for 'mistakes' i.e. forgetting to apply, without negatively affecting production. The wrong use of chemical fertilizers can also alter the soil properties especially lowering the pH, which affects uptake of essential nutrients like phosphorus. There are also cases where farmers divert chemicals destined for coffee, to non-coffee crops, such as maize, beans and horticulture which are short-lived and earn them income faster than coffee. But even when farmers have access to new knowledge, they may still be resistant to adopt new or different agricultural practices. KIIs in Uganda highlighted the fixed mindsets among farmers, particularly the older ones. Others may wish to wait to see the results among their peers.

The labour intensity and the costs for materials and inputs are important constraints. Some practices require significant labour. For example, the labour intensity of implementing soil erosion control methods such as digging trenches and making terraces can be high, particularly where the topography is steep or challenging. The demand for labour for maintenance of these practices can also be high. Other practices such as organic soil fertility management, pests and diseases management or pruning are also labour intensive. This can be particularly challenging for aging farmers who are not in the position to pay for hired labour. Farmers also referred to the lack of tools or inputs to implement the relevant measures (e.g. spades and pick axes for trenches). As described in the next chapter, farmers may face challenges in accessing various inputs. They may be unavailable, not affordable or of poor quality. The lack of finance opportunities for farm investments exacerbates this constraint.

Small farm sizes can also create disincentives for certain practices. Having small landholdings can make it difficult to implement crop rotations properly, meaning farmers effectively overburden the land – some crops can be particularly water intensive and detract from coffee production While small farm sizes can incentivize intercropping, these farmers may be less willing to give up farmland for trenches. Small-scale farmers may also be less willing to give up any short to medium-term income through pruning or stumping.

4.3 Household decision-making

Key messages: Most farmers in both countries stated that decisions are made equally by both men and women, though in Uganda a far higher proportion of farmers responded that the man decides on his own compared to Kenya. Men typically take decisions on to when or where to sell coffee, while women are more involved in other crops. For other household decisions (e.g. savings or schooling) the majority of the households had equal decision-making, followed by more male dominated decision-making.

Most farmers stated that decisions are made both equally by men and women. Most Kenyan farmers stated that a number of different decisions – from which crops to grow, how to use money earned from other crops etc – are typically made by both men and women equally, followed by those who stated that decisions are made mostly by men alone. However, there is some difference according to which decision is being made. For example, when it comes to when or where to sell coffee, men are more likely to decide alone, as compared to when and where to sell other crops, which women are more likely to decide upon. Regarding decisions on whether children go to school, this is more likely to be decided upon by men and women together rather than unilaterally by either men or women.

In Uganda, most farmers stated that decisions are made both equally by men and women. However, a far higher proportion of farmers in Uganda responded that the man decides on his own, than in Kenya. This suggests that women in Ugandan farming households are less likely to be empowered and less part of decision-making than farming households in Kenya. Similarly to Kenya, however, the one area where a woman might decide things 'mostly' is where or when to sell other crops. FGDs in Uganda reveal that there have been some improvements in the involvement of women in household decision-making, attributed to sensitization and gender programs. However, farmers confirmed the survey results: that typically men make decisions regarding marketing of coffee and other cash crops, even if production and processing activities are done jointly. For other crops (e.g. beans and bananas) women have more involvement in decision-making for household consumption and sale. The regression analysis found no correlation with education or farm income but it showed that older respondents reported that women had more say in the household decision-making than younger ones.

There was a sense among enumerators that survey respondents – who were often men – were keen to emphasise the shared decision-making between men and women on most key decisions, perhaps in a way that exaggerates the reality on the ground (where in fact men are likely the key decision makers on many aspects). FGDs in Kenya revealed that there was indeed some shared decision making between men and women within some households, but that there was significant variation between regions, with those in Bungoma most likely to have male-led household decision-making.

Table 19: % of farmers who stated which gender makes key household decisions (n=474)

Product	The man decides	Mostly the man	Both man and woman equally	Mostly the woman	The woman decides
Which crops to grow	12%	18%	55%	6%	9%
Which inputs to buy	12%	26%	46%	6%	9%
Where or when to sell coffee	16%	35%	35%	5%	8%
Where or when to sell other crops	11%	19%	42%	17%	11%
How to use money earned from coffee	14%	25%	49%	4%	8%
How to use money earned from other crops	9%	16%	56%	9%	10%
How to invest any income from the farm	11%	23%	54%	4%	8%
Where or when to obtain a loan from the bank	13%	24%	51%	4%	8%
Whether children go to school	9%	12%	66%	5%	8%

In Uganda and Kenya, a number of barriers to **women participating more fully in household decision-making were identified. These include:**

- **Dominant norms / cultural perceptions** of the role of women and men – where it is believed that men should make decisions and that men own everything in the household. This continues to hinder full participation of women in decision-making, this was worse off in the central region compared to Elgon and Rwenzori. Money is also associated with power, which means the man wants to retain as much control over finances as he can.
- **Domestic violence and alcoholism** can make it hard for women to have a voice in the household. There can be high levels of mistrust between men and women over how money is being used.
- **Lack of planning and budgeting** for income received in the household, which makes it harder for women to play a role in deciding how income will be spent, as well **as poor communication between men and women.**
- **Level of education and exposure** on gender issues. People don't attend trainings and this limits their exposure to information.

4.4 Child labour

Key messages: We found no instances of child labour in Kenya. In Uganda, children can be involved in work on the farm during school time and may do hazardous work – the closure of schools due to the Covid pandemic likely exacerbated this situation and the observations of the research team of child labour on the sampled farms. In both countries measures to protect against child labour are in place, but in Uganda they are less effective.

4.4.1 Occurrence of child labour

In Kenya, there were no observations of child labour by enumerators, while 12% of surveyed farms in Uganda had instances of child labour observed. Of the 12% of child labour cases (28 farms in total), 22 were engaged in what could be considered hazardous work. The most common form of hazardous work being carrying heavy loads (15 instances), followed by using dangerous machinery or equipment (6 instances – using jembes, hoes, pangas etc), followed by using toxic chemicals (5 instances). Most children observed on farms in Uganda were primary school aged (8-12 years), likely heavily influenced by lockdown and closure of schools. It was impossible to distinguish between external and family labour during enumerator observation, but KIIs implied that some farmers do use paid child labour (for example the manual transport of coffee, which is typically younger children, or motorbike transport by older youths). In addition, a number of enumerators observed boys of secondary school age engaging in coffee pulping in trading centres.

In Kenya, children do help out on the farm, but this work does not cause school dropouts and can therefore not be considered as child labour. Where school dropouts do happen, these are linked to economic hardship rather than being driven by a need for children to engage coffee farming. In Kenya, interviews with schoolteachers revealed that there are hardly any school dropouts in Kirinyaga and Embu. Where they do occur, this is not linked to coffee production, but may be the result of financial hardships of the family (made worse by COVID), whereby parents cannot afford fees, or transfer to another school. Children have limited time to spend on the farm in the week, due to homework, but they may support their parents in picking coffee berries or weeding during the holidays, under the parents' supervision.

In Bungoma, the dropout rate stands at approx. 10% per year as reported by a teacher in Kamusinde Primary School. This is due to unsatisfactory and poor living conditions/ standards within the community, and poor parental care. As a result, there is a common tendency for children to drop out of school to work in stone mines, in motorcycle/bodaboda sub-sectors, maize farms (planting, weeding, harvesting) and in Irish potato farms in Mt. Elgon area. Boys aged between 15-18 years show highest drop-out rates particularly during harvesting (coffee) and planting seasons (other crops e.g. sugarcane, maize).

Other key informants (not schoolteachers) stated that children under the age of 18 may be engaged in berry picking during the peak season for coffee harvesting and weeding small portions of coffee farms. In some cases, children may be involved in transportation of fresh berries from farms to the homes and sometimes to the factories. Some parents also involve children in some farm activities as a life skill for learning how to do selected farming practices.

Children's engagement on farms in Kenya was not linked to school dropouts by farmers and was not considered hazardous work. Farmers in Kenya, explained that they would engage their children in farm activities like weeding and berry picking only during peak harvesting seasons or during school holidays or weekends. However, this should be viewed as support that children provide to their families and a way of learning life skills. Cases of school dropouts in places like Bungoma are linked to economic hardships – parents cannot afford to pay school fees and need additional sources of income from the children being employed elsewhere, such as in brick making, or *bodaboda* riding etc.

In terms of hazardous work, farmers explained that they avoid children working for long hours on the farms. However, they might be used to carry coffee from the fields to home, before the coffee is taken to the mill. Weeding was another activity children would be engaged in, and although weeding would involve farm tools like jembes, farmers did not consider it hazardous. Parents assessed what role their children could play on the farm based on their age. For example, older children would be engaged in harder or more skilled activities e.g. pruning and transportation of berries.

In Uganda, farmers and key informants mentioned that children are involved in work on the farm during school time or may do hazardous work. In Rwenzori, children can be engaged in guarding vanilla during day instead of going to school, or at night, as well as working in cotton, salt mining, and fishing. Child labour in coffee, and overall, is less common in Rwenzori than other regions, however. In Elgon, children can be engaged in hazardous labour on coffee farms, including the spraying of chemical, pulping and carrying heavy loads from the farm. They may also be involved in the collection of firewood for sale to other households. In Central, children are involved in digging, weeding, planting and harvesting of coffee. Carrying heavy loads during harvesting is the main hazard.

4.4.2 Drivers behind child labour

In Uganda, the occurrence of child labour partly linked to the closure of schools due to Covid. This means that activities that are currently on the ground may not be a true representation of 'typical' activities. This may partly explain the higher levels of child labour observed by enumerators in Uganda as compared to Kenya, but key informants and FGDs gave a sense that child labour – both hazardous and non-hazardous – is more common in Uganda than in Kenya.

Besides the closure of schools, we found several reasons for child labour. They include

- **High costs of paid labour,** which can mean that child labour can be an important source of unpaid, family labour (drivers linked to poverty). Some families with little capacity to use hired labour do so in order to bridge the labour gap due to inadequate finances (Kenya).
- **Poverty:** which is a driver of child labour more widely (not just in coffee). Children charge for their labour to non-family members to generate income for food (and school fees when they are open) (Uganda). Poverty levels have been heightened by COVID.
- **COVID has meant that schools have been closed, and for a particularly lengthy duration in Uganda.** As a result children have more time to engage in labour. COVID has also exacerbated poverty for many households, exacerbating the need for additional sources of income, and for income to cover the cost of feeding children at home.
- **Criminality:** specifically the theft of vanilla and coffee is on the rise in Uganda, and has led to an increase in children guarding plots.
- **Limited access to water and firewood:** increasing the need for children to help collect them. Again, poverty can be a factor driving the lack of access.
- **Fixed mindsets** which mean that parents do not see the value of education

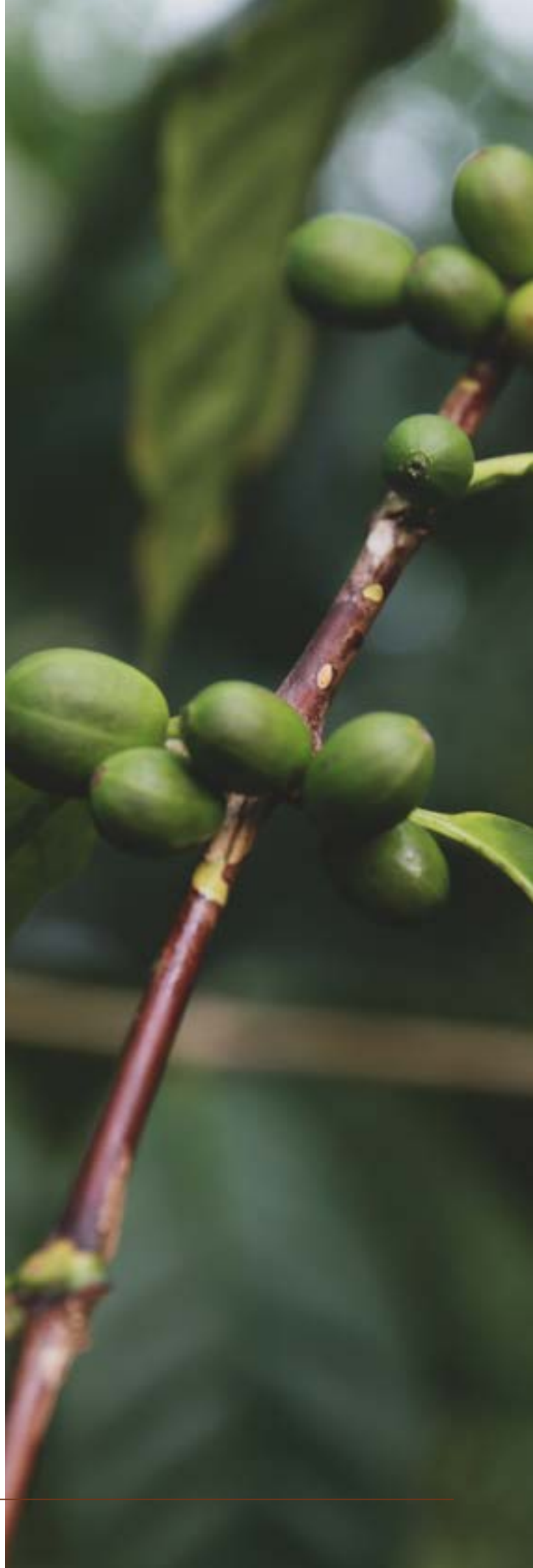
4.4.3 Measures to protect against child labour

In Kenya, key informants and farmers mentioned the following measures that are already in place in Kenya to protect against child labour on coffee farms:

- **Greater sensitisation of parents on the risks associated with child labour.** To enhance child protection, there is need to create general awareness and sensitization on the dangers of child labour, initiate life skills and mentorship programs to children and create learners' support clubs in schools particularly in Bungoma County.
- **Short-term credit** facilities by FCSs/factories, or advance payments for harvesting of coffee berries, to allow for school fees to be paid.
- **Advocacy** by factories and provincial administration (chiefs) and schools. The FCSs/factories advocate for zero child labour policy and in theory ban children working on coffee farms (but this ban remains without 'teeth' in practice. Ultimately family labour is decided at the family level and FCS are limited in their powers to stop them. However, they may place public notices within factories to advocate against child labour and educate their members on the dangers of child labour. The local provincial administration will advocate in local meetings for children to attend school instead of working on farmers (this was particularly common and strong in Embu and Kirinyaga, but less so in Bungoma). Advocacy against child labour and children rights occurs in local schools.
- **Certification:** certification schemes ban child labour. The auditing process can help ensure child labour does not happen.

In Uganda, the following measures are in place (according to key informants and farmers):

- **Intervention by community development officers** when cases of child labour are brought to the subcounty (Elgon and Central). These arrangements are effective in the short-term, however, and rely on mutual agreement between the school management, parents and sub-county leadership.
- **Mobilisation of children** by village education committees to get children into school at the start of the school year (Rwenzori).
- **Interventions by police:** Children may be arrested if they refuse to go to school (normally at the start of the year) (Rwenzori).



5. Outputs: Access to services

Key messages: Service provision at the moment is patchy in regards to availability, relevance and tailoring to regenerative agriculture. There is room for improvement in both access, quality/ satisfaction and relevance to regenerative agriculture. While some bundling of services takes place through cooperatives or farmer groups, most services target coffee only. As farmers divert inputs destined for coffee to other crops (e.g. fertilizers), there is opportunity for more blended service delivery targeted to specific non-coffee crops.

This chapter focuses on understanding services that are currently being received by farmers. These services mentioned are potentially in the scope of the program.

5.1 Access to training

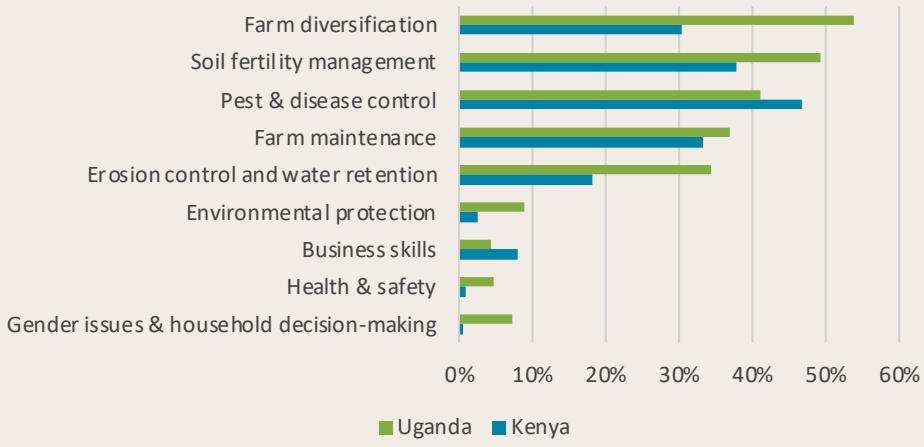
Key messages: Almost two thirds of surveyed farmers received farm related training in the last two years, but the number of topics included and the perceived quality varies a lot. Most training is focused on coffee production and not informed by the principles of regenerative agriculture. According to farmers, training on household decision-making and gender is basically absent in both countries and in Uganda further attention is needed to child labour. There is a clear need for more RA-orientated training and practical training in particular to help shift mind sets and encourage implementation and adoption of learnings.

Almost two thirds of surveyed farmers received training in the last two years, with men more likely to be trained than women. 66% of the farmers received at least one training. More farmers in Uganda received training than in Kenya (75% vs 57%) and more men than women (69% vs 59%). The gender difference in access to training is similar for both countries. FGDs revealed challenges for women to participate in off-site training specifically.

Most training is given specifically for coffee. Almost all farmers with access to training in the last 2 years, received training specifically for coffee (98%), while 41% also received training relevant to other crops and 5% received training unrelated to any crop. In Kenya, relatively more farmers with access to training received training for non-coffee crops or the farming system in general than in Uganda (67% vs 28%). FGDs in both countries revealed a need to expand training to other crops.

There is no comprehensive training package on the different aspects of regenerative agriculture. Those who received training, received on average training on 2 topics (in Kenya 1.8 and Uganda 2.4 topics). The most mentioned training topics were pests & disease management, soil fertility management and farm diversification. These were followed by farm maintenance and erosion control and water retention manners. Much less frequent were training on environmental protection, business skills, gender and household decision-making and health & safety. FGDs revealed a need for training on more topics. While farmers receive training on specific topics, they are generally not given in relation to the whole farming system, or do not promote regenerative agriculture.

Figure 6: proportion of farmers that received training on a particular topic in the past 2 years (n=474), for Kenya and Uganda



In Uganda, more type of actors provide training than in Kenya. In Kenya training is predominantly received from cooperatives (67% of those who received training received it from cooperatives) and value chain actors such as traders, mills or exporters (61%). Only 3% of the farmers received training from NGOs and no one received it from the government. In Kenya, a lack of government agricultural extension officers was noted. FGDs revealed that some farmers received training on regenerative agriculture related practices as part of certification programmes. It is important to bear in mind that the cooperatives in Kenya often act as a vehicle for training to be provided by others, such as a NGOs, exporters, government actors, or input companies. Farmers may therefore associate a significant proportion of the training they receive with the cooperative rather than the third party who is actually delivering the training via the cooperative. In Uganda, the sources of training are more diverse. While cooperatives (44%) and value chain actors (43%) are still the main source, several farmers also receive training from the government (15%) and NGOs (9%). Similarly to Kenya, cooperatives or farmer groups often act as a vehicle for other parties to provide training. In Elgon, a number of coffee exporting companies have trained farmers on how to control soil erosion. Training from the government is primarily received from extension workers of the agricultural department, and sometimes from research institutes. All project partners were mentioned as sources for training. Of the full sample size, 33% received training from them (which corresponds to 51% of the farmers who received training in the last 2 years) with Mountain Harvest reaching relatively most farmers (40% of the farmers) and Ugacof the least (23%).

FGDs revealed a need for more regular training, as well as more practical training. Particularly in Uganda, farmers mentioned several times that the training is not delivered practically (e.g. via demonstration plots). This can limit the level of adoption, since farmers do not see the benefits of implementing practices such as stumping, pruning, soil and water conservation practices. There are also complaints that trainings given are short, happen irregularly, and there is little follow-up. Farmers in Uganda, also mentioned the need for translation of manuals into Luganda by professionals and application instructions. Farmers also mentioned conflicting information or advice they received from different sources, e.g. on the use of chemicals.

5.2 Access to inputs

Key messages: Access to seedlings for coffee and non-coffee crops is moderate to good. Availability and quality of chemical inputs is better in Kenya than in Uganda, although affordability is a common concern. While in Kenya, most farmers procure these inputs via their cooperative (often on credit), the sources in Uganda are more diverse. Other services which are often unavailable or unaffordable are soil testing and equipment for stumping, digging trenches or irrigation.

5.2.1 Access to seed and seedlings

Access to seed and seedlings, whether for coffee and non-coffee crops is moderate to good, with Kenya scoring better than Uganda. Most farmers judge the availability, quality and affordability of coffee and non-coffee seed and seedlings to be moderate or good. Almost three quarters of farmers experience seedlings to be available, of good quality or affordable. Where farmers do struggle with accessibility, affordability is the main constraint. Accessibility, quality and affordability in Kenya is higher than in Uganda.

In the past 2 years, 35% of farmers received new coffee seedlings. In Kenya, the majority received these from a cooperative and in Uganda from the government. In Uganda, 22% of farmers procures its seeds or seedlings from neighbouring farmers or village traders, which could limit the adoption of new varieties. In Kenya, this number is 5%. The project partners have been mentioned by 6% of the farmers as source for coffee seedlings. Of those farmers who received seedlings, Kenyacof was most frequently mentioned source (38% of farmers linked to Kenyacof), followed by SMS (20%) and Touton (10%), Ugacof (9%) and Mountain Harvest (0%).

5.2.2 Access to organic fertilizers and pesticides

Access to organic fertilizers is considered to be good. In Kenya, 97% of farmers apply organic fertilizers on their coffee plots, as compared to 68% of those in Uganda. For non-coffee plots these figures are lower: 87% in Kenya and 54% in Uganda. Most farmers consider the availability and quality to be good (with Kenyan farmers rating availability higher than in Uganda). Manure is less available in the highlands of Uganda, as less people have livestock or farmers have split farms and struggle to transport (cause of the costs) manure to coffee plots. Only 11% rate the organic fertilizers they use on their coffee plot as unaffordable (7% for non-coffee plots).

For organic pest management, materials like ash, urine, herbs (e.g. red pepper) are cheap and readily available. Some FGDs in Uganda revealed challenges in the availability of red pepper as input for organic sprays as well as that the collection of inputs and fabrication of organic sprays is time-consuming.

5.2.3 Access to chemical fertilizers and pesticides (and herbicides, fungicides, insecticides)

Availability and quality of chemical inputs is better in Kenya than in Uganda, though affordability is a shared concern. The application of chemical fertilizers to coffee plots is much more common in Kenya than in Uganda (75% of farmers and 28% respectively). This is also true of application of chemical fertilizers to non-coffee plots (48% vs 17% of farmers in each country respectively). For chemical pesticides these numbers are 75% vs 30% for coffee and 38% vs 29% for non-coffee crops in the respective countries. Farmers who use chemical inputs rate the availability and quality to be moderate or good in both countries. Affordability is an issue to most farmers; 65% and 60% of farmers respectively rate fertilizers and pesticides as not affordable. Kenyan farmers find chemical inputs to be more available, of higher quality, but of lower affordability than Ugandan farmers. The figures for accessibility of inputs for coffee or non-coffee plots are comparable. As affordability is an issue, many farmers are not in a position to purchase the required quantities. The regression analysis shows that those farmers who have access to loans are more likely to find fertilizers affordable, which implies that affordability is in part linked not to just costs and prices, but also purchasing power. This demonstrates the potential value of bundled services.

In Kenya, chemical inputs come predominantly from cooperatives. They in turn, source them from agro-chemical companies or input dealers. Often farmers procure chemical inputs from their cooperatives through a credit arrangement whereby the amount is deducted from their pay for coffee. Accessibility of the required quantities on credit is dependent on the quantity of fresh coffee berries/cherry delivered to the mills. Due to high demand during some seasons, inadequacies in the supply of chemical inputs were reported in Kirinyaga and Embu Counties. As a result, some farmers would access chemical inputs in the local agro-input dealer instead. Farmers also complained about the lack of experience of cooperative management in sourcing inputs resulting in a perception among farmers that cooperatives were failing to get the best prices for inputs for farmers.

In Uganda, farmers mostly procure chemical inputs from local agro-input dealers which are located in town centres which makes accessibility a challenge for more remote farmers. However, even in towns such as Kisinga, Bwera and Kasese (all in Rwenzori) major input dealers are absent. Dealers also often lack technical knowledge on how to apply these chemicals, which in turn limits the information farmers receive. Advice and training on the use of chemical inputs was noted as a key gap by farmers. Some farmers in Central have obtained chemicals from the exporter they work with (Ugacof) and use them across coffee and non-coffee plots.

In both countries, there are reports of sub-standard or counterfeit chemical inputs, though this is more prominent in Uganda. Farmers have a challenge to identify fake inputs, although also in Kenya some issues around quality of particular chemical fertilizers exist in the three regions.

Farmers in FGDs also referred to other inputs for which challenges in terms of availability or affordability exists, include equipment for coffee drying, storage, irrigation digging trenches as well as affordable and quality soil tests.

Table 20: Key findings on access to inputs

Inputs	Kenya		Uganda	
	Accessibility	Source	Accessibility	Source
Seedlings	Good	Cooperatives	Poor (unaffordable and moderate or mixed quality)	Government
Pesticides	Moderate-good (affordability an issue)	Cooperatives; agro-input dealers	Poor (sometimes available unaffordable, moderate quality)	Agro-input dealers
Chemical fertilizers	Moderate-good affordability an issue)	Cooperatives; agro-input dealers	Moderate	Agro-input dealers
Organic fertilizers	Good (moderate quality)	Own-farm: neigh-bouring farmers	Good (moderate quality)	Own-farm; neigh-bouring farmers

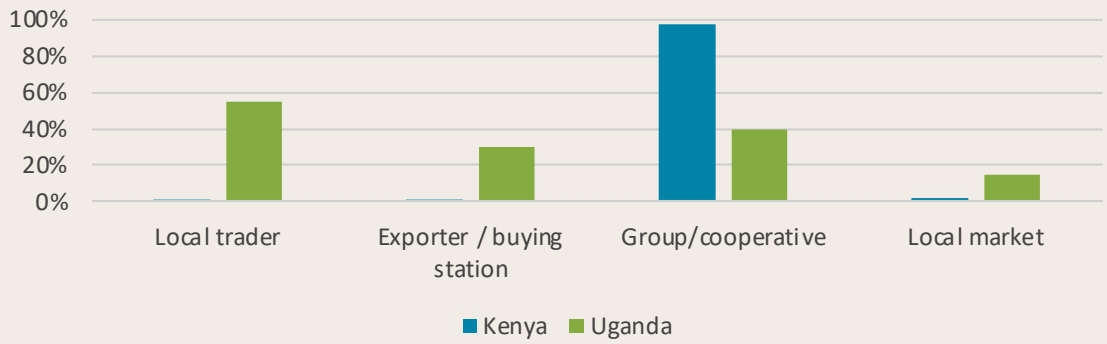
5.3 Access to markets

Key messages: Market access for coffee is good as all farmers are able to sell their coffee, but there is room for improvement in satisfaction levels. In Kenya, all coffee is sold to cooperatives, while in Uganda buyers are diverse. Competitive prices, timely cash payments, and access to services are important factors in farmer satisfaction with buyers, but these services are often absent. Market access for some non-coffee crops are lacking or of poor quality.

5.3.1 Access to markets for coffee

All farmers are able to sell their coffee. While in Kenya farmers sell their coffee predominantly to a cooperative, the market outlets in Uganda are more diverse. In Kenya, 97% of farmers sell their coffee to their cooperative, 2% reported selling to the local market (which is illegal). There is some competition between cooperatives, since farmers can choose which cooperative they join. Farmers can, in theory, be members of more than one cooperative. In reality, the direct and indirect costs of multiple membership, especially where the cooperative is located further away from the farmer, typically inhibits multiple membership. Farmers in Kenya stated that they would prefer to have more marketing options for coffee to increase competition and prices and avoid a monopoly (although one strategy is to register a spouse to a different cooperative to increase marketing options). Annual supply contracts are signed between cooperatives and marketing agents/millers. Cooperatives can choose to change marketing agent and miller on an annual basis if the terms of trade and service provision are not to their satisfaction. This results in significant competition between marketing agents and millers for coffee supply services from cooperatives.

Figure 7: Coffee buyers in Kenya and Uganda



In Uganda, market outlets are more diverse. The most frequent buyers are local traders, i.e. middlemen (55%), followed by farmer groups or cooperatives (40%, they are often linked to exporters), exporters directly (30%) and local markets (14%). Farmers can have multiple buyers: 38% sells to two or three types of buyers. FGDs revealed that coffee – organic and sorted cherries – is typically sold to coffee exporters directly (or their groups) while whatever is left is sold to other buyers or local traders. There is a high level of competition between exporters in all regions. Main exporters like Kawacom, Kyagalanyi Coffee Limited and Great Lakes buy coffee across all the three regions. Other buyers of coffee include small-scale exporters and local millers (mainly in Central and Rwenzori). Coffee buying is highly liberalised in Uganda, anybody can buy and sell coffee at whatever price they want. Most farmers are registered with more than one exporter or farmer group and are able to access services like extension and inputs from all of them, hence the level of loyalty is quite low.

There is quite some variation in coffee prices. On average farmers received in Kenya 82 KES (0.73 USD) for a kilogram of cherries. There are important differences between the regions. Prices in Bungoma are typically reported to be around 60 KES per kg/cherry, in Kirinyaga between 80 and 100 KES while in Embu they float around 100 KES per kg/cherry. The price information from Uganda is possibly less reliable. As farmers sell to different buyers at different times, a price given by farmer may be less likely to reflect the average price they received throughout the year than in Kenya. For Arabica we found an average price close to 1450 Ush (0,41 USD) for a kilogram of cherries with comparable prices in Rwenzori and Elgon. In Rwenzori, many farmers produce dried cherry for which they sell on average 5000 Ush a KG, which translates to a cherry price of 2500 Ush (using a conversion rate 2:1). Some also have their cherries hulled at private milling plants and sell their coffee as green beans (this is referred to as FAQ in Uganda). For these green beans they have been paid on average close to 6000 Ush per KG. This translates to a cherry price of below 1000 Ush which is significantly less than the conventional cherry price (conversion rate 6.25:1). In Elgon, several farmers produce dried parchment for which they receive on average 6600 Ush from mainly cooperatives and exporters. This translates in a fresh cherry price which is slightly lower than the average price farmers received for the fresh cherry (conversion rate 5:1). The price farmers in Central received for Robusta fresh cherry was on average 830 Ush (0,23 USD). However, most farmers sell dried cherry and/or green beans (i.e. FAQ) with average prices of 2500 Ush and 4000 Ush. Converted to fresh cherry volumes both types receive an added value compared to the fresh cherry price (conversion 2:1 for dried cherry and 4:1 for green beans). For dried cherry, farmers received higher prices at cooperatives and exporters than from the local market or local traders. For green beans, prices were comparable.

There is room for improvement on satisfaction levels. In Kenya, 52% of farmers who deliver to cooperatives are quite or very satisfied with this trading relationship, while 23% are neutral and 24% are not satisfied or very unsatisfied. In Uganda, farmers are more likely to be satisfied with their trading relationships with the farmer group or cooperatives than with other buyers (82% are satisfied, while only 12% is not satisfied with cooperatives). The local market (e.g. neighbouring farmers or local agents) is valued slightly higher than selling to exporters, while farmers are least satisfied with local traders: 43% of farmers selling to them are not satisfied or very unsatisfied.

Farmers in both countries revealed concerns about the poor management, capacities and corruption of the cooperatives to effectively market on their behalf. FGDs in Uganda revealed various factors which determine satisfaction levels on trading relationships. They include timely buying, paying competitive prices, accurate weighing scales, timely cash payments (and secondary payments), and access to services (including tarpaulins and drying beds). Not all of these practices are offered by every buyer, including project partners. In Kenya, there are complaints about the long period of payment for coffee, taking approximately 9 months from the time of first delivery to the factory/mill. Other cropshave a monthly payment scheme to farmers, which is preferred. Second payments are preferred to avoid cash flow difficulties later on. Because of the long payment time, farmers in need of cash may prefer to sell to neighbouring farmers or local traders (which is illegal) who pay instantly. However, farmers perceive them to pay lower prices.

In Uganda, there are issues with the quality of coffee beans sold. This is for various reasons. Buyers want ripe coffee, but farmers may be under pressure to pick coffee too soon to access cash. Another factor is the risk of theft, which also pushes farmers to harvest before the berries are ripe. This means they receive low prices and affects their access to competitive markets. Farmers may also face constraints in transporting their ripe cherries to the mill or collection point on a daily basis and prefer to deliver one or twice a week with a mixed bag. Depending on how close collection points are to the farmers, farmers are or aren't able to travel there every (or every other) day. Also, for processed berries there are multiple issues. Most farmers dry them on the ground and have generally poor post-harvest handling practices (which could be a reason why above mentioned prices for processed cherries are relatively low compared to fresh cherries). Farmers also lack the post-harvest handling and storage materials.

Figure 8: Type of buyer for non-coffee crops

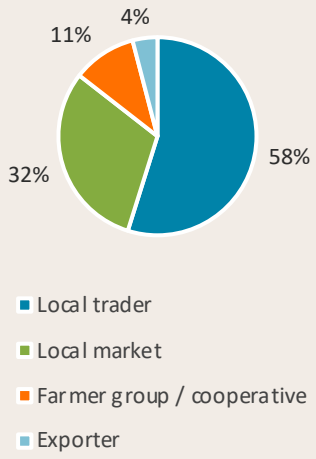
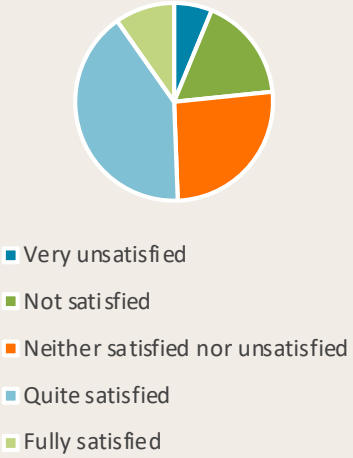


Figure 9: satisfaction with trading relationship f or non-coffee crops



5.3.2 Market access for non-coffee crops

Market access for non-coffee crops is lacking for some farmers and products. For the non-coffee crops which the service providers promote, local traders were last year the most dominant market outlet 58%), followed by the local market (31%). There are a few exceptions. Cooperatives in Uganda also buy vanilla, while some cooperatives in Kenya also have collection centres for dairy and macadamia nuts (e.g. in partnership with a dairy company). In Kenya, macadamia nuts were also sold directly to an exporter of macadamia nuts.

Most farmers selling these products to the local market, cooperative or exporter are satisfied with this relationship. Approximately a quarter is not satisfied with the cooperative or local market. Local traders have a poorer reputation as 30% are not satisfied and 37% are very unsatisfied with this trading relationships. In Uganda, local traders in vanilla are often seen as untrustworthy.

Market access is lacking for some farmers and products. In nearly 30% of the cases, farmers did not sell any volumes at all of a specific product, while roughly the same proportion of farmers did not sell all of their production. This is partly because products are used for the household consumption, or crops are not mature yet, but FGDs revealed that farmers also face challenges in selling some of their production. For example, in Uganda, farmers referred to the impact of the Covid pandemic, where fewer traders were buying from farmers, overall demand was reduced, and in turn prices were lower.

Price volatility and poor infrastructure are key issues related to market access. For coffee, as well other crops, price volatility is a major concern to farmers. As a result, farmers are not in a position to make financial plans. In the hilly parts of Kenya and Uganda, and during the rainy season, transportation can be problematic. In such situations, products are often carried on the head in Uganda, possibly increasing the workload for women and children. As a result, most farmers sell to whoever reaches them, losing their bargaining power in the process. Farmers in Uganda also mentioned that the lack of access to market information also puts buyers in a stronger bargaining position than farmers.

5.4 Access to finance

Key messages: Slightly more than one third of the farmers reported to have accessed a loan for their farm, although in Kenya this number could be higher as farmers may not have considered the inputs they received on credit. Farmers in Uganda do not access insurance services. In Kenya health insurance is quite prominent, but crop insurance is barely accessed. Climate change and drought are exacerbating the need for agriculture-related insurance, while there is also a need for crop theft insurance in Uganda.

Implementation of RA practices may require investments which can be challenging for farmers to make. Examples of investments include inputs (e.g. seed and seedlings for coffee, other crops and shade trees), chemical fertilizers and pesticides, organic pesticides (or their inputs) and manure. Chemical inputs are considered to be particularly expensive by farmers and the lack of purchasing power is an important reason not to apply them or apply them below the recommended doses. Investments may also be needed in livestock. Other costs include purchasing tools such as pruning sheers, jembes/spades or larger equipment (e.g. irrigation, post-harvest handling and storage). Farmers may also need to make investments into smartphones, apps and data to gain access to weather or market information. Where soil health tests are available they are often financially out of reach. Labour can be another significant cost. A number of RA-practices are labour intensive e.g. implementing measures to control soil erosion or conserve water (e.g. digging trenches), weeding, stumping and replanting. Where farmers are ageing, some practices may be beyond their physical capabilities and hired labour might be a necessity. Many farmers mentioned during FGDs that labour is expensive.

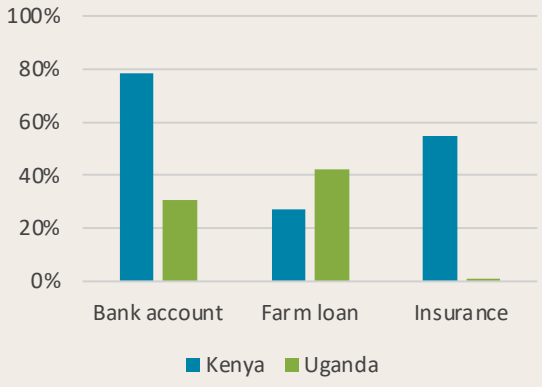
Practices like stumping or replanting may also incur short to mid-term income loss, posing additional constraints to families who already have cash shortages. Most farmers lack working capital to make necessary investments in the farm.

5.4.1 Access to a bank account

Over half of the farmers have a bank account (54%).Costs and distance to the bank are key reasons why other farmers do not have bank accounts. More of the sampled farmers in Kenya have bank accounts than those in Uganda (78% vs 31%). Male headed-households are more likely to have a bank account than female headed-households (58% vs 42%). In Uganda less than a quarter of the female headed households has a bank account. In Kenya, farmers have bank accounts with a total of 19 different banks and SACCOs. The most frequently mentioned banks were Nawiri Bank (28% of all farmers mentioned this as the source of their bank account), Fortune Bank (23%) and Equity Bank (19%). In Uganda, 20 banks were mentioned, of which the Centenary Bank most frequently (43%), followed by Stanbic (15%).

In Kenya, 94% of farmers who have bank accounts are satisfied with their bank accounts, in Uganda 89%. In both countries, the primary reason for being dissatisfied is that the fees are too high. Of those who did not have a bank account, 40% referred to the high costs as key constraint. In Uganda, 39% also referred to the long distance to the nearest bank branch. Across both countries, 31% indicated not to need a bank account or not to have any money to put in it. Less frequently mentioned constraints were the complexity of the application procedure (5%) or inability to meet the bank requirements (1%).

Figure 10: Access to financial services



5.4.2 Access to loans

35% of surveyed farmers accessed credits or loans for their farm in the last two year. In Uganda, more farmers accessed a loan for farming purposes than in Kenya (42% vs. 27%). In Uganda, relatively more female headed households accessed a loan compared to male headed ones (46% vs 40%), while in Kenya this was the other way around (19% female vs 30% male). Of those who have accessed loans, most in Uganda (87%) have been short-term (less than a year), with the remainder medium-term (1-3 years). In Kenya, 45% have been medium-term, 38% short-term and 18% long-term (more than 3 years). However, farmers are typically cash poor, and the loans that are taken by them (beyond inputs on credit) are typically taken to pay for emergencies or household/family necessities (health, school fees), rather than for investments in agriculture. The regression analysis showed that farmers with a bank account are more likely to have access to loans for farming purposes. This could be explained by the fact that farmers already have a degree of 'bankability', documentation, identification, collateral, bank account etc which means it is also easier for them to obtain a loan. Other factors like gender of the household head, education or farm size did not show a significant relation with having a bank account or not.

There is some contradiction between survey data from Kenya and information from FGDs and KIIs. Many farmers stated that they receive inputs on credit from the cooperative. Not all farmers have considered these when they were asked whether they had accessed a loan for their farm in the survey. Some farmers in FGDs also stated that they can access loans for tools and equipment to enhance farm production and to pay school fees.

In both countries, the cooperative is the main source for a loan (49% in Kenya and 45% in Uganda). In Kenya, this is followed by microfinance providers (25%), government banks (14%), private banks (12%) and traders (12%). In Uganda, the second source for loans are private banks (23%), followed by Village Savings and Loans Associations (VSLAs) (16%). In Uganda, male headed-households access loans mostly from the cooperative often through cooperatives and local private banks, while female headed-households access them through the cooperative and informal lending groups. In addition to farm inputs, farmers and local key informants in Uganda mentioned obtaining small loans from VSLAs for school fees, to cover food costs during months of hunger, in times of

illness, to set up businesses, and during other emergencies. Some farmers also obtain small amounts from microfinance institutions (e.g. Fura, Hofokam, Finca, Brac). The largest loan size from VSLAs is around 50,000 Ush. (14 USD). They also seek loans from the bank when they require large amounts or when the groups do not have enough to lend. Farmers in Central Uganda more commonly mentioned loans from banks (Centenary, Finance trust bank) which is to be expected based on their larger-than-average farm size. Ugacof was mentioned as a provider for loans of a maximum of 500,000 Ush. (140 USD). However, few farmers are eligible for this loan. As previously mentioned, a number of farmers in Kenya mentioned during FGDs that they access small loans via mobile money services (e.g. Fuliza or M-shwari, via M-PESA, owned by Safaricom), but they typically only qualified for small amounts which they will use to settle small urgent personal expenses.

Local key informant interviews in Kenya confirm that cooperatives are the major provider of financial services for small-scale farmers (both savings and loans) for agricultural purposes as well as others (e.g. paying school fees). Collateral is required, in the form of coffee deliveries. Generally, however, access to financial services via cooperatives is good, due to the farmer cooperative societies being shareholders in a number of financial institutions. Nevertheless, the size of the loan that farmers can obtain from the cooperative is dependent on the quantity of coffee harvest delivered by the farmer to the cooperative/mill, which can limit the amount smaller or less productive farmers are able to obtain. Poor harvest forecast due to weather events also limits what cooperatives can to lend them.

When asked about their preferred loan provider, farmers most commonly mentioned cooperatives (both countries), followed by micro-finance institutions (particularly in Kenya) and private banks. Government banks (in Kenya) and VSLAs or relatives (in Uganda) are also mentioned. In both countries, local money lenders are least preferred. Coffee companies are rarely preferred.

Most farmers are quite satisfied with the loan they received. In both countries over three quarters of farmers are satisfied with the loans they received, while 13% are not satisfied. The main reason for dissatisfaction are high interest fees, followed by the limited loan amount and short repayment duration. In Bungoma, Kenya, farmers suffered as a result of corrupt practices and mismanagement by one cooperative, whereby a savings/credit scheme started by farmers collapsed.

Of those who did want a loan, but could not access it, high interest rates were most often mentioned as main reason for lack of access (by 58% of relevant farmers), This was followed by the inability to meet collateral requirements (notably land deeds) or other requirements (19%). Farmers in Uganda mention interest rates of 23% per annum charged by banks. In addition, banks may charge insurance charges in case the farmer should default on their loan due to poor harvests. These fees lack transparency, so farmers are not clear on what the fees/deductions are made for. Additional constraints to accessing finance include that: some banks do not give a grace period before they require repayment, which can be challenging for farmers, and some lenders require monthly repayment schedules. Farmers may also not meet the requirements of banks for financial services (e.g. land agreements/ land titles or minimum farm size) or have the required collateral (land title, ownership of houses or businesses in their name). Larger loans are particularly hard to obtain without assets to act as collateral. There is also a lack of understanding on the part of farmers when signing loan agreements. FGDs in both countries also revealed that the physical distance to a bank is seen as a constraint as well as the absence of mobile banking services.

While there is a clear need for access to finance, it can also lead to financial vulnerability. The combination of a short-term loss of income or long-awaited return when implementing some RA practices, combined with high interest rates on loans can lead to financial vulnerability. Interviews with several subcounty extension workers in Uganda mentioned that rates of farmer defaults on loans are high, often attributed to poor weather and failing harvests, which can result in farmers losing their belongings. Mitigation options are limited, as are affordable financing options and insurance options in case of crop failure or crop theft.

5.4.3 Access to insurance

There is hardly any insurance against crop loss. Only 3% of the Kenyan farmers (6 farmers) have it and no one in Uganda. Kenyan farmers mention a variety of providers including cooperatives, a trader, and private associations. Of these 6 farmers, 3 have been paid out by their scheme, but all 3 report lower amounts than they expected. There are no specific sources of insurances for theft or weather mentioned by surveyed farmers. However, key informants state that theft insurance cover is taken in Kenya by cooperatives for coffee delivered by farmers. Even though farmers do not therefore insure their coffee at farm level, it is insured at cooperative level.

While half of the surveyed Kenyan farmers have access to health insurance, Ugandan farmers have almost no access. In Kenya, 53% of farmers are part of some kind of insurance scheme (men and women are similar). The insurance scheme mentioned is the government-run National Hospital Insurance Fund scheme. NHIF membership is open to all Kenyans who are over the age of 18 years and have a monthly income of more than Ksh 1000. For self-employed people (i.e. farmers), they make a monthly voluntary contribution of 500 Ksh (approx. 5 USD), typically via mobile money. Most farmers using the National Health Insurance fund are found in Kirinyaga and Embu. Some farmers who are also tea growers have health insurance (e.g. via the Kenya Tea Development Agency). Farmers who have NHIF are generally satisfied with the service. All farmers have been paid out at least once to cover health costs. Of the small number of farmers who are not satisfied, the main reason given is that the costs of the monthly payments are too high. Two farmers in Uganda had insurance against personal illness, provided by a bank and a hospital. Both were satisfied with the schemes.

Costs (Kenya) and unavailability (Uganda) are the main reasons why people do not have insurance. Of those farmers in Kenya who are not part of any kind of insurance scheme, the most common reason stated for not being part of a scheme (66%) is that the costs of being part of a scheme are too high. The second most common reason given (18%) is that farmers do not need insurance services. The primary reason given for farmers in Uganda is that there is no insurance provider available (47%), while an additional 13% are not aware of that insurance exists or do not have any information about it.

The second most common reason given for not being part of a scheme is that the costs are too high (28%), followed by 17% of stated responses being that farmers did not need insurance. During FGDs in Uganda, farmers explained that they are not accessing any insurance services and do not have any information about such services. In Uganda, public insurance services are absent and they are only provided by the private sector and are quite expensive. In one location, Bulambuli, it was reported that one financial institution offers crop insurance. Apart from crop failure, crop theft is also a serious risk for farmers in Uganda.

5.5 Access to information

Key messages: Information services are weak on market information (especially in Kenya), and the quality of weather information is poor often because it lacks regional specificity.

In The majority of the farmers have access to weather information through media, which the majority finds quite useful. In Kenya, 65% of the farmers and in Uganda 54% of the farmers state that they have access. Of farmers with access to weather information, 68% find it quite to very useful, 24% somewhat useful and 6% not useful. In FGDs in Uganda, farmers were more critical by stating that weather information was not really reliable or useable for farming – largely because it is not accurate in terms of regional differences in weather.

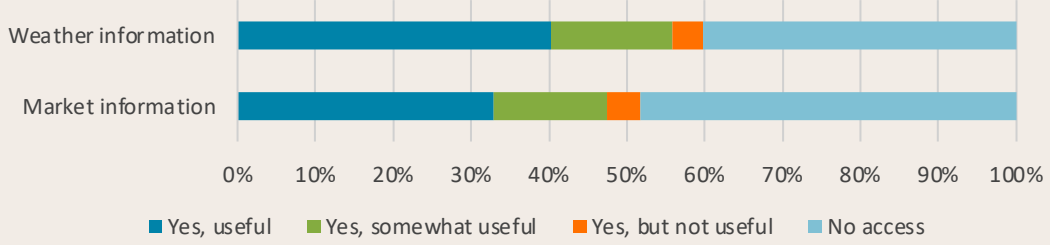
The dominant source of information is media (radio/newspapers) (96% of responses), followed by fellow farmers/relatives/neighbours (14% of responses). Only 5% of farmers in Kenya and 4% of farmers in Uganda get their weather information digitally.

Access to market information is higher in Uganda than in Kenya. In Kenya, 28% of farmers and in Uganda 75% state that they have access to information on prices. In Kenya, men have more access than women (33% vs 19%) whereas this is more equal in Uganda.

In Kenya, farmers get market information from their cooperative (79% of those who have access). This is supported by key informant interviews. A number of farmers obtain commodity price information from radio and TV programmes (e.g. Mugambo wa Murimi in Kirinyaga and Embu counties, Sulwe FM in Bungoma County). In Uganda, the dominant sources are media (53%) and fellow farmers or local traders (48%). In Uganda only 3% referred to a digital source of market information. Extension officers also provide information to farmers in Uganda. Of all farmers in the survey, 18% refer to a project partner as source for market information, with Ugacof most frequently mentioned (29% of farmers linked to Ugacof), followed by Mountain Harvest (26%), SMS (17%), Touton (15%) and Kenyacof (10%).

There are issues on timeliness and reliability of market information. Of farmers with access to market information, 64% find the information useful, 28% somewhat useful and 8% not useful. 43% of farmers that receive market information use this to determine their selling price, while 30% use it to improve and plan their farm practices. During FGDs in Uganda, farmers complained about market information being late, inconsistent and distorted by moving through multiple actors before it gets to farmers. Some farmers lack access to radios in Uganda or the internet to use mobile-based information services (also valid in Kenya). Network coverage can also be a challenge, as is language. For example, most farmers in Uganda speak only Luganda and some information is not well translated. Literacy levels are also low. Lack of timely and reliable information on prices and buyers reduces the bargaining power of farmers. Farmers in Kenya felt frustrated not having more information on pricing and perceive cooperatives acting as gatekeepers.

Figure 11: Access to information



5.6 Household decision-making

Key messages: Farmers have very limited access to training on gender and household decision-making.

Farmers have very limited access to training on gender and household decision-making. As explained under access to training, only 4% of the farmers access training on gender and household decision-making in the past two years. Except for one farmer, these were all located in Uganda (Rwenzori and Elgon). Key informants shared that some sensitisation on the role of women has been carried out by NGOs like ActionAid and SNV in Rwenzori. Otherwise, initiatives to support women's role in household decision-making are limited.

In Kenya, a number of initiatives or factors are promoting a more equal role between men and women in household decision-making, as identified by key informants. For example:

- Equal access to savings and loaning services for men and women depending on the amount saved or quantity of coffee supplied, rather than gender.
- Equal access to education loans for children.
- Provision of advance loaning scheme for coffee harvesting for both genders
- Proper management and good leadership of some FCS e.g. Karithathi ensures availability of financial resources and inputs for women.
- With the support of SMS, Kanjuu FCS (Kirinyaga East SC) has developed a Women Forum whose membership is mainly composed of women (with the blessing of men i.e. their spouses) for information access and practice in their households through the GIRLS approach. The approach could be successful through continuous engagement of both men and women.

6. Service provision context

Key messages: From a farmer perspective it makes sense to promote blended and bundled service provision based upon the principles of regenerative practices as long as services are relevant, of quality and fairly delivered. Special attention needs to be paid to whether additional investments in non-coffee crops will increase the financial vulnerability of farmers. For service providers, blended and bundled service delivery can offer opportunities to ensure security of supply and deliver market benefits, though it may also introduce new challenges and requirements/investments in terms of expertise, resources and partnership management. We found few examples of blended service delivery in the project context. Where they exist, they are often project-based and not build upon long-term commercial strategies. We did notice an increasing attention to regenerative agriculture particularly within development projects. Market dynamics and policy context are key influencing factors that need to be considered when promoting blended and bundled service provision. The presence of community-based or landscape management processes may also be a condition to ensure the presence of ecosystem services or to address child labour.

6.1 Advantages and disadvantages of blended service provision

The previous chapter showed that training and input services often target one specific crop or product. When cooperatives and exporters also provide access to loans for inputs or market information to farmers, this is usually focussing on one crop. In contrast, services by banks, micro-finance institutions and village saving schemes are generally not crop specific. Weather information is usually product indifferent and market information through the media is often combined with information for multiple products.

Advantages and disadvantages for farmers

There are several advantages for farmers in receiving blended services. The focus groups discussion revealed farmer interest in blended service provision. Farmers cultivate different crops, often combined with livestock and agroforestry products. Improving performance of all products can increase farmers' total income, income stability and reduce the dependency and vulnerability related to the success of one product (e.g. price volatility, crop loss or theft). Coffee and non-coffee crop production can also be mutually beneficial as is the integration of trees and livestock in the farming system (e.g. in terms of nutrient recycling, nutrient mining, pest and disease control). Beyond direct income effects, key informants (service providers, government representatives and development organisations) argued that benefits include improved soil health and climate change resilience of the whole farm as well as improved food security if food crops are integrated. Obtaining coffee-specific services and lacking access to services to enhance non-coffee crop production leads to missed opportunities to realise these mutual benefits. Blended services would also mitigate the risk that farmers divert inputs intended by the service provider for coffee to non-coffee crops, leading to adverse impacts on coffee output.

Investing in multiple crops may, however, increase the financial vulnerability of farmers. The biggest risk for farmers is probably the investment that is needed to procure services on multiple crops rather one. The return on investment may be unknown or less than expected. We found cases in Uganda where farmers had invested in production on the basis of an available market, but that the offering of marketing services for these crops eventually failed. Farmers may also face challenges in producing new crops according to market standards. Investments in multiple crops becomes particularly risky when farmers need to borrow money for these additional investments (or take them on credit). This can increase their financial vulnerability. Even though blended service delivery can reduce transaction costs for farmers, it can also lock them into working with one buyer or service provider which can be risky where the services provided are not of high quality or where marketing services are not sustained over time.

Advantages and disadvantages for service providers

For service providers, blended service provision could increase the security of supply in the short and long-term. Advantages for service providers (i.e. coffee companies) of providing coffee-only services include the ability to realize greater production-related impact (e.g. enhanced and more stable volumes and quality) and in turn marketing benefits from enhanced sales volumes and/or quality premiums from the market (this is as stated by service providers during KIIs). This assumes, however, that services – particularly inputs – are used as intended, and service provision is effective in enhancing coffee productivity and quality. When blended service delivery for regenerative agriculture result in the long-term in more productive and resilient farms, then this will improve the long-term supply security.

Service provision is also an important factor in driving loyalty between service providers and farmers and their representative bodies (e.g. cooperatives) and therefore coffee supply. Blended service provision, assuming it is of good quality, builds loyalty among farmers who are obtaining services – loyalty to their cooperative and in turn to the coffee exporter who provides services to the cooperative for onward delivery to farmers (according to key informants at local level, both service providers and cooperative leaders). This is particularly important in Kenya where contracting for supply with cooperatives is highly competitive (though also politicized) and contracts are signed on an annual basis. Offering effective blended service delivery that enhances productivity of coffee and other crops could strengthen loyalty of cooperatives to coffee marketing agents and millers in Kenya (and potentially also Uganda, though it is not regulated in the same way) ensuring stability of coffee supply.

Blended services can create additional income streams for cooperatives. According to one implementing partner interviewed for this research, if cooperatives were to provide marketing services for multiple crops it could deliver financial benefits for the cooperatives, by offering more diverse and multiple income streams (from marketing and service provision to crops other than just coffee), throughout the year. This could help improve their financial viability and reduce incentives for mismanagement of funds by cooperative leaders. This is important bearing in mind the high levels of corruption and governance challenges that exist within some cooperatives.

Blended service provision in support of regenerative agriculture can strengthen exporters trading relationships with downstream buyers. Working to ensure coffee production is as sustainable as possible – via regenerative agriculture and diversification of livelihoods – can support exporters to retain their trading relationships with downstream buyers that have sustainable sourcing policies in place which emphasize regenerative agriculture (including reducing climate change impacts or building climate change resilience) and working towards living incomes. Sustainability is increasingly a 'must' for suppliers, according to one implementing partner.

In term of challenges, blended service delivery ultimately poses risks by introducing additional complexities in how services are provided with a return on investment that can be unknown and not guaranteed. Blended service delivery is fundamentally new, with very few existing service providers offering blended services already. Service needs of farmers across multiple crops can be complex. Blended service delivery will require more investments in expertise, systems, infrastructure, transaction and partnerships compared to a coffee-only focus. The return on investment of these investments may be unknown or not guaranteed. This can impede attracting additional finance in cases bundled service provision requires more pre-financing. This is where IDH's financing is important: to de-risk the investments to some extent. In addition,

new service delivery models may not deliver immediate or significant additional profits for the exporter itself, particularly where its partners engage in marketing services of non-coffee crops and earn the majority of profits associated with sales of those non-coffee crops. And in Uganda, where farmers sell products to multiple buyers, investments in service delivery may not be recouped by the service provider since the farmer may still sell his or her product elsewhere. However, farmer loyalty to exporters who are provided services and marketing can be enhanced through second payments, early buying, early provision of market information and competitive pricing.

Blended service delivery will require new partnerships which may increase reputational risks and require additional investments. Blended service delivery typically requires coffee companies to establish partnerships with new and different partners for services that the company itself is not able or willing to provide, including marketing partners for non-coffee crops. This will increase the complexity of relationship management and introduce new risks and transaction costs. There may be capacity gaps within new partners that need to be filled for blended service delivery to be a success. Some of these partners may not have knowledge of specific geographical regions, for example. Expertise and quality of extension is a particular concern. It poses risks that if partners underperform, this may also affect the relationship between the coffee company and the cooperatives and farmers. Key informants referred to the risk that off-takers for non-coffee crops may not have the financial strength to offer farmers a long-term stable market. When working with cooperatives, capacity challenges to deliver services to a larger range of crops, or provide a wider range of services, are likely to exist. These capacities will need to be built. It will be important for exporters to carry out effective due diligence on potential partners and to ensure clarity on roles and expectations, and find areas of mutual interest e.g. on regenerative agriculture, before partnerships advance. It may also require investments in capacity building.

6.2 Examples of blended service provision and regenerative agriculture promotion

We found few examples of blended service delivery in the project context. One example in Kenya is a cooperative partnering with Brookside for marketing services for dairy and. In Uganda, some cooperatives buy vanilla as well as coffee. The majority of these Uganda cases can be linked to Touton's project with the International Institute of Tropical Agriculture (IITA) to promote diversification strategies to improve coffee farmers economic and climate resilience in Rwenzori, Uganda. Ugacof is establishing partnerships with marketing agents to sell honey and avocado.

Other examples outside the project context include various projects focus on promoting farm diversification among coffee farmers. An example is Solidaridad's Coffee Resilience Programme in Eastern Uganda (amongst others with Kawacom Ltd and the National Coffee Research Institute) which support coffee farmers to produce and market seed, honey, bananas, beans and goats. They also promote vegetable gardens for household consumption and explore whether farmers can sell carbon credits. Another example is the Green Future Farming project implemented Aidenvironment, MetaMeta, and Justdiggit (and funded by IKEA Foundation) which promotes regenerative agriculture among coffee farmers in the Elgon Region (districts of Kapchorwa, Kween & Bukwo). It targets 8000 farmers through a combination of farmer support and landscape management. In Kenya, Solidaridad implements a similar project in Meru county where it also promotes fish farming (this project is in collaboration with Kenya Coffee Research Institute, Jomo Kenyatta University of Agriculture and Technology, Kahawa Bora and African Coffee Roasters EPZ Ltd.). Nonetheless many of other coffee development projects in the country focus mainly on coffee and where they are involved in promoting farm diversification, this is usually done on a temporary project-oriented basis, rather than as a long-term commercial strategy.

We found more examples of bundled service provision (combining different services in one package). This research found multiple examples of cooperatives and exporters providing a range of services to the same farmer (e.g. training, inputs, finance, market and information). Often this is in collaboration with other partners. For example, in Uganda, Touton has established partnerships with fertilizer suppliers and financial institutions. In Kenya, many cooperatives are shareholder in financial institutions which allows them to distribute inputs on credit. It is also not uncommon that input sellers provide additional training through cooperatives to market their products. In Kenya, Farm Africa also packages training and marketing services together for farmers with different partners.

Initiatives which explicitly focus on regenerative agriculture include the above-mentioned Green Future Farming project in Uganda and the Village Based Agent Model in Kenya led by Farm Africa and funded by IKF and AGRA, Rainforest Alliance training of farmers on regenerative and climate-smart agriculture and Fairtrade's lead farmer training model on regenerative agriculture in Kenya.

Some projects focus on organic coffee production. Solidaridad's TRACE Kenya project targets 15,000 farmers in the Bungoma, Kericho and Nandi counties. Farm Africa also provides demos/trials with farmers on organic farming while the county agricultural office provides technical backup.

Step-wise approaches are generally found in certification programmes. Certification appears to support step wise approaches towards regenerative agriculture in some cases. Standards like Fairtrade, Rainforest Alliance, 4C and Starbucks's Café Practices all promote step-wise or continuous improvement approaches among farmers, giving priority to quick-wins or must-haves while more complex practices are

demanded in a later stage. While several of the practices support regenerative agriculture, they usually only target coffee, may not promote all relevant practices or even allow for practices which go against the principles of regenerative agriculture. We did not have the time to identify to what extent other actors explicitly promote step-wise approaches. We suspect that this is not happening often, but that service providers, particularly extension officers, take into account the absorption and investment capacity of farmers to adopt practices, which may result in a less structured step-wise approach. Some also explicitly target farmers who are already more advanced.

Exporters and NGOs typically work in silos. There is a perception among some sector stakeholders that many service providers work without consideration of what others are doing and avoid collaboration. While there are many partnerships between exporters and NGOs, there is little collaboration between these partnerships. This is largely driven by competition. Coffee companies compete for supply and competitive advantage to the market, while both NGOs and exporters also compete for donor money. Many actors also ignore the government, though others have deliberately sought to obtain government buy-in with a view to long-term sustainability (e.g. Village Based Agent Model in Kenya led by Farm Africa and funded by IKF and AGRA). Though government extension is seen to be patchy in Kenya – especially in comparison to Uganda – one international NGO working in Kenya on regenerative agriculture mentioned that government extension officers are highly regarded and trusted by farmers, particularly in regards to which inputs and practices to use. Government buy-in of extension services and consistency in messaging/curricula across sources of extension for farmers is likely an important determinant of successful uptake of RA-related training.

National platforms such as those from the Global Coffee Platform do, however, promote information sharing and knowledge exchange between sector stakeholders.

6.3 Influencing contextual factors

Market dynamics have a big impact on the results of service delivery models. Prices for coffee and other products will affect profits and profit-sharing arrangements and the success of any schemes (for example whether profits from marketing are low and therefore investments in new services don't make financial sense). Where the sector is very competitive, and marketing services have been established as part of blended and bundled service delivery, high levels of side-selling can happen, undermining the return on investment linked to service delivery. This risk increases when farmers need immediate cash payments to sustain their livelihoods. A mitigating strategy is to pay lead prices, ensure faster payments or pre-finance or to offer loan opportunities for emergencies. Unpredictable prices and a lack of information on coffee prices can lead to farmers diverting efforts and investments away from coffee production, which risks coffee volumes not being secured by exporters/service providers. This dynamic is also valid for other products and crops.

Rising inputs and labour costs and the unavailability of finance are other important factors. High input costs can lead to farmer dissatisfaction or limited uptake of inputs, and service providers are limited in their ability to reduce those costs (e.g. through bulk purchasing and negotiations with suppliers of inputs). High rates of inflation can be a contributory factor, by reducing purchasing power for imported goods (e.g. chemical inputs). Increase scarcity and costs of labour can also have a big impact on the attractiveness of more labour-intensive practices. The absence of finance to pre-finance inputs or trade can also constrain the scaling of service provision.

Poor infrastructure and low density in service provision locations can impede effective service provision. For example, in Uganda, the number of buying centers for coffee are limited or located far away from farmers. Consequently, farmers may end up selling coffee to middlemen at lower prices to avoid transportation costs. These factors also impede the access to banking services or input suppliers.

Crop theft is an important factor in Uganda for some crops. For example, theft of vanilla can disincentivize production in these crops, despite the favourable market. Where service providers are providing services to additional crops such as vanilla, there are risks that they will lose the return on their investment where they are not able to secure supply of a commodity.

Another major factor is the public policy environment and investments by the government. Service provision is heavily regulated in Kenya, with contracts for marketing and service provision between coffee companies and cooperatives being signed for a maximum term of one year. According to KIIs (with service providers) this leads to strong competition between coffee companies for business from cooperatives which can be beneficial for cooperatives and their members, but can be challenging for coffee companies who can invest significantly in a trading relationship and complementary service provision only for the relationship to be terminated the following year. According to key donors working in the sector and service providers, the politicization of cooperatives (elite capture or influence of boards by politicians or private sector) can make it challenging for coffee companies to maintain cooperatives' loyalty purely on the

basis of marketing and other service provision. Some coffee companies complain that the contracting decisions are often guided by politics and perverse incentives, rather than a consideration of the genuine needs of farmers and how cooperatives can address those. Government extension programmes to improve cooperative management are only partially effective to reduce this risk.

The Kenyan government also plays an important role in controlling the quality of certain inputs. For example, the Kenya Bureau of Standards (KEBS) should ensure quality of inputs reaching the market is not compromised. The government also tries to cushion the price of certain inputs. The government is also an important provider of subsidies to enable farmers access quality inputs and provision of planting materials. It also launched loan schemes to farmers, but the uptake is usually low due to the requirement to obtain a loan guarantee from Cooperatives. Default on these loans are high as farmers often divert the funds to other uses or invest in unprofitable farming practices. Side-selling of the coffee where its purchase is used as collateral is also a problem. Due to small-scale farmers and cooperatives constituting an important voter base for politicians, many of such loans end up being written off by successive governments to promote and reward voter loyalty.

The government has launched a coffee cherry advance fund to enable farmers to access credit affordably while the Warehouse Receipt Services Act of 2019 should reduce post-harvest losses experienced by cooperatives who are not able to access credit on time.

In Uganda, a new coffee bill was passed through parliament in August 2020 (The National Coffee Act 2021). The Bill could have an important impact, as it seeks to achieve more comprehensive planning for coffee farmers when it comes to linking buyers and farmers, setting up irrigation systems, provision of planting materials and extension services. Although the Bill does not alter the current market structure, -private sector actors are concerned that it signals a drive for the government to claim more control of the coffee sector so that the Association/government can access coffee-related revenues. This Bill states that all coffee farmers need to be registered in a public register managed by the Uganda Coffee Development Authority (UCDA). If partners want to access farmers they will have to obtain the information from this register. UCDA may ultimately play a strong gatekeeping role when it comes to accessing farmers and gaining permission from government for service delivery and coffee marketing, and stakeholders are concerned that as a bureaucratic institution this could hamper effective service delivery.

In addition, the government can also roll out projects which support farmers in addressing specific challenges. For example, in Uganda, government projects have supported farmers in addressing soil erosion (e.g. Nusaf 3 project via contour water sheds, and Mount Elgon Forest Conversation Project giving farmers tree seedlings in Bulambuli).

The availability of ecosystem services beyond the farm boundaries can influence the effectiveness of promoting regenerative agriculture. For example, the availability of water or beneficial insects do not only depend on what practices farmers adopt. It can also partly depend on what is happening beyond their farm boundaries (e.g. in terms of forest, riverbank protection, water management or pest management). The same can be said about child labour, where the presence of schools and community-based engagement mechanisms can be important mechanisms to reduce on-farm child labour.

Covid is another influencing contextual factor. This baseline showed that Covid (with the closure of schools) had a negative impact on the prevalence of child labour in Uganda and reduced demand and prices for certain products. Covid-related lockdowns can also impact service provision when resulting in temporary reduced availability or higher inflation of prices of certain services (e.g. inputs).

7. Conclusions and recommendations

The need to improve farmer income in a sustainable way

There is a clear need to improve farmer livelihoods. Farm income is the primary source of income for the farmer households surveyed in Kenya and Uganda with coffee being the main income generator. Coffee represents approximately half of the total farm income for Arabica farmers in both countries, while this is almost three quarters for Robusta farmers in Uganda. Despite that, coffee farmers in Kenya appear to perform better than farmers in Uganda, though they also suffer like their Ugandan counterpart from hungry months or low-cash flow months. Considering farmers' diversified farming systems, it makes sense to promote bundled service provision for multiple crops.

Basing bundled services on regenerative agriculture principles can support farmer income and food security while creating the agro-ecological conditions which allow benefits to sustain over time. Although soil health is generally good on coffee plots, context specific improvements would be beneficial. The soil tests found some imbalances which could be improved though simple measures. Both key informants and farmers did refer to the risk that unsustainable agricultural practices (e.g. the wrong or overuse of chemical fertilizers) could lead to deterioration of soil conditions. Promoting regenerative agriculture could avoid this. The baseline also shows that there is relatively limited scope to improve farm income by an exclusive focus on improving soil health. Instead, a more holistic approach of farm diversification and sustainable intensification is needed, in which good agricultural practices and the use of organic and inorganic inputs are combined in such way that they increase farm profitability while maintaining soil health in the long-term.

The current state of regenerative agricultural practices

Farmers apply many farming practices that are relevant to regenerative agriculture, but there is significant room for optimization. Almost all farmers take measures which promote plant diversity and soil organic matter. Plant diversity is notably promoted by intercropping and planting shade trees (though shade trees are less practiced in Uganda than in Kenya). Most Kenyan farmers apply manure, while in Uganda a minority does. Mulching is common practice in both countries but the sources vary. Chemical fertilizer use is much more frequent in Kenya than in Uganda. Most farmers face mild to severe problems with pests and diseases on their coffee plots. Climate change is seen to be a major driver of pests and diseases, including the emergence of new ones. All farmers try to treat them. The tendency to use chemicals to treat them is far higher in Kenya, while some farmers in Uganda use home-made organic pesticides. All farmers practice weeding, normally using hand tools or by hand, with some limited herbicides. Almost all farmers prune their coffee trees, while three quarters did at least stump some trees in the last year. Farmers in Uganda are more likely to have sloping or hilly farms than farmers in Kenya and to implement measures to control soil erosion or retain water.

We conclude that farmers do not sit neatly on any step of a RA ladder as proposed in NewForesight and CIAT (2020). For example, nearly all farmers take measures to control P&D or apply manure (steps 4 and 2) but they

may not have adequate planting density (step 2) or basic anti-erosion measures (step 1). In addition, farmers generally have adopted many relevant practices, but do not necessarily apply them in the best way. The current low yield figures and quality issues (with Ugandan farmers performing worse than Kenyan farmers) in coffee growing and post-harvesting show that there is much room for improvement on individual practices and how they can be combined in a holistic way.

The implementation of RA practices appears to be primarily driven by socio-economic considerations rather than environmental. For example, intercropping and planting shade trees make economic sense in terms of the provision of more income and perceived income stability. Farmers believe that these practices deliver benefits in terms of soil fertility and yields. Intercropping may be a necessity for some farmers due to small plot sizes and a need for alternative income sources and sources of food. Some of the current practices that align with regenerative agricultural principles are applied because farmers do not have the resources to invest in other practices. This is, for example, the case with organic soil fertility and pests and diseases management. Without proper technical assistance, there is a risk that once farmers have more opportunities to invest, they may adopt chemical measures which go against these principles.

Key constraints in changing farming practices are a lack of knowledge, fixed mindsets, availability and costs of labour and some inputs, and small farm sizes. Many farmers lack knowledge on what to do and how. A number of practices require specialist advice or guidance to be done effectively. Examples of knowledge gaps include optimal plant diversity measures, production of organic fertilizers and pesticides, application of chemical fertilizers, and erosion and water control measures. Even where farmers have the knowledge, they may resist adoption of new practices before they see practical demonstration and benefits among their peers. The labour intensity of certain practices is also seen as a constraint, particularly in light of farmers aging demographic, as is the costs of some inputs or equipment and their limited availability. Farmers may also lack the financial resources to make certain investments and have challenges around accessing loans. Small farm sizes can be a constraint to adopting practices like crop rotation or digging trenches.

Main gaps in service provision

Service provision at the moment is patchy in regards to availability, relevance and tailoring to regenerative agriculture. There is room for improvement in both access, quality/satisfaction and relevance to regenerative agriculture. While bundling of services tend to take place through cooperatives, most services target coffee only. Examples of blended services in training, input and marketing services are rare, while loans and information services are often applicable to multiple crops.

Almost two thirds of surveyed farmers received farm-related training in the last two years, but the number of topics included and the perceived quality varies significantly. Most training is focused on coffee production and not informed by the principles of regenerative agriculture. According to farmers, training on household decision-making and gender is basically absent in both countries and in Uganda further attention is needed on child labour. There is a clear need for more RA-orientated training and practical training in particular to help shift mindsets and encourage implementation and adoption of learnings.

Access to seedlings for coffee and non-coffee crops is moderate to good. Availability and quality of chemical inputs is better in Kenya than in Uganda, although affordability is a common concern. While in Kenya, most farmers procure these inputs via their cooperative (often on credit), the sources in Uganda are more diverse. Other services which are often unavailable or unaffordable are soil testing and equipment for stumping, digging trenches or irrigation.

Market access for coffee is good as all farmers are able to sell their coffee, but there is room for improvement in satisfaction levels. In Kenya, all coffee is sold to cooperatives, while in Uganda buyers are diverse. Competitive prices, timely cash payments, and access to services are important factors in farmer satisfaction with buyers, but these services are often absent. Market access for some non-coffee crops are lacking or of poor quality.

Slightly more than one third of the farmers reported to have accessed a loan for their farm, although in Kenya this number could be higher as farmers may not have considered the inputs they received on credit. Farmers in Uganda do not access insurance services. In Kenya health

insurance is quite prominent, but crop insurance is barely accessed. Climate change and drought are exacerbating the need for agriculture-related insurance, while there is also a need for crop theft insurance in Uganda.

Information services are weak on market information (especially in Kenya), and the quality of weather information is poor often because it lacks regional specificity.

The needs and service gaps identified among the intervention group farmers also exist within the comparison group farmers. There were only a few locations, where farmers had better access to some services than in the intervention group. This suggests room for expansion of viable service delivery models in all project regions.

The need for farmer segmentation

This baseline shows that there are plenty of farming practices to improve upon and plenty of service gaps to be filled. Service provision may need to be segmented according to farmer type. Some potential relevant criteria include:

- **Existing crops/products:** services will need to be tailored to crops which farmers already produce. Introducing new crops or products is an option, but would require additional investments by farmers.
- **Farm size:** certain crops or practices can be more of a challenge on smaller farms. Intercropping and shade trees are an option for them, though the density and mixture of plants/crops should be managed to avoid competition between crops for nutrients. Smaller farm sizes may also disincentivize practices which take productive space (e.g. trenches).
- **Coffee tree density:** there are important differences between coffee tree densities which influence the type of crops and practices that can be promoted.
- **Purchasing power:** some practices will require investment in inputs or labour. Not all farmers will be able to make such investments. Even when services are provided on credit, it is important to make assess the creditworthiness of farmers to avoid they become overly indebted or that loan providers are not capable to recoup their money. Purchasing power is partly dependent on farm size as the data in Uganda shows that larger coffee farms are more likely to use chemical fertilizers.
- **Household needs:** The relevance of crops and practices promoted should be considered in light of farm and household size, the need for regular income or subsistence crops. For example, one should recognize that women, specifically female-headed households, are often more vulnerable to income shocks, hunger, debt and have more months with insufficient cash.
- **Farmer age / willingness to change:** we heard multiple times that farmers, and particularly older farmers, may be resistant to changing practices. While this is something which could be mitigated by providing practical training and demonstration plots, it is something that could be considered as criteria. Older farmers may also have more challenges to adopt more labour intensive practices and be more reliant on paid labour, raising their costs of production.

Practical considerations for service provision

From a farmer perspective it makes sense to promote blended and bundled service provision based upon the principles of regenerative practices as long as services are relevant, of quality and fairly delivered. Considering the diverse farming systems and the multiple needs in service provision there is a need for blended and bundled services. It also makes sense to base these services on the principles of regenerative agriculture. Many RA practices are already widespread, though there is ample space for optimization and wider adoption to improve farmers' income position, food security and climate resilience. Although the data does not suggest major issues on soil health, RA practices can mitigate potential risks to soil health of unsustainable intensification practices. Soil testing could also allow for more targeted and precise inputs possibly resulting in reduction of production costs. However, investing in better practices and multiple crops also comes with risks to farmers. Particularly if it implies spending considerable time, money or taking out a loan, the event of a crop failure or market access constraints can have seriously adverse effects on farmers' livelihoods. Therefore it is of importance to ensure the services are relevant, of good quality and provided under fair conditions (i.e. costs and payment terms).

It is important to base the service offer on a careful assessment of the costs, benefits and risks of various RA practices and wherever possible to tailor to specific farmer realities. This needs to include the current farming systems, agro-ecological and socio-economic contexts. For example, while intercropping may be a popular measure by smaller and poorer

farmers, other measures, such as more, or better targeted use of chemical fertilizers may be challenging to implement, due to cost and a lack of knowledge on soils. Similarly, application of manure may be a popular and easy measure for farmers with conveniently located livestock, but expensive for those without. There can also be trade-offs (e.g. intercropping versus coffee output in contexts where intercropping is excessive). Issues faced by farmers may also be context specific. Pest and disease challenges differ according to regions and require a regionally-informed and targeted approach. Similarly, soil health differs between regions and between farms, implying that soil health improvement practices should be tailored to specific farm contexts. The different needs and absorption capacities do suggest that step-wise approaches are relevant as long as the steps are tailored to specific contexts.

Services, and particularly technical assistance, needs to be practical and inclusive. To overcome fixed mindsets around practices, the program and its partners should prioritize practical training, e.g. by using lead farmers, demo plots or farmer exchange visits. Gender-targeted or sensitive approaches to service provision may be necessary to overcome the challenges women face in attending training and implementing learnings. This baseline also showed that many farm-related decisions are made by both men and women, hence the importance of involving them both.

Offering reliable and remunerative market access is a key success factor in promoting investments in additional crops. The baseline shows that current satisfaction with profitability in non-coffee crops is not high. Farmers refer to market access issues as key constraint. For non-subsistence crops for which local markets are not remunerative, the projects should ensure reliable and fair market access (e.g., early buying and cash payments and competitive pricing). The choice of crops promoted should consider market potential (in addition to relevance for subsistence and environmental advantages).

Risk mitigation strategies for service providers

Blended and bundled service delivery will introduce new challenges in terms of expertise, resources and partnership management. There are several potential advantages for the project partners in offering blended and bundled services. Service provision is an important factor in driving loyalty between service providers and farmers and their representative bodies (e.g. cooperatives) and therefore coffee supply. However, blended service delivery can also introduce additional complexities in what and how services are provided. The return on investment can be unknown and not guaranteed. Offering services for integrated farming systems are inherently more complex than those focusing on coffee only. This will require investments in new knowledge, recruitment of staff or partnerships with organizations working on other crops or services. The project partners need to be aware of the risks attached to these investments and carefully select and manage their partnerships.

The efficiency of comprehensive service provision to many farmers can be a challenge. Project partners often use farmer groups or cooperatives to reach out to farmers. In both countries, concerns exist regarding the performance of some of these organizations. This can become a constraint to efficiently reach out to farmers. This may require building the capacity of cooperative leaders. In Kenya, the annual supply contracting system between exporters and cooperatives could create a continuity risk and therefore the inability to recoup certain investments. This emphasizes the need to create strong ties with, and benefits for the cooperatives, in delivering blended and bundled services, and incentives to avoid politization and establish more stable trading relationships where these are best for the farmer.

Service providers also need to manage the risk of conflicting advice from other sources of information. This can confuse farmers and may undermine efforts to implement RA practices. The project partners should consider how to build synergies and collaborate with other service providers to avoid this. For example, government extension officers are a particularly prevalent source of advice in Uganda and are highly trusted in Kenya despite their limited coverage.

The need for convening

There is need for knowledge development and sharing. Project partners highlighted the need to access expertise on regenerative agriculture. There are still many lessons to be learned on which farming systems work in what context. The experiences with blended service delivery are also still thin. It will be beneficial to the project partners as well as the wider community to create a community of practice around these topics. The previous

chapter identified various practitioners who could make valuable contributions to this and the existing national sector platforms can host this. As convener, IDH will have to convince the participants, including the project partners, to keep insights, best practices and lessons out of the competitive space and help to identify areas of synergy, collaboration and mutual benefits. Knowledge sharing between both countries is also recommended.

As convenor, IDH could also further work on coalition building and creating alignment. As part of this programme, IDH is also playing a convening role by promoting consortia and continuous learning and sharing (see pathway 1 in Appendix I). This appears to be an important role as it could ensure consistency and buy-in from other actors in support of existing projects and future sustainability and scaling. Examples of the roles other actors could play include:

- **Governments:** integrating RA practices consistently in their extension services; investing in public research (e.g. effective organic fertilizer and pesticide production and application); investing in seed and seedling varietal development, multiplication and distribution; controlling quality of inputs.
- **Companies from non-coffee industries:** collaborating with project partners to develop blended and bundled service delivery models.
- **Input suppliers/ service providers:** distributing affordable quality inputs, making available price and weather information.
- **Coffee roasters and brands:** providing market incentives for coffee produced according to regenerative agricultural practices.
- **Other coffee exporters**: sharing of knowledge, aligning messaging and approaches
- **NGOs & development projects:** sharing best practices and lessons learned, co-investing in scaling
- **Donors and financial sector:** providing access to finance where this is needed, co-investing and de-risking future scaling of successful models.
- **Voluntary standard systems:** further integrating RA practices in their standards and support activities.

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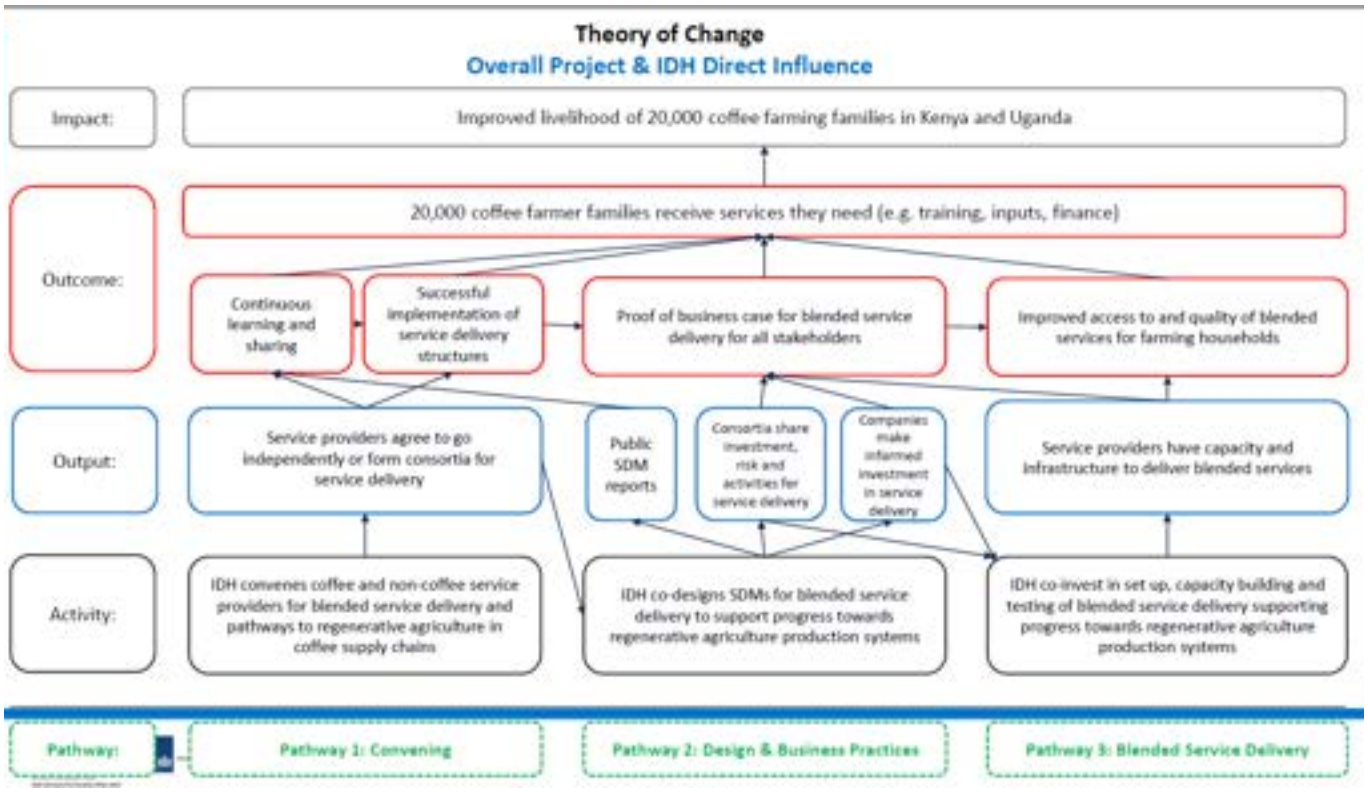
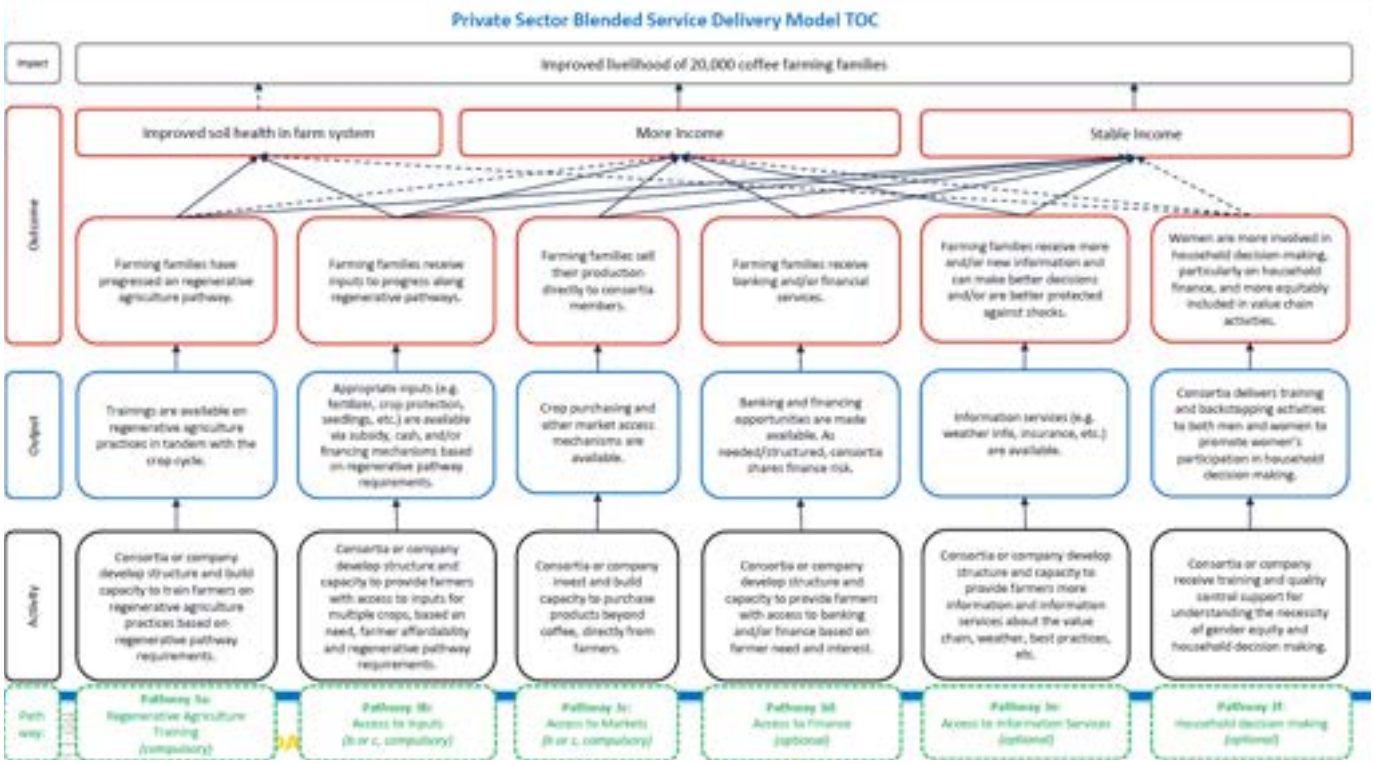
Appendices

Appendix I: The program's Theory of Change

The diagrams below set out the theory of change for the program, including overall impact, outcomes, outputs and activities.

The programme's Theory of change





Source: IDH

Appendix II: Methodology

The research approach for this baseline is a theory-based one, based on principles of contribution analysis, with longitudinal studies including at least baseline and endline assessments. It focuses on the program's pathway 3 on Blended Service Delivery (see Appendix I) and to provide input to research questions developed by the program team.

The baseline used a mixed methods approach combining a household survey, soil testing and FGDs with farmers targeted by the projects (i.e. intervention farmers), as well as key informant interviews with sector stakeholders at the national and local levels. The approach pays attention to the current state of outputs and outcomes of pathway 3, as well as contextual factors/influences and other projects and actors intervening in the targeted area.

Sampling approach
The survey was conducted with 474 farmers of which 238 in Kenya and 236 in Uganda. We applied a stratified sampling approach to farmers targeted by the program. First, 3 counties in Kenya and three regions in Uganda were selected considering diversity in agro-climatic zones, and diversity in the program's service provider partners. Within these geographies a number of districts and sub-counties were selected using the same criteria, as well as the number of farmers, quantity of coffee as well as the presence of cooperatives, washing stations and mills to ease recruitment. Within each sub-county farmers were randomly selected from the farmer lists of a cooperative, washing station or mill. Only in some locations In Kenya, where most registered farmers were men, registered women farmers were given preference to ensure a balance in gender participation. In Uganda, purposive sampling for female-headed households was not carried out. The cooperatives, washing stations and mills helped to mobilize the farmers by providing contact details, directly contacting and/or navigating the research team to farmers that have been randomly selected from the farmer lists.

In all sub-counties focus groups discussions (FGDs) were conducted with the intervention group. These included up to 10 participants in each group and took up to 2 hours. We sought to recruit as many women as possible – encouraged women to speak up, and ensured a majority of women wherever possible. These were conducted in a safe and quiet space, outside wherever possible to minimise COVID-19 risks.

Soil health tests
Soil health tests were conducted at every second farmer in the sample (113 in Kenya and 119 in Uganda, with an equal spread across the regions sampled for the survey Soil health tests consisted of a visual assessment and lab tests. Visual assessments were done using a scorecard developed by CropNuts, a soil testing specialist based in Kenya (see Appendix III). It looked at for example compaction, colour and macro-fauna. The visual observations were each converted into a separate numerical score per indicator and then combined to create a final score for soil health on each sampled farm. The lab-based testing involved a starter Soil Scan to measure pH, Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Organic Matter (OM), Total Nitrogen (N) and Reactive Carbon. The samples were analysed in the lab of CropNuts. A one-day training was done at the Cropnuts offices in early September to provide the field enumerators with the theory and the rationale of the score card and how to implement it on the ground.

Key informant interviews (KII)
Across both countries we conducted a total of 49 key informant interviews, the bulk of which were conducted with district, County/sub-county level informants, including agricultural extension officers, farmer cooperative or group leaders, managers of mills, project partners, and school teachers. We also conducted a total of 15 national-level KIIs across both countries with research and development agencies, service providers/exporters, sustainability certifiers, and national government agencies linked to coffee and agriculture.

Use of comparison groups
We included mini-surveys on a reduced number of indicators, and FGD with farmers that are not directly targeted by the service providers. In total 200 comparison farmers were surveyed of which 60 in Uganda and 140 in Kenya. Comparison groups have been included as an additional input for future contribution analysis. It will more plausible insights on whether the project has contributed to the changes in outcomes at the intervention group, and what the role of other factors has been. It should also allow identification of future spill-over effects of the program to farmers outside the direct intervention group. Note that the sample size and method of the comparison group farmers are not suitable for a RCT or difference-in-difference approach.

The comparison farmers were recruited both in non-targeted and targeted sub-counties to capture farmers who are most likely to be exposed to spill-over and farmers who are less likely to be exposed to spill-over. The identification of the sub-counties to include were done in consultation with the project partners. Access into these sub-counties) and access to/contact with local cooperatives, farmer groups, mills etc was facilitated by IDH country offices.

Data analysis

The analysis of the survey data included a statistical analysis to obtain insights on relations between interventions, outputs and outcomes and the extent to which the outcomes relate to each other. The findings have been triangulated and supplemented with qualitative insights from the FGDs, key informant interviews and secondary sources. For intervention farmers, we conducted a regression analysis to look for specific correlations and obtain insights on relations between interventions, outputs and outcomes (we used a $p < 0.05$ value). We also used statistical tests on the datapoints collected for the comparison groups to see whether the comparison group is comparable with the intervention group (see appendix IV)

Research limitations

- Voice of women: Before the research started, there had been concerns about women speaking up in FGDs if men were also present. The team decided to go ahead with mixed groups based on prior experience of women being vocal in these groups if well moderated and sufficient women are present. This was indeed not found to be a challenge, other than in one area in the Central Region in Uganda were women's participation had to be solicited by the facilitators because it was not forthcoming.
- Reliability of quantitative data: Research teams had a strong sense that farmers were not always comfortable or willing to give accurate data on costs or revenues. The figures given did not always make sense in light of farm size, number of commodities grown etc. In Kenya, there was a sense that some farmers were underreporting their revenue/income data because of sensitivities. Farmers also struggled to estimate their farm size and recall information from last year on production costs. For data on non-coffee plots and non-coffee crops, design errors in the questionnaire allowed enumerators and farmers to input data that was at times contradictory (e.g. whether or not farmers had a non-coffee plot to enter relevant information on different RA practices). One challenge with the data collection app also made it possible for enumerators to enter production cost data which could not be linked to a specific target crop. We partly solved this by additional data cleaning and making subsequent phone calls to some respondents to understand which data applied to what crop. It did however result in a lower number of values than what would have been possible without these errors. The combination of these factors makes cost, revenue and income level data less reliable than other quantitative data.

Appendix III: Soil health variables and scorecard

The importance of each variable used in the soil tests is reported in the table below.

Explanation of chemical parameters and their importance for soil health and crop productivity

Parameter	Importance
pH	pH is important for the solubility of nutrients in the soil. At high and low pHs certain nutrients become unavailable to plant roots, hence it is important to maintain optimal levels of pH (between 5.8 and 6.8).
Phosphorus (P)	Phosphorus is one of the three macronutrients required for crop growth; hence it is essential in appropriate levels in the soil. Typically, the higher the Phosphorus the better.
Potassium (K)	Potassium is one of the three macronutrients required for crop growth; hence it is essential in appropriate levels in the soil. Typically, the higher the Potassium the better.
Calcium (Ca)	Calcium promotes good soil structure: it allows for soil aggregates to "flocculate", meaning that it holds aggregates together, improving soil structure with advantages to drainage, water infiltration, soil aeration and root growth. Typically, the higher the calcium the better, but it is important to consider the balance or ratios between calcium, magnesium and potassium.
Magnesium (Mg)	A good balance between calcium and magnesium is essential to guarantee a good soil structure and avoid compaction. High magnesium levels will make the soil harder and more compact, making it harder for plants to take root and grow.
Organic Matter (OM)	Organic matter gives several positive properties to the soil, including nutrient holding capacity and thus a nutrient supply for crops, soil aggregate stability with positive effects on water infiltration, water storage and soil structure.
Nitrogen (N)	Nitrogen is one of the three macronutrients required for crop growth. It is essential for crop growth. Typically, the higher the nitrogen the better. Nitrogen is commonly added to soils as a fertilizer for crop growth.
Reactive Carbon	This is the fraction of carbon which is most readily degradable by microorganisms. It is an indication of the number of beneficial microorganisms present in the soil.

Indicator	Soil health property assessed
Surface conditions: presence of crusts and salts	Risks of poor water infiltration, erosion, and risks of high levels of salts (detrimental)
Type of vegetation present (weeds, trees, crops)	Indication of the biodiversity on the farm – higher number of species indicate higher diversity of insects and other organisms indicating a better biological health.
Colour of soil (Topsoil, subsoil, and deep soil)	Levels of organic matter and indication of soil drainage – poor drainage is negative for soil health as it translates to poor soil aeration, meaning there is insufficient oxygen for plant growth.
Presence of Gleys	Presence of high and/or fluctuating water tables – linked to rooting depth and drainage. Rooting depth is essential for the crops/trees to anchor to the soil for support and for guaranteeing the crops enough soil volume for nutrient and water uptake.
Soil Depth (presence of compaction layers and/or impermeable rock layers)	Available rooting depth, volume of soil that can effectively store water (water holding capacity).
Texture	Water holding capacity, drainage, water infiltration rates
Soil smell	Indicates presence of beneficial microfauna – these are essential in breaking down organic matter and making nutrients available for crops.
Evidence of soil erosion	Risks of erosion. Erosion indicates a loss of topsoil. Topsoils are typically rich in organic matter so can compromise soil fertility and plant growth when lost.
Presence of soil fauna (macro and micro fauna)	Another indicator of biodiversity in the soil – which is essential in breaking down litter (leaves and other decaying material) to produce organic matter.

Soil health scorecard

In addition to the lab test on above mentioned chemical parameters, visual assessments were conducted using a scorecard developed by CropNuts. he qualitative data recorded during the field assessments on the score card was converted into a numerical index using a simple 0, 1 or 2 score, where 2 represents the most favourable/healthiest soil condition and 0 the worse/unhealthiest condition. The table below presents the rationale of the scoring system

Ratings used for visual soil health assessments

	Best Soil Health 2	Average 1	Worse Soil Health 0
Surface Crust	None	Some	A lot
Presence of Salts	None	Some	A lot
Vegetation	Plenty/diverse	Mid	Bare/none
Topsoil Colour	dark brown/black	brown/red	grey/blueish/yellow
Sub & Deep soil Colour	dark brown/black	brown/red	grey/blueish/yellow
Gleys	None	Shallow	Very Shallow
Compaction	None	Shallow	Very Shallow
Rocks	None	Shallow	Very Shallow
Topsoil Texture	Loam	sand	clay/sand
Subsoil Texture S	Loam	sand	clay
Deep soil Texture D	Loam	sand	clay
Soil Smell	petrichor/mushroom	normal	none
Evidence of Erosion	None	Rills/sheet	Gullies
Animal life	Many, varied	some	None

Each farm could therefore achieve a maximum soil health score of 28. The soil score for each farm has been presented as a percentage of the maximum score.

Findings

Chemical soil health on sampled farms (main coffee plot) in Uganda and Kenya with number of farmer below or above thresholds (country and regional level)

Country	no. farms	pH	P	K	Ca	Mg	Ca:Mg	CEC	N	OM	C.N	Reactive Carbon
			ppm	*%*				*meq/100g*	*%*			%
Uganda	119	6.20	Low	5.63	60.2	16.5	3.64	16.3	0.16	4.2	14.9	0.074
Kenya	113	5.80	Optimal	6.81	52.5	12.9	4.08	16.6	0.20	5.0	15.0	0.100
Uganda	*Max*	9.0		9.5	75.1	30.1	5.2	35.0	0.4	6.7	20.4	0.16
	Min	4.8		2.1	31.0	9.7	1.8	7.5	0.1	2.9	8.2	0.03
	Farms lower than threshold	29	61	4	59	2	99	50	88	1	6	58
	Farms higher than threshold	13	na	0	6	35	0	7	0	0	0	59
Kenya	*Max*	7.4		11.2	74.3	21.1	6.3	28.1	0.5	7.0	18.3	0.16
	Min	4.8		3.0	27.2	7.5	2.5	9.5	0.1	3.0	5.2	0.01
	Farms lower than threshold	56	48	0	82	17	56	38	51	0	4	53
	Farms higher than threshold	2	na	3	1	7	0	0	1	0	0	48

Region	Country	no. farms	pH	P	K	Ca	Mg	Ca:Mg	CEC	N	OM	C.N	Reactive Carbon
				ppm	%				meq/100g	%			%
Central	Uganda	40	6.20	Low	4.36	60.5	16.5	3.66	12.7	0.15	3.8	14.9	0.061
Elgon	Uganda	40	5.95	Optimal	6.25	54.4	15.2	3.57	21.4	0.18	4.5	12.7	0.098
Rwenzori	Uganda	39	6.40	Optimal	6.17	61.5	17.4	3.53	15.7	0.16	4.4	15.8	0.074
Bungoma	Kenya	36	6.25	Optimal	7.54	61.8	15.4	4.01	17.0	0.20	4.6	13.5	0.110
Embu	Kenya	39	5.60	Low	6.45	49.5	12.2	4.06	16.5	0.20	5.1	15.5	0.091
Kirinyaga	Kenya	38	5.45	Sub-Opt	6.46	43.8	11.5	3.80	16.0	0.19	5.3	15.5	0.099
Uganda	Central	*Max*	7.3		8.2	75.1	22.1	4.6	21.7	0.2	6.0	18.3	0.10
		Min	5.1		2.2	40.0	12.2	2.9	7.5	0.1	2.9	12.7	0.03
		Farms lower than threshold	11	18	2	17	0	34	28	38	1	0	30
		Farms higher than threshold	3	na	0	2	11	0	0	0	0	0	9
	Elgon	*Max*	6.6		9.4	66.7	27.6	4.6	33.5	0.4	6.1	16.4	0.16
		Min	4.8		3.0	31.0	9.7	2.1	11.4	0.1	3.0	8.2	0.03
		Farms lower than threshold	14	13	1	29	2	31	5	21	0	5	9
		Farms higher than threshold	0	na	0	0	6	0	2	0	0	0	31
	Rwenzori	*Max*	9.0		9.5	73.4	30.1	5.2	35.0	0.3	6.7	20.4	0.15
		Min	5.0		2.1	34.8	11.6	1.8	7.7	0.1	3.0	9.3	0.04
		Farms lower than threshold	4	13	1	13	0	34	17	29	0	1	19
		Farms higher than threshold	10	na	0	4	18	0	5	0	0	0	19
Kenya	Bungoma	*Max*	7.4		11.2	74.3	21.1	4.7	28.1	0.3	6.0	18.3	0.16
		Min	5.3		5.3	38.5	10.7	3.0	9.5	0.1	3.0	10.8	0.01
		Farms lower than threshold	5	3	0	13	0	18	11	15	0	0	12
		Farms higher than threshold	2	na	3	1	7	0	0	0	0	0	22
	Embu	*Max*	6.5		8.9	65.6	15.2	6.3	27.0	0.5	6.1	17.1	0.15
		Min	5.0		3.0	34.5	8.0	3.0	12.1	0.2	3.7	5.2	0.06
		Farms lower than threshold	23	13	0	31	7	18	12	16	0	3	22
		Farms higher than threshold	0	na	0	0	0	0	0	1	0	0	14
	Kirinyaga	*Max*	6.1		8.8	59.9	17.3	4.9	21.7	0.5	7.0	17.2	0.15
		Min	4.8		4.6	27.2	7.5	2.5	10.2	0.2	4.3	7.8	0.05
		Farms lower than threshold	28	3	0	38	10	20	15	20	0	1	19
		Farms higher than threshold	0	na	0	0	0	0	0	0	0	0	12

Notes on thresholds used: For the reactive carbon the threshold used was the median value of the country. For the ppm values of Calcium, Magnesium, Potassium thresholds are based on soil type and levels of CEC so cannot be given. Thresholds have been provided for these nutrients in % form as these represent the values of their base saturation on the soil exchange complex (CEC) and there are optimal levels for these.

Chemical soil health on sampled farms (main coffee plot) in Uganda and Kenya per village

Kenya	Gituto	Kirinyaga	7	5.60	Optimal	430	1600	260	6.1	48.5	12.6	3.84	0.2	5.1	16.1	0.095
	Kabingara	Kirinyaga	9	5.10	Very Low	300	900	150	6.5	35.7	9.3	3.86	0.3	6.3	14.3	0.110
	Kanjuu	Kirinyaga	2	5.70	Optimal	455	2000	260	6.2	53.2	11.5	4.62	0.2	5.1	15.8	0.105
	Kiaumbui	Kirinyaga	10	5.55	Optimal	440	1550	215	7.0	47.9	11.5	4.16	0.2	4.9	15.6	0.089
	Kibarange	Kirinyaga	1	5.90	Very Low	420	1900	370	6.1	53.4	17.3	3.08	0.2	6.2	15.6	0.120
	Kiunyu	Kirinyaga	9	5.10	Very Low	310	1100	190	6.3	37.5	12.0	3.13	0.2	5.5	15.4	0.100
	Kamusinde	Bungoma	36	6.25	Optimal	450	2150	325	7.5	61.8	15.4	4.01	0.2	4.6	13.5	0.110
	Karuriri	Embu	11	5.20	Very Low	300	1100	190	5.6	39.2	11.2	3.51	0.2	5.7	16.7	0.087
	Kiini	Embu	9	5.30	Low	330	1100	190	5.6	40.7	10.2	3.98	0.2	5.0	16.0	0.077
	Mwiria	Embu	19	6.00	Low	510	2200	300	7.0	58.7	13.3	4.40	0.2	4.9	13.1	0.110

	Village	Country	no. farms	pH	P	K	Ca	Mg	K	Ca	Mg	Ca:Mg	N	OM	C.N	Reactive C. %
					• • • • •	•	• • •	• • •		• •			• •			
Uganda	Bushiswabula	Elgon	2	5.45	Low	325	1400	285	5.1	43.2	14.6	2.95	0.1	3.7	15.3	0.086
	Kisabasi	Elgon	1	5.20	Low	290	1100	260	4.9	36.2	14.3	2.54	0.1	3.1	12.8	0.075
	Nabuyoka	Elgon	4	5.55	Low	245	1300	250	4.5	45.9	14.4	3.19	0.1	3.5	15.3	0.083
	Narudi	Elgon	2	5.20	Low	200	1150	195	3.7	41.0	11.6	3.52	0.1	3.7	14.7	0.092
	Bushiyi	Elgon	1	5.80	Optimal	490	2300	370	5.9	54.0	14.5	3.73	0.2	4.9	15.8	0.059
	Makhuyu	Elgon	1	5.80	Optimal	390	2100	350	5.2	54.7	15.2	3.60	0.2	5.1	16.4	0.049
	Namirumba	Elgon	1	5.70	Optimal	420	2200	350	5.2	52.9	14.0	3.77	0.2	4.7	16.2	0.046
	Buginyanya	Elgon	1	5.30	Low	580	1800	250	6.9	42.1	9.7	4.32	0.3	4.9	9.8	0.068
	Bumugibole	Elgon	4	5.95	Optimal	670	2300	450	8.0	53.3	17.1	3.11	0.2	3.4	11.8	0.083
	Logoli	Elgon	10	5.80	Optimal	625	2400	395	7.5	51.2	15.7	3.27	0.2	4.4	12.7	0.097
	Birongo	Central	1	5.80	Low	150	1300	240	3.2	53.7	16.5	3.25	0.1	3.7	15.2	0.047
	Kabuye	Central	1	5.40	Very Low	170	1100	200	3.7	46.2	14.0	3.30	0.1	3.2	14.2	0.027
	Kilimanyaga	Central	2	6.50	Sub-Opt	305	2100	340	5.2	64.9	17.9	3.63	0.2	4.7	15.3	0.060
	Lukenke	Central	3	6.50	Optimal	240	1800	260	4.7	67.7	16.7	4.06	0.2	4.4	15.1	0.070
	Lwemiwafu	Central	4	6.05	Very Low	155	1500	235	3.6	62.5	15.2	4.10	0.1	3.9	15.6	0.055
	Chemwet	Elgon	3	6.40	Optimal	650	3500	530	6.9	61.8	15.6	3.96	0.2	4.9	12.4	0.130
	Kamengong	Elgon	4	6.30	Very Low	410	2350	355	6.1	63.5	15.1	4.21	0.3	5.2	9.7	0.135
	Kaptama	Elgon	2	6.10	Sub-Opt	550	2800	420	6.1	60.6	15.2	4.00	0.3	4.7	11.3	0.135
	Kewachesit	Elgon	1	6.10	Optimal	540	2900	380	6.0	62.5	13.6	4.58	0.3	4.7	9.4	0.150
	Kopkwosojon	Elgon	1	6.00	Optimal	600	3000	400	6.3	61.2	13.6	4.50	0.2	5.0	12.2	0.140
	Sipi	Elgon	1	6.10	Low	620	2900	520	6.4	58.2	17.4	3.35	0.3	4.9	10.2	0.140
	Sowos	Elgon	1	6.30	Low	640	3100	610	6.2	58.7	19.3	3.05	0.3	4.4	10.2	0.130
	Kagando 1	Rwenzori	3	6.30	Optimal	540	2400	480	6.7	60.4	18.5	3.26	0.2	4.4	15.9	0.063
	Kasokero	Rwenzori	1	6.20	Low	320	1600	300	6.2	60.2	18.8	3.20	0.2	4.2	16.1	0.066
	Katunura	Rwenzori	1	5.90	Low	240	1400	270	4.8	54.3	17.4	3.11	0.1	3.7	16.5	0.050
	Nsenyi	Rwenzori	3	6.40	Optimal	350	2000	400	5.7	63.3	19.7	3.21	0.2	4.6	15.2	0.084
	Nyabirongo	Rwenzori	5	6.50	Low	280	1700	260	6.6	61.2	16.4	3.74	0.1	4.2	17.2	0.082
	Nyakaina	Rwenzori	2	6.25	Optimal	420	1750	280	7.5	60.6	16.1	3.77	0.2	4.4	14.8	0.082
	Kabango	Rwenzori	5	5.80	Low	260	1100	190	5.3	53.9	15.5	3.47	0.2	4.3	15.5	0.070
	Kajorogho	Rwenzori	9	6.40	Optimal	340	2000	330	5.7	62.1	17.2	3.60	0.2	4.5	16.0	0.079
	Kanyampara	Rwenzori	2	7.15	Optimal	850	4300	740	7.1	68.9	19.9	3.47	0.2	5.8	14.6	0.120
	Kasithu	Rwenzori	1	7.20	Optimal	480	2700	350	6.7	73.0	15.8	4.63	0.2	4.9	15.8	0.080
	Kasungu	Rwenzori	3	6.80	Optimal	330	1700	290	6.9	66.4	18.6	3.56	0.1	3.9	16.6	0.080
	Katasenda	Rwenzori	1	8.20	Optimal	950	4700	540	7.6	73.4	14.1	5.22	0.1	3.9	16.3	0.061
	Kitsutsu	Rwenzori	3	7.50	Optimal	750	4300	880	6.1	65.3	21.0	3.12	0.2	6.1	15.6	0.120
	Buzinga	Central	4	5.80	Very Low	180	1300	200	4.5	54.6	15.0	3.64	0.1	3.5	14.5	0.071
	Kalagala	Central	1	6.50	Low	420	1700	290	8.2	64.4	18.3	3.52	0.2	3.8	13.7	0.069
	Kalisiizo	Central	1	5.90	Very Low	240	1100	200	6.3	56.7	17.2	3.30	0.1	3.4	15.0	0.053
	Katoma	Central	2	5.65	Very Low	140	1050	190	3.5	50.2	15.2	3.31	0.1	3.4	14.0	0.047
	Kitazigulukuka	Central	4	5.55	Very Low	175	1000	180	4.6	48.6	14.0	3.46	0.1	3.3	15.0	0.042
	Lubumba	Central	1	5.30	Low	180	800	150	4.9	42.6	13.3	3.20	0.1	3.3	14.9	0.043
	Lwezinga	Central	1	7.20	Low	360	2300	440	5.6	69.3	22.1	3.14	0.2	4.0	14.7	0.069
	Bikoko	Central	2	6.30	Very Low	245	1800	300	4.4	63.5	17.5	3.63	0.2	3.7	13.8	0.067
	Kakoni	Central	2	6.30	Low	215	1650	280	4.1	62.5	17.6	3.54	0.1	4.3	17.0	0.073
	Kyamuganga	Central	2	6.10	Sub-Opt	270	2150	345	3.8	59.6	16.1	3.71	0.2	4.6	15.0	0.086
	Kyanyinamudu	Central	1	6.60	Optimal	410	2100	430	6.3	62.5	21.3	2.93	0.2	4.0	14.4	0.085
	Luuma	Central	1	6.60	Optimal	330	2000	380	5.5	64.9	20.6	3.16	0.2	3.6	14.1	0.062
	Lwankakala	Central	1	6.90	Low	280	1900	300	5.4	70.9	18.7	3.80	0.2	3.8	14.5	0.060
	Mbaale	Central	3	5.60	Low	180	1300	210	3.3	52.8	14.6	3.62	0.2	3.8	14.9	0.055
	Nkandwa	Central	1	7.30	Optimal	440	2900	390	5.8	75.1	16.8	4.46	0.2	4.6	14.8	0.083
	Nsagala	Central	2	6.40	Optimal	350	2050	370	5.4	62.6	18.8	3.32	0.2	4.3	15.0	0.066

Appendix IV: Analysis of comparability of comparison and intervention groups

Comparison groups have been included as an additional input for future contribution analysis. It will offer more plausible insights on whether the project has contributed to the changes in outcomes on the intervention group, and what the role of other factors has been. It should also allow identification of future spill-over effects of the program to farmers outside the direct intervention group. Note that the sample size and method of the comparison group farmers are not suitable for a RCT or difference-in-difference approach. However, using a statistical test we were able to explore how comparable intervention and comparison group farmers are. For continuous variables, we used an independent sample t-test to compare the means of two groups to determine if there's statistical evidence that they are significantly different. For categorical variables, we used chi-square test of association to determined whether the two groups were comparable.

474 intervention group farmers were surveyed, of which 238 were in Kenya and 236 in Uganda. 200 comparison farmers were surveyed of which 60 in Uganda and 140 in Kenya. Mini-surveys were used on a reduced number of indicators, as well as FGDs.

The following annex explores the comparability of the groups on all key indicators and follows the same structure as the main report (final outcomes, intermediate outcomes, outputs etc.).

Farm characteristics

Intervention and comparison group farmers are comparable across a number of key indicators – though there is some difference between country. For example, in Uganda, the gender breakdown of the comparison group is statistically comparable to that of the intervention group, with the majority of farmers being male. In Kenya, there are more women in the comparison group than men, and they dominate the comparison group sample (the reverse is true in the intervention group sample). The same is true of the comparability of the age of farmers between intervention and comparison groups in Uganda. In Kenya, however, the age of the groups is not comparable, with a larger proportion of farmers in the intervention group being aged 64 and above as compared to the comparison group. The marital status of comparison and intervention group farmers in both countries is not comparable with more single farmers constituting the sampled comparison group in both countries. In terms of educational status farmers in Kenya are comparable across intervention and comparison groups, while they are not comparable in Uganda. In both countries the coffee species being grown (Arabica and Robusta) is comparable between comparison and intervention group farmers with virtually all farmers growing arabica coffee in Kenya, and around 30% growing robusta coffee in Uganda within both comparison and intervention groups.

In Kenya, the number of crops grown in addition to coffee are comparable across intervention and comparison groups (between 3 and 4 crops are typically grown in addition to coffee). While few of the proportions of different crops grown (in addition to coffee) are comparable across the groups in either country, the order of popularity of crops is similar across comparison and intervention groups in both countries with the first 4-5 crops being grown after coffee following the same popularity ranking across groups within the countries.

In Kenya, intervention group farmers are more likely to have cattle and timber than comparison group farmers, but otherwise they are comparable in terms of additional products and livestock. In Uganda the intervention group is less likely to have pigs than the comparison group, otherwise the two groups are comparable in terms of additional farm products/livestock.

Coffee farm sizes are not comparable across intervention and comparison groups in Kenya, with coffee farm sizes being smaller among comparison group farmers (0.57 acres versus 0.75 acres). However, overall farm sizes are comparable across intervention and comparison groups in Kenya.

In Uganda, neither overall farm sizes or coffee plot sizes are comparable, with intervention group farmers having larger coffee plot sizes than the comparison group (2.13 versus 3.65) and larger farm sizes overall. This can be in part explained by the inclusion of farmers in Central and a minimum farm size requirement for them to be part of the program. Indeed, when farmers in Central are removed from the sample overall farm size is comparable between intervention and comparison group samples.

Final outcomes: soil health and incomes

Soil health
In Kenya, the farmers' perception of the quality of their soils and the contribution it makes to coffee yield are not comparable. Famers in the intervention group are more likely to rate their soils as poor than the comparison group and are less likely to rate them as very good. They also do not give similar responses on possible reasons why. Farmer ranking of soil health are comparable in Uganda. Farmers across the groups give similar reasons as to why their soils are poor.

More farm income
In Kenya, comparison group farmers are more likely to state that coffee has been profitable for them in the last 12 months as compared to intervention group farmers. The contribution that farm income makes to overall household income is comparable across comparison and intervention groups in Kenya. However, comparison group farmers are more satisfied with this contribution than intervention group farmers. The contribution that coffee makes to household incomes are not comparable between the two groups in Kenya, with comparison group farmers being more reliant on coffee income for household income than intervention group farmers.

Farmers in comparison and intervention groups in Uganda have similar perceptions on how profitable coffee has been in recent years. The contribution that farm income makes to household income is also comparable across the groups. Farmers across the two groups are similarly satisfied with the contribution farm income makes to household income. However, the percentage contribution that coffee makes to household incomes is greater among intervention group farmers than comparison group farmers.

In Kenya, total production volumes of coffee, coffee prices for fresh cherry, gross coffee revenue, and gross coffee income per acre are all comparable across intervention and comparison group farmers.
In Uganda, total production volumes of coffee are not comparable across intervention and comparison group farmers, with comparison group farmers producing greater volumes of coffee. However, gross coffee revenue and gross coffee income per acre are similar across intervention and comparison group farmers. Intervention group farmers receive higher prices for their dried cherry than comparison group farmers, but prices for other coffee types are comparable across the two groups (dried parchment and green bean).

Stable farm income
While the specific months that farmers are likely to suffer from hunger are similar across comparison and intervention group farmers, comparison group farmers in Kenya are more likely to suffer from hungry months and have more severe hunger (i.e. more hungry months) than intervention group farmers. The number and specific months when farmers are likely to have income shortages are similar across comparison and intervention groups in Kenya, however. In Uganda, the number of hungry months and the specific months farmers are likely to suffer from hunger and income shortages are similar across the comparison and intervention groups

Intermediate outcomes

Coffee productivity
Total production of coffee is not comparable across intervention and comparison group farmers in Uganda. Farmers across the two groups have similar opinions on the trends in volumes of coffee produced. Total production of coffee is comparable in Kenya across comparison and intervention groups. However, farmers between the two groups have differing perceptions on trends in volumes of coffee produced, with comparison group farmers more likely to state that the volumes of coffee they have produced over the last 12 months have increased.

Adoption of RA practices (plant diversity, soil organic matter management and pest and disease management)
In Kenya, intervention and comparison group farmers implement similar practices, bar the planting of cover crops which is more typically implemented by comparison group farmers than intervention. In terms of plant diversity practices, comparison and intervention group farmers are similarly likely to implement intercropping and planting cover crops in Uganda. However, comparison group farmers are more likely to rotate crops and plant shade trees than intervention group farmers. Overall, comparison group farmers are more likely to implement more practices relating to plant diversity.

In Kenya, comparison group farmers are less likely to apply coffee litter, coffee prunings or shade tree litter to their coffee farms as compared to intervention group farmers – implying that they implement fewer soil organic matter management techniques overall as compared to the intervention group. However, the two groups are comparable in the likelihood

of them applying coffee pulp and unwanted suckers. Comparison group farmers in Uganda are less likely to apply coffee prunings to their coffee plots than intervention group farmers. The likelihood of applying all other practices across groups is comparable.

In terms of trends in pests and diseases, Ugandan farmers in the comparison and intervention groups are not comparable. More farmers in the comparison groups are likely to state that pests and diseases have been getting worse, as compared to the intervention group. Severity ratings are similar, however. Similarly in Kenya, comparison group farmers are more likely to state that they have an issue with pests and diseases as compared to intervention group farmers and that their pests and disease issues are worsening or staying the same (rather than better), as compared to the intervention group. Comparison group farmers are also more likely to state that they have issues with pests and diseases. Severity ratings are similar, however.

Outputs: access to services

Training
Kenyan comparison group farmers are more likely to have received training than intervention group farmers (57% in the intervention group, versus 73% in the comparison group have received training), and the two groups are not comparable. In Uganda, the reverse is true, more farmers in the intervention group (75%) have received some form of training as compared to the comparison group (42%).

Access to inputs
In terms of inputs, comparison and intervention group farmers in Kenya have similar access to seedlings, and the availability and quality of agrochemicals. However, the affordability of agrochemicals differs between the two groups, with intervention group farmers much more likely to state that the agrochemicals are not affordable. Chemical fertilizers are less available to intervention group farmers than comparison and are reported to be less available. However, the quality of chemical fertilizers is considered to be higher among intervention group farmers than comparison group farmers. Organic fertilizers are more accessible to intervention group farmers than comparison group farmers (in terms of availability, affordability and quality).

In Uganda, access to inputs is broadly similar between the two groups apart from for agrochemicals and chemical fertilizers, which are more likely to be rated as poor quality among comparison group farmers, than intervention group farmers. Comparison group farmers also state that chemical fertilizers are less available as compared to intervention group farmers. Organic fertilizers are less available to comparison group farmers than intervention, due to accessibility and quality.

Marketing services
Satisfaction with market access is similar between comparison and intervention group farmers in Uganda, but are not comparable in Kenya, where more comparison group farmers tend to be fully satisfied with their market access for coffee than intervention group farmers – despite the buyer type being similar (i.e. cooperatives). This may be explained by the different cooperatives serving farmers – and the quality of their management – between comparison and intervention group farmers. Farmers in Uganda are similarly satisfied with their market access for coffee, even though comparison and intervention group farmers are not comparable in terms of their typical coffee buyers: intervention group farmers are more likely to sell to a cooperative, and less likely to sell to a local trader or the local market than the comparison group farmers.

Access to finance
In terms of access to loans, fewer intervention group farmers (42%) have accessed loans in the past 12 months, as compared to the comparison group (63% have accessed). Similarly in Kenya, fewer intervention group farmers have accessed loans (27%) than comparison group farmers (55%). Statistical tests show that they are not similar. This may reflect a poorer financial position among comparison group farmers.

Participation in insurance schemes are similar among intervention and comparison group farmers in both Kenya and Uganda.

Access to information
Farmers in Kenya have similar access to weather and market information across groups, and to find it of similar use. Farmers in Uganda have similar levels of access and satisfaction in regards to weather information. However, more intervention group farmers in Uganda have access to market information. Comparison and intervention group farmers who do have market information find it similarly useful.