

## **Can Extension Close the Gender Gap in Agriculture?**

### **A Mixed Methods Impact Evaluation from Uganda**

Sara Davidsson (23073) and Anton Ståhl (41040)

---

**ABSTRACT:** Malnutrition and food insecurity are urgent problems and increasingly salient policy topics, especially in the African context. Enhanced efficiency in agriculture and reduced gender inequalities have been raised as key solutions to these problems. One way to address the former is agricultural extension (AE) programmes. Despite their popularity, little research has been conducted on the specific impact of AE on dietary outcomes. This paper investigates the impact of AE on dietary outcomes and its differential impact on female headed households (FHHs) on rural farmers in Uganda. A mixed methods approach was used to quantify the effect of the AE programme and to explore the underlying mechanisms behind the result in interviews and group discussions. The quantitative results were obtained by matching data on a treatment group (AE programme participants) with a control group (from the Uganda National Panel Survey dataset). The quantitative results showed that the programme led to a substantial increase in food consumption on all three outcomes variables measured. However, the increase in the meals per day for FHHs was only around half of the average. The qualitative results showed that the overall positive impact stemmed from improved production, marketing and intra-household collaboration. The mechanisms explaining the differential impact for FHHs were lack of access to complementary inputs, in particular time and labour.

---

Keywords: agricultural extension, female headed households, Uganda  
JEL: Q160, Q13, D130

Supervisor:	Anders Olofsgård
Date submitted:	13 May 2018
Date examined:	29 May 2018
Discussant:	Alice Hedda Nielsen
Examiner:	Maria Perrotta Berlin

## **Acknowledgements**

This study would not have been possible without the data and continuous support provided by our collaboration partner Vi Agroforestry (Vi-AF), Uganda. The authors of this paper are particularly grateful for the time and commitment given to us by our local supervisor Nasur Abdallah. We also want to thank the country manager Sara Dahl and the vice country manager James Walusimbi for their engagement in the discussion on mutually interesting research topics that resulted in this study. Furthermore, our qualitative data collection would not have been possible without the incredibly competent translators Moses Mununuzi and Winnie Nakyanzi. All Vi-AF staff gave valuable input in a group discussion on the preliminary results of this paper, for which we are very thankful.

In addition, we are grateful for the helpful support provided by our supervisor Anders Olofsgård, Associate Professor Stockholm School of Economics. We also thank Vidhya Soundararajan, Assistant Professor at Indian Institute of Management in Bangalore, for her important feedback at the start of writing this thesis.

## Table of content

<b>1</b>	<b>Introduction.....</b>	<b>5</b>
<b>2</b>	<b>Literature review.....</b>	<b>7</b>
2.1	Agricultural Extension's impact on nutrition .....	7
2.2	Gender differences in the impact of Agricultural Extension .....	10
2.2.1	Support for higher impact of AE programmes on FHHs .....	11
2.2.2	Support for lower impact of AE programmes on FHHs .....	12
<b>3</b>	<b>Research setting .....</b>	<b>14</b>
3.1	Vi Agroforestry and their AE programme.....	14
3.2	Programme selection .....	16
3.3	Programme evaluation .....	18
<b>4</b>	<b>Research questions &amp; Hypotheses .....</b>	<b>19</b>
<b>5</b>	<b>Method.....</b>	<b>20</b>
5.1	Part 1: Quantitative programme evaluation .....	21
5.1.1	Matching using the propensity score - in theory.....	21
5.1.2	Identification strategy: preselection & PSM .....	23
5.1.3	Econometric specification.....	25
5.1.4	Outcome variables - disentangling the AE effect.....	27
5.2	Part 2: Qualitative data collection and analysis.....	28
5.2.1	Purposeful Sampling .....	28
5.2.2	Preparations, the focus group discussion and the interview .....	29
5.2.3	Coding.....	30
<b>6</b>	<b>Data.....</b>	<b>31</b>
6.1	Female headed households.....	31
6.2	Treatment data .....	33
6.2.1	Manual linking of family cards to group records .....	33
6.2.2	Unbalanced panel .....	34
6.3	Testing for field officer attention bias .....	36
6.4	Time variable specifications .....	37
6.4.1	Verification of Vi-AF's digitization process .....	40
6.5	The qualitative data.....	40

<b>7</b>	<b>Results .....</b>	<b>41</b>
7.1	Quantitative results – main specification.....	41
7.1.1	Sensitivity of the quantitative results .....	44
7.2	Qualitative results.....	49
7.2.1	Reasons for overall increase in nutrition.....	49
7.2.2	Qualitative results on the gender difference.....	51
7.3	Testing qualitative findings on FHHs in the data .....	54
<b>8</b>	<b>Discussion .....</b>	<b>56</b>
8.1	Impact of AE on dietary habits .....	56
8.2	The differential impact of AE on FHHs.....	58
8.3	Internal validity.....	60
8.4	External validity.....	62
<b>9</b>	<b>Conclusion .....</b>	<b>63</b>
<b>10</b>	<b>References .....</b>	<b>65</b>
	<b>Appendix .....</b>	<b>70</b>
	Appendix 1.....	70
	Appendix 2.....	70
	Appendix 3.....	73
	Appendix 4.....	76
	Appendix 5.....	76
	Appendix 6.....	77
	Appendix 7.....	79
	Appendix 8.....	79
	Appendix 9.....	80
	Appendix 10. ....	80
	Appendix 11. ....	81

# 1 Introduction

Food security and malnutrition are urgent problems in parts of Sub-Saharan Africa. The FAO estimates that one in four over the age of 15 in the region are severely food insecure (FAO 2017) and a recent World Health Organisation report showed that almost 60 million children are suffering from stunting as a result of malnutrition (WHO 2017). Furthermore, these problems are aggravated by climate change, fast population growth (Godfray et al. 2010; Phalkey et al. 2015) and rapid urbanisation (Farnworth et al. 2016). Improving food security and nutrition is therefore high on the agenda for policy makers. In January this year, the initiative “African Leaders for Nutrition” was launched. At the launch, the strong economic argument for investing in malnutrition was laid out; investments in nutrition is estimated to yield a 16-fold return in low and middle-income countries. Agriculture, as the main source of livelihoods for many poor households, is seen as a key solution to addressing this problem (IFPRI 2015).

Research has shown that global productivity differentials in agriculture are driven by a combination of crop selection, capital and technology use rather than by geographic endowments. This suggests that large productivity gains in developing countries can be made with the right policies (Adamopoulos & Restuccia 2018). Gender equality has been shown to be such a policy. The Food and Agriculture Organization estimated that the number of hungry people could be reduced by 100–150 million if women in rural areas would get the same access to assets, knowledge and markets as men (FAO 2011).

The implementation of agricultural extension (AE) programmes has been a popular policy tool for improving the productivity in agriculture (Ragasa & Mazunda 2017). AE in its broad interpretation refers to training relating to a set of issues relevant to development such as the implementation of better agricultural technologies. Many impact evaluations of AE programmes have found positive effects across a range of outcome measures including yields, income levels and crop diversification (see review in Faure et al. 2016). However, there are at least two areas where the evidence for the impact of AE remains scarce.

Firstly, the specific impact of AE on diet diversity has, to our knowledge, only been studied in two papers. Firstly, a programme in Zambia which included both AE training and additional

components aimed at improving nutrition was evaluated and showed significant impact on diet diversity. In contrast, the result of the second study, which was conducted in Malawi, did not find that AE impacted nutrition in its main model specification (Ragasa & Mazunda 2017). Calls have been made for more research to uncover the linkages between agriculture and nutrition (Webb & Kennedy 2014) and to establish if AE programmes are an effective way of delivering nutrition interventions (Fanzo et al. 2015).

Secondly, the heterogeneous impact of AE on female headed households (FHHs) and male headed households (MHHs) is an area where the literature has found mixed results. Evaluating an East Africa-wide AE intervention, Davis et al (2011) found that FHHs benefitted more from AE than MHHs. Several theoretical channels and proximate empirical findings also support this. For example, low-resource households (a category to which many FHHs belong) tend to benefit more from AE than more wealthy households and be more prone to prioritize spending on food. On the other hand, Saito et al. (1994) found the opposite when evaluating an AE programme in Kenya. The programme contributed significantly and positively to output on male-managed plots, but not on female-managed plots. Economic theory offers reasons for why this could be true as well. One example is that female farmers tend to have weaker land rights, which is something that has been shown to discourage investments (Deininger et al. 2008; Goldstein & Udry 2005).

This paper contributes to the existing literature by investigating 1) the impact of AE on nutrition and 2) the heterogeneous impact of AE for FHHs and MHHs. Follow up data on Ugandan farmers who received an AE programme 2009–2011 was matched to farmers in a publicly available panel dataset based on baseline characteristics. The results showed a general increase in both the quantity of food consumed and in diet diversity. However, this increase was substantially lower for FHHs on the quantity indicator. An explanatory mixed methods approach was used in which the quantitative analysis was followed by a qualitative part. In this, the causal channels for the general increase and the heterogeneous impact were explored further. Through interviews and focus group discussions, it was shown that time & labour constraints were the most limiting factors for FHHs.

The remainder of this thesis is structured as follows: in Section 2, existing literature on AE's impact on nutrition and the gender differences in AE is outlined. Section 3 provides background on the

specific AE programme that is evaluated in this study and is followed by research questions and hypotheses (Section 4). In Section 5, the mixed methods approach used in this thesis is explained. Section 6 describes the data on the treatment and control group. In Sections 7 and 8 the results from the quantitative and qualitative analysis are presented and discussed and policy implications are drawn.

## 2 Literature review

### 2.1 Agricultural Extension's impact on nutrition

Agricultural extension (AE) in this paper refers to its broad interpretation as described by the Food and Agriculture Organisation of the United Nations (FAO). This interpretation includes trainings provided to farmers across a range of themes; soil erosion prevention techniques, fertilizing techniques, planning & budgeting, credit advancement trainings, marketing and cooperative organizational development (Rivera 2001). In this definition, neither nutrition training nor input distribution is included.

AE programmes are implemented across developing countries by governments, private actors and NGOs to improve efficiency in agriculture. Over the years, the programmes have evolved to include all the aspects mentioned above or combinations of them (Rivera 2001). AE-focused development programmes sometimes include non-training components such as investment subsidies or input distribution. The fact that AE programmes can include different types of trainings and sometimes non-training elements, makes it difficult to establish through which causal links the programmes have effect (Faure et al. 2016). Evaluations of AE-centred programmes normally do not disentangle the effect of a pure AE component and potential additional inputs. For the sake of clarity, the relationships between the AE programme, AE and other inputs as they will be discussed in this study are presented in **Figure 1**.

**Figure 1. Agricultural Extension centred development programmes**

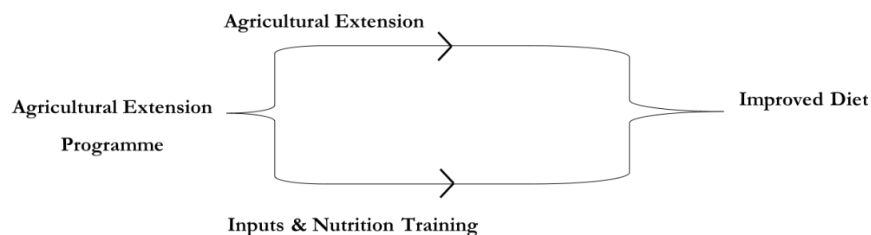


Figure 1. (Authors' own). AE programmes consist of AE trainings, but also often include inputs and nutrition trainings. The main interest of this study is to evaluate AE's impact on dietary patterns (the upper part of the figure).

To our knowledge, there have been only two studies that evaluated the impact of an AE centred development programme on nutrition specifically. The first one found a positive effect on diet diversity of a programme in Zambia (Gondwe et al. 2017). That programme was implemented by the International Institute for Tropical Agriculture and had, in contrast to many other AE centred programmes (Faure et al. 2016), a pronounced focus on nutrition training. Farmers were given seeds and nutrition trainings and also took part of discussions on community level.

The second study that has evaluated an AE programme's impact on nutrition used panel data from a national household survey in Malawi 2010–2013 (Ragasa & Mazunda 2017). In Malawi around this time, 28% of farmers received AE from government agencies, 6% from NGO's and 2% from private actors. The focus of the AE programmes was on production and included promotion of seed varieties, irrigation and fertilizers. Hence, these programmes did not specifically focus on nutrition. The study measured whether anyone in the household had received advice on agricultural training. The study found that the impact of the AE programmes on nutrition was consistently insignificant. However, significant improvements were found for the subset of farmers who reported to be very satisfied with the service.

The two papers above differed in their main results, in what type of AE programme they were evaluating and by whom it was provided. Both papers used diet diversity, counting specified groups or food groups, as a proxy for nutrition, which will also be done in this study. Several studies have shown a positive relationship between diet diversity and nutritional outcomes (see review in Ruel 2002).



**Figure 2** illustrates that the direct link of AE-centred development programmes on nutrition, represented by arrow A, has been scarcely studied. However, many papers have shown that AE programmes can have positive impact on agricultural outcomes (arrow B) and that agricultural outcomes in turn drive improved diets (arrow C).

**Figure 2. Previous literature: the link between AE programmes & diet improvements**

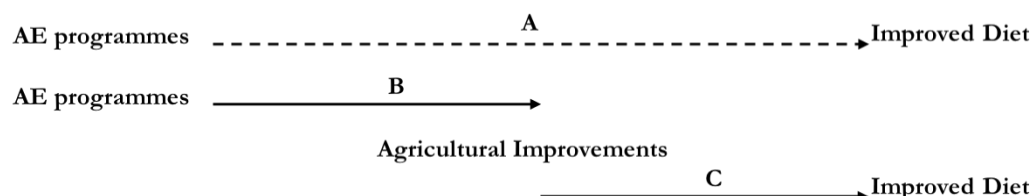


Figure 2. (Authors' own). The link between AE programmes and diet diversity has only been sparsely studied (dashed arrow A). Other links that have been more extensively been research are the those between AE programmes and agricultural improvements and between agricultural improvements and improved diets (arrow B and C).

In support for the link between AE programmes and agricultural outcomes (arrow B), an AE programme in Kenya was shown to improve both agricultural productivity and income (Wanjana & Muradian 2012). Similarly, Davis et al. (2012) showed that participation in a certain AE programme in East Africa could increase income by 61%. Another study in Kenya showed that an AE programme had significant effect on the adoption of a more nutritious bean species. The programme increased the adoption of the beans substantially (from 0–20%) even though increasing income and productivity was the primary objective of the intervention. Adding general training in nutrition to the treatment increased the adoption further (Ogutu et al. 2018).

Agricultural outcomes' positive impact on nutrition (arrow C) has been shown in literature to occur both through direct consumption of increased production, and indirect consumption through increased income (see review in Carletto et al. 2015). Muller (2009) highlighted the first channel in a study of rural farmers in Rwanda who had limited access to markets. The farmers' nutrition levels (measured as BMI) were found to be improved by their increased production of agricultural products rather than income gained from them. Similarly, a study by Jones (2016) showed that increased crop diversity on the farm lead to improved diet diversity. Furthermore, that increased income can improve food consumption and diet diversity has been shown in several studies and the effect has been most prominent for poor households. For example, Hoddinott & Weismann (2010) used Conditional Cash Transfer programmes to measure the income elasticity of calorie

consumption. The results revealed that poor households spent the additional income on increasing calories while wealthier households spent more on improving quality and diversity of food. Another paper that studied this was Rajendran et al. (2017). For levels of income below average, improved incomes made farmers increase their dietary diversity at an increased rate. These studies showed that the effect of an increase in income on nutrition is not linear and has highest impact on poor people.

In sum, several studies suggest that AE can improve agricultural outcomes and that agricultural improvements can drive food security and diet diversity. Given the importance of AE as a tool for improving agriculture, the direct link between AE programmes and diet diversity needs to be investigated beyond the two papers discussed in the beginning of this section.

## **2.2 Gender differences in the impact of Agricultural Extension**

Over the past decades, a consensus has emerged about the importance of gender considerations for the success of development programmes (Peterman et al. 2014). For example, the World Bank now includes it in the design and monitoring and evaluation (M&E) systems for 95% of their rural development programmes (O'Sullivan et al. 2014).

A common way of studying the gender gap in AE has been to differentiate based on the sex of the household head. While the norm in most African countries is male headship, female headed households (FHHs) make up a substantial share of households in many countries (World Development Indicators). However, this category hides considerable heterogeneity. FHHs get created through divorce, the death of the husband, polygamous marriages or by having a husband who works in another place (Buvinić & Gupta 1997). Since the FHH category is so diverse, attribution of causal relationships based on it is not straightforward. Observed differences could be driven by gender dynamics or other factors such as a higher dependency ratio. Indeed, Daniels and Minot (2015) find that conditional on a broad set of poverty indicators from Ugandan survey data, FHHs are no poorer than MHHs.

While the empirical research has shown a stark gender gap when it comes to access to extension services (e.g. World Bank & IFPRI 2010; Gilbert et al. 2002; Katungi et al. 2008), a smaller and

inconclusive body of evidence has been devoted to the differential impact of programme participation (Lambrecht et al. 2015). The theoretical drivers and the empirical support for a higher-than average and lower-than-average impact of AE programme participation for FHHs are presented in the following sections and are summarized in **Table 1**.

**Table 1. Expected impact of AE on nutrition for FHH, relative to MHH**

<b>Support for higher impact of AE programmes</b>	<b>Support for lower impact of AE programmes</b>
Higher dietary impact for poor households	Time, labour and resource constrained
Higher returns to information & technology	Less market access
No intra-household bargaining	Weaker land rights
More likely to prioritize food	Fewer visits

Table 1 lists the causal channels for a higher than average AE effectiveness for FHHs and lower than average AE effectiveness that have been found in previous literature and will be discussed in the following paragraphs.

### 2.2.1 Support for higher impact of AE programmes on FHHs

An empirical observation in the literature has been that increased income yields a higher dietary impact for poor households. Theoretically, this could be explained by the fact that a lower initial consumption level means a higher marginal rate of substitution between consumption and leisure. Hence, with lower initial consumption levels farmers are expected to be more inclined to use labour to achieve increased consumption through higher-yielding technologies. As FHHs as a group are poorer than MHHs, the same argument would mean that they would have stronger implementation incentives and thereby gain more from AE. Additionally, women have been shown to often have less access to agricultural technologies and be less connected to networks in which such information is shared. Assuming diminishing marginal returns to new information, the impact of extension could therefore be higher for female farmers (Lambrecht et al. 2015).

The literature has moved away from a historical view of households as cohesive units toward one in which household decisions are a result of intra-household bargaining. Bargaining power is decided by for example the resource ownership structure (Quisumbing 2003). This is important since men and women have been shown to have systematically different priorities in some respects. For example, women have been shown to prioritize food expenditure to a higher degree than men

(Doss, 2006). An extension programme that increases the amount of resources could therefore be expected to increase the food expenditure more for FHHs than for MHHs. However, an extension programme could also alter the intra-household bargaining power in MHHs e.g. by increasing women's stock of particular assets and thereby increasing their power to prioritize food. This would reduce differences in priorities between MHHs and FHHs (Johnson et al. 2016; Ruel & Alderman 2013).

This bargaining process could also influence the effectiveness of AE by influencing the degree of implementation. A clear majority of MHHs have a spouse, whereas the FHHs normally have not. If there are two spouses in a household and only one of them is attending trainings, research has shown that those trainings have less impact (Lambrecht et al. 2015). As a consequence, knowledge extended to females in MHHs may translate into concrete changes to a lower extent than for FHHs (Johnson et al. 2016).

A higher impact of AE programmes for female than MHHs has been observed empirically. Extension in the form of farmer field schools in East Africa have been shown to yield substantially higher impact for participating women than men on a number of welfare indicators (Davis et al. 2012). Research has also shown that there is a gender gap in technology adoption. However, this gap can disappear, or even reverse, when knowledge of the benefits of the technology are accounted for. This suggests that knowledge-spreading interventions should be at least as impactful for women as men (Kabunga et al. 2012).

#### **2.2.2 Support for lower impact of AE programmes on FHHs**

Given that many FHHs have higher dependency ratios, they may lack the time and resources to implement new technology. For example, women in Uganda have cited time constraints due to domestic responsibilities as a reason for why they did not commercialize their farm (Ellis et al. 2005). Extension of time and capital-intensive technologies might therefore be less impactful for FHHs (Johnson et al. 2016).

A number of contextual factors could also play a role. Firstly, the effectiveness of commercially oriented AE programmes could be reduced by women's limited access to output and employment

markets (Johnson et al. 2016). In some places, women even get excluded from organisations that facilitate joint market access, such as cooperatives (World Bank & IFPRI 2010). Secondly, land ownership and tenure status could play a role in AE effectiveness, both since land can act as collateral for credit which facilitates investments and because tenure status shapes investment incentives (Manfre et al. 2013). Evidence from Ghana has shown that insecure land tenure discouraged women from investing in their land (Goldstein and Udry 2005). Similarly, knowledge of legal tenure security increased uptake of soil conservation activities among farmers in Uganda (Deininger et al. 2008).

In addition, the content of AE has been found to have been tailored to preconceptions of the productive and reproductive roles of women and men (Saito et al. 1994; Cohen & Lemma 2011). It is not clear what this would lead to in terms of nutrition levels for female and MHHs. As the traditional female role includes food provision, this could mean trainings given to women being focused more on nutrition and that trainings to men being focused more on the income generating, productive side of the farm activities. Furthermore, visits by extension officers have been shown to occur less frequently to female than MHHs (Githinji 2011).

Empirically, Saito et al. (1994) showed that an AE programme in Kenya contributed significantly and positively to output on male-managed plots, but not on female-managed plots. Similarly, Doss and Morris (2001) have shown that even with the same level of access to extension, lower levels of complementary inputs meant that the adoption levels of improved maize were still lower for female farmers. Yet other studies have found that no significant difference between females and males can be found in the impact of AE programme. Alene et al. (2007) found no difference in the impact of extension services for FHHs and MHHs in Kenya. The same result was found by Kilic et al. (2015) in a decomposition of the agricultural gender gap in Malawi.

The linkages that have been discussed in this literature review and how they are expected to impact FHHs was summarized in **Table 1**. Some of the channels, such as receiving different advice, are clearly driven by gender dynamics. Others, such as the resource constraint, are at least partly a function of the composition of the FHHs and the higher intra-household dependency ratio that results from it. While both women and low-resource households may be of importance for a

practitioner, the strategies required for reaching the two groups may be very different. Understanding the drivers of a potential heterogeneous effect is therefore important. This study contributes to previous literature by isolating the impact of AE on dietary habits and by investigating whether this impact is different for FHHs relative to MHHs.

### 3 Research setting

Uganda's population of 41 million has one of the fastest growth rates in the world and is expected to reach 100 million around the middle of the century (UN 2017). The share of the population living in urban areas has increased from 12 to 16 percent since 2000. Agriculture is the main source of livelihood and almost 70% of the population is employed in the agricultural sector (World Development Indicators). Over the past decades, increased agricultural output has been driven by a steady expansion of cultivated land. However, as the stock of unused agricultural land is becoming more constrained, continued food security has to be assured through increased productivity (Kyomugisha 2008). In recognition of this fact, the government launched an initiative called the National Agricultural Advisory Services (NAADS) Programme in 2001 which is still in place. The NAADS programme aims to use AE for spreading information, knowledge and technology to Ugandan farmers. The programme consists of both AE and inputs. Trainings were given to farmer groups which are formally registered at the sub-county level (National Agricultural Advisory Services Act 2001). The group also has to present a constitution and minutes from past meetings to get the formal registration. In practice, however, many only have to pay a fee (Stroud et al. 2006).

#### 3.1 Vi Agroforestry and their AE programme

Vi Agroforestry (Vi-AF) is a Swedish non-governmental development organization which has been active in East Africa since 1983. It seeks to reduce poverty and improve the environment through group-based AE to small holder farmers in the Lake Victoria Basin (LVB) (see Appendix 1 for map of LVB boundary). Vi-AF's work is organized into programmes which span over several years. This study evaluates the impact of the Lake Victoria Regional Environmental and Sustainable Agriculture Productivity Programme (RESAPP) which was implemented in 2009, 2010 and 2011 (Vi-AF 2012). More specifically, the impact of the programme on food consumption and diet diversity among participating farmers in Uganda is investigated.

The RESAPP programme operated in Mpigi, Mityana and Ssembabule districts in Uganda's central region. Vi-AF had not been active in those areas before the programme. The programme had three main components which targeted improvements in production, marketing and the strength of the farmer groups. In addition, "gender mainstreaming" was a cross-cutting issue. In practice, this meant that representatives from the groups were given gender training and that the groups had to write in their constitutions that they included women in decision making (N Abdallah 2018, personal communication, 21 February). The programme's three main components will be discussed below.

Firstly, the core of the agricultural production part of the programme was the implementation of Sustainable Land Management (SLM) practices on the farm. The SLM practices consisted of nine different parts which together were supposed to increase agricultural productivity in the short run and to preserve and enhance the productive capacity of the land over the long term. The practices included for example agroforestry, nutrient management, soil and water conservation, land restoration and integrated livestock management (Vi-AF 2009).

The practices vary in the amount of time and resource investments that they require and by the time horizon over which they are expected to yield results. For example, mulching, the practice of surrounding the base of a perennial crop with crop residue to preserve moisture, requires relatively little investment and yields almost immediate benefits. Digging ditches and bunds to preserve water and control soil erosion is time- and labour intensive but yields quick benefits. Intercropping, the practice of combining trees and shrubs with crops, is a longer-term investment (N Abdallah 2018, personal communication, 21 February).

Secondly, improved marketing was supported in several different ways under the Farm Enterprise Development (FED) component. After recruitment, each group went through an enterprise selection exercise in which a projected income statement was drawn up for the potential agricultural enterprises. These included the sale of crops, animals and animal products, and farmer groups were encouraged to mix both these income sources to leverage synergies between them (e.g. animal fodder from agroforestry shrubs and the use of animal droppings as fertilizer). Group members were also trained in basic book keeping. Financial access was supported through trainings on the

establishment of village savings and loan associations (VSLAs). The content of trainings would depend on what the group requested but often built on the enterprises that the group had selected (N Abdallah 2018, personal communication, 21 February; Vi-AF 2009).

Thirdly, the Organizational Development (OD) component supported groups in establishing internal structures for democratic governance. It also involved trainings for the establishment of joint commercial activities such as joint input purchasing and collective marketing. The content of the trainings would depend on the strength of the group. For example, cooperatives with governance structures in place would start with more advanced trainings such as value addition (N Abdallah 2018, personal communication, 21 February; Vi-AF 2009).

Apart from the major components of the programme there were three smaller ones that relate to nutrition. Firstly, the programme included nutritional training to marginalised groups. Marginalised groups were defined as those having at least 50% marginalised members (widows, elderly or people with HIV/AIDS). The trainings given to this subgroup included information on ways to achieve a balanced diet and how to prepare foods to preserve their nutrients. Secondly, seeds and tree seedlings were distributed to all groups for the establishment of kitchen gardens and the planting of fruit trees. The vegetable gardens were small areas right by the house that were established with the aim to allow households to eat more vegetables. The fruit tree seedlings were given with the aim of improving environmental conditions and avoiding soil erosion, but they also enabled the household to consume more fruits. Lastly, programme participants were supported in constructing wood saving stoves using locally available materials (N Abdallah 2018, personal communication, 21 February; Vi-AF 2009).

### **3.2 Programme selection**

Vi-AF went through several steps for choosing which farmers to work with in the programme. The selection will be described in detail as it is important for the identification strategy used in the quantitative part of this study. Firstly, the LVB was chosen as a target area. The area is defined by the Lake Victoria Basin Commission as the area including systems of water (both underground and surface waters) that flow into Lake Victoria (EAC 2003). By preventing soil erosion through agricultural practices, Vi-AF aimed at mitigating erosion causing ecological imbalance in the lake.



Secondly, districts were selected using proximity to the office in Masaka as the most important deciding factor. The Masaka office opened in 1992 based on that it was one of the big trading centres located centrally in the LVB (N Abdallah 2018, personal communication, 3 April; Vi-AF 2009).

After the districts were selected, Vi-AF would introduce themselves and their goals to leaders on different levels in the community to build trust (Vi-AF 2009). Subsequently, the sub-counties (around six in each districts) would apply to join the programme. The selection of the sub-counties that would join was supposed to be based on their population density and proximity to Masaka office (M Mununuzi 2018, personal communication, 27 March). Data on population density for the sub-counties show that this had not been a decisive criterion in practice.<sup>1</sup> Maps of the districts show that proximity had been more important. Sub-counties that were not selected were the ones that were often located further away from the organisation's office in Masaka. For example, in Ssembabule district, the sub counties Ntusi and Lwemiyaga were not selected to the program and they were located furthest away from the Masaka office. All other Ssembabule districts (Lugusulu, Mateete, Lwebitakuli and Ssembabule Town Council) were selected.

In the selected sub-counties, group leaders of farmer groups were invited to meetings with Vi-AF on parish level (a parish consist of 400–700 households). In the meetings, information about the programme was given and groups were invited to join. Approximately 90% of groups in the sub-counties were recruited to the programme in 2009 (M Mununuzi 2018, personal communication, 27 March).

Vi-AF had a minimum requirement of 20 members for groups and 50 members for organizations to be eligible to join the programme. Groups or organizations that showed interest in participating but did not meet this criterion were advised to merge with other groups or recruit more members and after that they joined the programme (M Mununuzi 2018, personal communication, 27 March). In sum, the selection criteria of farmers were based on 1) residing in an LVB district, 2) residing in a sub county close to Masaka and 3) being part of a farmers group.

---

<sup>1</sup>Data from 2014 showed that in one of three VI-AF districts, 3/4 selected sub counties had population density levels below the district average.

### 3.3 Programme evaluation

Data collection was done once in 2009 (baseline) and twice per year in the subsequent two years (in February and August). Two main monitoring and evaluation (M&E) tools were used; a group record and a family card (see Appendix 2). In interviews with Vi-AF staff, it emerged that the quality of the data differed depending on how it had been collected. The practices of data collection and its pros and cons were thoroughly discussed and sources of bias in the data as well as where the data was reliable were pointed out. Data which was deemed unreliable was not used in this study.

The first M&E tool was the group record. Some data on this record was collected with the group leadership and was cross-checked against physical records. For example, if the group claimed it was conducting collective marketing, it was asked to produce records of how much each farmer had contributed, where it had been sold etc. Due to this method of collecting data with the group leadership, this part of the data was deemed to be reliable. However, the remaining data on the group record was collected through a raise of hands with all the members of the group. This data had turned out to be non-reliable when a verification exercise was carried out by the central M&E department in 2009.

The second M&E tool was a so-called family card, for which a representative sample of households was selected. Family card holders were selected both in 2009 and in 2010 and tracked to the end of the programme. The family card holders were randomly selected; each field officer sent an exhaustive list of all his/her member households to the central M&E department who conducted the randomization. Furthermore, field officers were told that the central M&E department could make unannounced visits to the family card holders and make sure that what was recorded corresponded to reality. Additionally, in contrast to group level achievements which were collected by a show of hands, data from family card holders was collected in a sit-down interview in the private setting of the household (M Mununuzi 2018, personal communication, 20 February). For these reasons, the family card data was deemed to be reliable, with the exception of one section. This section will be described in Part 6.4.1. of this thesis and was not used.

The dietary indicators which were tracked on the family card and will be used as outcome variables in the qualitative part of this study were i) meals per day, ii) number of times food containing protein content was eaten in the past week and iii) number of fruits eaten in the past week.

## 4 Research questions & Hypotheses

As outlined in the literature review, the evidence for AE programmes' direct impact on food consumption is scarce. One related body of literature connects exposure to AE to higher yields and increased income. Another shows that higher and more diversified agricultural production leads an improved diet, directly through the consumption of farm produce and indirectly through increased food purchases.

Furthermore, there is a stark gender gap in agricultural productivity which has far-reaching dietary consequences. An important driver of this gap is differential access to resources, including AE. However, the potential contribution of AE to the closing the agricultural gender gap depends not only on access, but also on effectiveness. Theory offers arguments both for and against a gender gap in AE effectiveness, and the empirical literature is small and inconclusive.

This thesis seeks to shed more light on both of these issues through the evaluation of Vi-AF's RESAPP programme in Uganda. More specifically, the research questions of this study are the following:

**Figure 3. Research questions**

1. Can agricultural extension improve dietary habits?	1.1 If yes, through which channel(s) does agricultural extension impact dietary habits?
2. Is the impact different for male and female headed households?	2.2 If yes, through which channel(s) did AE have this effect?

Figure 3. (Authors' own). This figure outlines the research questions that this paper set out to answer.

The hypothesis for the first research question is that the programme positively impacted the food consumption and diet diversity. Although previous literature on AE's specific impact on nutrition is scarce, improvements in nutrition have been found among those who perceived the quality of the AE service as high, suggesting that it has potential.

Previous research gives no clear guidance for a hypothesis to the second question. As outlined in **Table 1**, a number of factors could influence the effectiveness of AE on FHHs and MHHs in either direction. On the one hand, high marginal returns mean strong implementation incentives. A unitary decision-making structure and priorities which align with the outcome should also make dietary impact high. On the other hand, the literature suggests a complementary relationship between AE and a number of other inputs including land, market access, time and labour. As FHHs are likely to be more severely constrained in these inputs, the full potential of AE might therefore not be realized for them. Given all of these factors, we hypothesize for there to be a difference between FHHs and MHHs but we refrain from making a prediction one way or the other.

## 5 Method

**Figure 4** shows the two-part mixed methods approach used in this study. The first part was a quantitative post-programme evaluation. This part used a matching method to find a control group that was comparable to the Vi-AF programme participant group at baseline. Two panel datasets, one with a sample from the treatment group and one from a randomly selected sample of people in Uganda, were matched to each other. In practice, the matching was conducted by mimicking the treatment selection and using a propensity score (PS). After the matching and harmonization of data, the panel data regression was conducted.

**Figure 4. A Mixed Methods Approach**

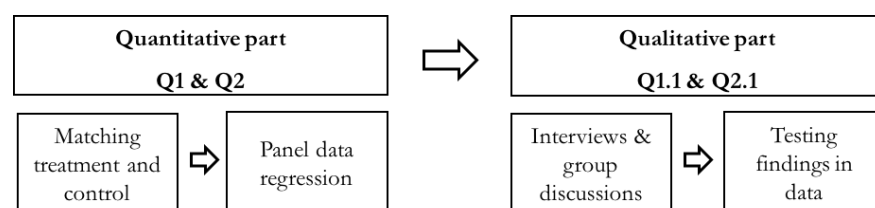


Figure 4. (Authors' own). The quantitative part of this study answers research questions Q.1 & Q2. The qualitative part answers questions Q.1.1 & Q.2.1.

The results from the quantitative analysis was subsequently investigated through interviews and group discussions with programme participants. Combining methods in this way allows the strengths of both the quantitative and qualitative methods to be leveraged. The quantitative analysis

allows for using a relatively large sample and making generalizable claims of differences between control and treatment households and thereby answering research questions Q.1 and Q.2. However, quantitative methods give limited detail on which specific mechanisms are driving the result (Clark & Ivankova 2016). This is a reoccurring problem when evaluating bundled AE interventions where many potential impact channels exist (Faure et al. 2016). Hence, adding a qualitative method provides more detailed insights on the mechanisms that could have been important for the quantitative effect (research questions Q1.1 and Q2.1). By conducting purposeful sampling for interviews and group discussions, more detailed data on a few programme participants could be collected. Some potential mechanisms that came out of the qualitative results could be brought back to the data and get tested in a second quantitative part of this study. In the following pages, the mixed methods approach used in this thesis will be explained in detail. Part 1 lays out the quantitative method and Part 2 the qualitative method.

## 5.1 Part 1: Quantitative programme evaluation

### 5.1.1 Matching using the propensity score - in theory

The ideal way of estimating the average treatment effect on the treated (ATET) of a programme would have been through a randomized experiment. The benefit of using randomized appointment of treatment and control is that it solves the issue of selection bias by ensuring that all potential participants have the same probability of being selected. This, in turn, makes them on average equal in all respects except for in exposure to the treatment. In contrast, AE programmes almost never select their participants at random. They often target people in certain geographical areas, certain vulnerable groups or those who can benefit from the type of advice being extended.

A way of dealing with the problem of non-randomization was developed in Rosenbaum and Rubin (1983) and involves finding a control group based on an estimated propensity score (PS). A PS is given to each observation based on its likelihood of being selected for the treatment. Matching based on the PS is a way of creating a control group with people who were as likely to be selected for treatment when the programme started, and therefore constitute a comparable counterfactual (Holmes 2013).

Being able to identify the effect of the treatment using PSM rests on two assumptions. The first is unconfoundedness which implies that treatment status is fully explained by the set of variables used for matching (Rosenbaum and Rubin 1983). Following from this, the probability of being selected for treatment should be calculated based on a set of observable characteristics that influence i) selection and ii) the outcome of interest. The unconfoundedness assumption states that there are no unobservable characteristics that influence the treatment and the outcome variable. With  $T$  representing treatment status,  $X$  the set of matching variables and  $Y$  the outcomes, unconfoundedness assumption is written as:

$$(Y_i^{treatment}, Y_i^{control}) \perp T_i | X_i \quad [1]$$

The second assumption behind using the PSM is the one of common support. The assumption stipulates that there exist control observations which are similar enough to the treatment observations in terms of propensity score. This implies that observations for which no such observation can be found, observations outside the common support, have to be dropped. Similarly, treatment observations without matches may have to be dropped. This could be problematic if they are systematically different from the remaining group. The common support assumption can be written as:

$$Pr(T_i = 1 | X_i) < 1 \quad [2]$$

Having estimated the PS of the treatment group and control samples, the specific way of selecting control observations depends on which matching procedure is used. The procedure used in this study is caliper matching, which means that matching with PS differences above a certain tolerance level is not allowed. This makes sure that the matches are good (i.e. are close to each other), but it can leave observations without matches. When it comes to choosing a tolerance level, little theoretical guidance is available. However, Austin (2011) has shown empirically that a caliper width of 0.2 times the standard deviation of the propensity score has yielded accurate results and was therefore used in this study.

Another type of matching that is commonly used one is nearest neighbour matching, which means that observations can be matched with each other with very different PS as long as the match is the nearest neighbour in the control group. However, nearest neighbour matching has been shown to not perform well in cases where the PS distribution is non-normal (Holmes, 2013) which is why

it was not used in the main model specification of this paper. Instead, it was tested as a sensitivity analysis (see Section 7.1).

### 5.1.2 Identification strategy: preselection & PSM

**Table 2** outlines the identification strategy used to select a control group that was comparable to the treatment group at baseline. For each stage of the process, the criteria used to select the treatment group were mimicked. For all selection criteria except the last one, the identical variables were available in the control group data. Hence, it was straightforward to use these variables as preselection criteria for the control group as well. For the last selection criteria, which was group membership, the variable was not available in the data on the control group. Therefore, the final selection of the control group was made using PSM, focusing on group membership.

**Table 2. Identification strategy – selecting a comparable control group**

Stages of selection	Treatment selection	Control group selection
District level	Lake Victoria Basin  Proximity to Masaka office	Lake Victoria Basin Excluding treatment districts
Sub-county level	Proximity to Masaka office	
Group level	Farmers, rural Members of a group (>20 famers) (PSM)	Farmers, rural Proxies for group membership (PSM)

Notes: This table outlines how the stages in the selection process of the treatment group was mimicked in the control group selection.

The preselection criteria were applied on the nationally representative control group dataset. Firstly, the treatment selection of LVB-districts was imitated by using districts where a substantial part was located in the LVB area. Households in districts that were part of the RESAPP programme were excluded to avoid spill-over effects or avoid selecting a control household which was in fact treated. The next treatment selection criteria had been proximity to Vi-AF's head office in Masaka. Masaka had been chosen as the office location because it was a centrally located trading centre in the LVB region in 1992. As the LVB region was defined based on the flow of water to the lake, being centrally located in this region was not expected to have systematic impacts on the conditions for farmers. Furthermore, at the time of selection into the RESAPP programme (2009), there were many equally big trading centres located in the LVB (Mbarara, Mpigi, Mityana etc.). For these

reasons, proximity to the Masaka office was not expected to introduce additional selection bias in the treatment group. The next stage in the selection process was on sub-county level where the same criteria, proximity to Masaka office, was used. No systematic differences were expected from this selection stage either, for the same reasons as outlined above. Turning to the group level selection criteria, only farmers in rural areas were considered for the programme. This was used as preselection criterion for the control group as well.

The last selection criterion for the treatment group was group membership. In the selected sub-counties, Vi-AF recruited groups that consisted of a minimum of 20 farmers. Ideally, the control group would also have been preselected on group membership. However, information on group membership was not available. Instead, proxies for group membership were used and a matching was conducted based on those proxied variables using the propensity score. The proxies for group membership will be described below.

Firstly, we used variables that captured NAADS-group or cooperative membership. These were stricter group definitions than the one used by Vi-AF, i.e. groups existed that were neither NAADS-groups or cooperatives. In the LVB districts, 11% of farmers belonged to this category at baseline, which was a lower share than the 20% of farmers that were recruited to the programme in the areas in which Vi operated<sup>2</sup>. Hence, to find a comparable control group, other characteristics that could act as a proxy for group membership were used and will be described below.

Secondly, we used characteristics that were shown to correlate with group membership in the Uganda setting for the year of interest. Adong et al. (2013) used data from the Uganda Census of Agriculture from 2008/09 and showed that the four characteristics that differed the most between group and non-group members were; i) having access to credit, ii) owning livestock, iii) managing a plot and ii) having land under cultivation. These variables were available in both the treatment and control dataset and could therefore be used for matching after some harmonization (see Appendix 3 for all definition of variables). Their corresponding variable names in this study are: *credit informal, credit formal, dairy animals, non dairy animals, types other animals and land owned*.

---

<sup>2</sup> Treated sub counties had a total rural population of 610,589 in 2009 (UBOS 2010). The programme reached 23,579 households (Vi-AF 2012) or 117,895 people (avg. household size of 5.0).



The rest of the variables that significantly differed between group members and non-group members in the study mentioned could not be used matching due to data limitations. Those concerned household size as well as the age and literacy rate of household head (see Appendix 4 for full table). The fact that these variables could not be controlled for is a potential threat to the unconfoundedness assumption that the PSM relies on. To investigate the extent to which this had an impact of the main result in this study, a robustness check was conducted using a control group that only included the households that were part of NAADS-groups or cooperatives. Put differently, two more preselection criteria were used (NAADS and cooperative) instead of the matching procedure. This specification did not alter the main result of the study (see Appendix 5).

Harmonization of variables between the two datasets was needed for the variables used for matching and measuring outcomes. This carried a risk of misspecification which could bias the matching. Therefore, extensive interviews with field officers were conducted to make the harmonization based on an understanding of how the farmers had interpreted the questions asked in the two data collections. Three field officers who had been living in different parts of the areas of implementation and were all familiar with data collection practices were interviewed several times and independently of each other. Based on these discussions a judgement was made for each of the variables. For the variables included in this study, the risk of misspecification was deemed relatively limited.

### 5.1.3 Econometric specification

When the control group had been selected through the matching procedure outlined above, a panel data regression was preformed using the matched samples. **Figure 5** describes the key parameter estimated in the panel data regression, the Average Treatment Effect on the Treated (ATET)..

**Figure 5. Measuring programme impact**

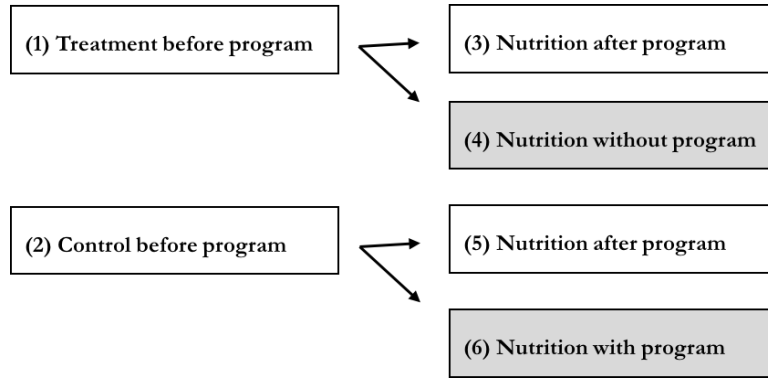


Figure 5. (Authors' own) This figure shows how the programme impact was measured in this study by subtracting the change in nutrition of the control group from the change in nutrition of the treatment group. The ATET is (3-1)-(5-2).

Box (1) and (2) in the figure represent the treatment and control observations respectively before the treatment was rolled out. To measure the programme impact on nutrition, the ideal scenario would have been to be able to observe the same individuals with and without the programme in place, represented in the figure by taking the difference between box (3) and (4). As it is never possible to observe the same individual in two different states (the grey boxes in the figure can not be observed), data on the control group was used. By measuring the change in nutrition of the treatment group and the change in nutrition for the control group, the ATET could be estimated in the following way:  $ATET = (Box\ 3 - Box\ 1) - (Box\ 5 - Box\ 2)$ .

The econometric specification used in the main model of this paper is presented below. The ATET estimate enters the specification as  $\beta_3$ .

$$Nutr_{i,t} = \beta_0 + \beta_1 T_t + \beta_2 P_t + \beta_3 (T_t * P_t) + \beta_4 (T_t * P_t * FHH_t) + \beta_5 FHH_t + \beta_6 (FHH_t * P_t) + \beta_7 (FHH_t * T_t) + \lambda_i + \varphi_t + \varepsilon_{i,t}$$

$\beta_0$  is the intercept,  $T$  is a dummy representing the treatment group across time,  $P$  is a dummy which takes the value 1 for the two post-treatment periods and 0 at baseline and  $FHH$  is the female headed household dummy.  $\lambda_i$  and  $\varphi_t$  represent a set of household and time fixed effects. The inclusion of household fixed effects means that only the within-household variation across time is used and factors that do not change over time are differenced out. This, in turn, means that time-invariant characteristics that could influence both selection and outcome, will not bias the

estimates. In this setting, land fertility could be one such factor. Owning relatively productive land clearly influences dietary patterns through the size of the harvest and could also plausibly affect the likelihood of joining a farmer's group. Similarly, time fixed effects absorb factors that change in a monotone fashion over time. For example, this means that societal trends that affect all households in the same way are accounted for. Together, the household and time fixed effects thereby remove two important sources of bias while reducing the amount of variation in the data. The FHH\*T and FHH\*P interactions are included to ensure accurate estimates of  $\beta_4$ .

In practice, several variables get excluded due to perfect collinearity. The post treatment ( $P_t$ ) dummy is perfectly collinear with the time fixed effects and both the FHH and treatment ( $T_t$ ) dummies are perfectly collinear with the household fixed effects. What remains of the econometric specification and will appear in the output regressions presented in this paper is therefore:

$$Nutr_{i,t} = \beta_0 + \beta_3(T_i * P_t) + \beta_4(T_i * P_t * FHH_i) + \beta_6(FHH_i * P_t) + \beta_7(FHH_i * T_t) + \lambda_i + \varphi_t + \varepsilon_{i,t}$$

#### 5.1.4 Outcome variables - disentangling the AE effect

As highlighted in **Figure 1**, AE programmes often have one AE component and one input and nutrition training component. Hence, a challenge when measuring the impact of the AE component (which is the purpose of this study) is to disentangle the effect of the other components of the programme. In this study, the nutritional training component of the programme could be separated since it was given only to a subset of the treatment group.

The other non-AE component of the programme was the free distribution of inputs (fruit tree seedlings and vegetable seeds), which was given to all programme participants. However, the effect of the input distribution component was likely to be contained to one of the outcome indicators.

There were three outcome variables available for dietary improvements: i) meals per day eaten on average in the past week, ii) number of proteins eaten in the past week and iii) number of fruits eaten in the past week. There were no obvious ways in which *meals per day* or *protein* were expected to be impacted by the inputs. The vegetable seeds were used in small kitchen gardens. These allowed for some diet diversification, but since they only made up a small fraction of the overall

land of the participant households, and food availability is determined by the size of the overall harvest, they were not expected to impact *meals per day* in a significant way. In addition, as fruit is not used as fodder for animals, the seedling distribution was not expected to impact *protein*. The outcome variable *fruit*, on the other hand, was expected to be significantly impacted by the inputs (the distribution of fruit trees). However, as the fruit variable still contained valuable information about the performance of the programme as a whole, it was included in all the regressions of this paper.

The qualitative part of this study will investigate the mechanisms behind the programme impact and could shed additional light on how to interpret the change in the outcome variables. This topic will be brought up again in the discussion section of the paper (Section 8.1).

## 5.2 Part 2: Qualitative data collection and analysis

Following the quantitative analysis, a qualitative data collection was conducted aimed at explaining the findings from Part 1. Eight in-depth interviews and eight group discussions were conducted with treatment farmers. For practical reasons, it was not possible to conduct interviews with non-treatment farmers; the risk of spill-over effects in the surrounding villages was deemed too high and there was no way to get in touch with non-participants who would have been eligible for the programme. Collecting data only on treatment farmers could mean that the qualitative result also could have been applicable for the control group (for example, improved weather patterns could impact both the control and treatment group positively). To handle this, the data collectors made sure to ask about specific links to the programme for any topic discussed.

### 5.2.1 Purposeful Sampling

Farmers were sampled on group level for practical reasons and a purposeful sampling method was used to assure farmers who could inform the quantitative results were interviewed (Creswell & Clark 2011). The following purposes were considered in the sampling; i) achieve variation across the three districts, ii) achieve variation within districts with different agro-ecological conditions and iii) meet FHHs. Based on these purposes the sampling was done in the following steps.

Firstly, groups were sampled across the three treatment districts, to capture variation in implementing field officers in different districts. Secondly, within the districts, the sub-counties were categorized based on agro-ecological conditions. Thirdly, the groups with the word “women” in their name (often in the form “...women’s group”) were identified and from these groups, one was randomly selected. Fourthly, the agro-ecological categories that had not been selected in the third step were identified and a second group was randomly drawn from this subset of groups. All groups that were sampled using this procedure were still connected to Vi-AF and agreed to participate.

The sampling method for the individual interviews continued when the group met. 15–25 people met in their usual location and plenty of time was given for introductions by the group leader, the researchers of this paper and the Vi-AF staff before the selection of the interviewee started. The selection was done by asking who in the group that were the head of their household. Out of the women who i) were head of their household and ii) had been part of the group during the programme in 2009–2011, one was randomly selected (through a lottery procedure) for an interview.

#### **5.2.2 Preparations, the focus group discussion and the interview**

The questions asked to farmers were purposefully designed to test alternative mechanisms behind the quantitative results. The mechanisms tested steamed from potential explanations to the results provided in interviews with Vi-AF staff and from previous literature. These mechanisms will be further explained in Section 7.2.

Two translators were used in the data collection (since one of them was not available for all visits) and the purpose behind each question was thoroughly explained to them in preparation of the visits. Using two translators could potentially bias the results and for this reason a script was followed to at least assure the same phrasings. In this script, the farmers were assured that there was no right or wrong answer, anonymity etc. See Appendix 6 for full script.

The group discussion started when the member who had been selected for the individual interview had left the group. The remaining group members were given a question and seven minutes to

discuss it. Afterwards, they were asked to summarize their conclusions. During the summary, some follow up questions were asked. The same procedure was repeated for the second question. During their discussion, the group was left in private to talk.

For the interview, a semi-structured format was used. This more structured format was chosen to minimize the bias introduced by the use of a translator's. Both the interview and the conclusion from the group discussions were recorded, in case there would be any ambiguities in the notes from the interviews. All farmers agreed to be recorded.

One concern was that the questions would be sensitive to answer, especially for FHHs. For this reason, the female author of this paper held the interviews accompanied with the translator. When raising this concern to Vi-AF, they explained that answering the questions would be sensitive only if anyone with links to the community would hear. In the case of FHHs, it could also be sensitive if the husband heard the interview. This was taken into consideration by letting the interviewee choose the location for the interview.

A caveat for the qualitative data collection was that seven years had passed since the programme ended and was quantitatively evaluated. This could make it difficult to disentangle if the effects seen now were thanks to the programme or more recent interventions. It is possible that the groups had been supported by other institutions, in addition to Vi-AF, in some of those years. In that case, some of the answers may have reflected non-Vi-AF interventions. With this in mind, however, follow up questions were asked to minimize this risk when this was suspected.

### 5.2.3 Coding

The translations of the interviews and discussions were transcribed in real time. Voice recordings were made for cross checking the transcriptions. As the interview was semi-structured, the questionnaire (see Appendix 6) was structured according to five broad sections, corresponding to the hypotheses that were developed based on the results from the quantitative data analysis. A table was created for each section in which questions and answers from each of the interview- and group discussions transcripts were placed. Each section was studied in detail; key words and concepts were highlighted and compiled. The words and concepts were categorized. Links to the causal

channels highlighted in the literature were made and discrepancies between earlier accounts and analyses were noted.

## 6 Data

For the quantitative part of this thesis, we combine follow up data from Vi-AF's programme with data from the Uganda National Panel Survey (UNPS). The UNPS followed around 3000 households during four consecutive years starting from September 2009. The survey was representative on the national and regional level and collected by Uganda Bureau of Statistics (UBOS) with support from the World Bank's Living Standards Measurement Study household survey programme. As in the Vi-AF family card data, the household head was the preferred respondent for questions in the UNPS (UBOS 2009). Data separated by treatment and control group will be presented in the results section to highlight the differences between the matched and unmatched samples.

### 6.1 Female headed households

29.6% of households in the nationally representative sample were headed by a woman and the corresponding figure for the treatment group was 32.2%. This section outlines the differences between FHH and MHH.

**Table 3** shows that the dependency ratio was higher for FHHs (1.7 compared to 1.4 children per adult) and that the share of households with a spouse was higher in MHH (almost 90% compared to 22%). This follows from the norm that if two spouses live together, the man is the household head.

**Tabell 3. Dependency ratio**

	MHHs	FHHs
Share with spouse in HH	89.7%	22.1%
Children per adult	1.4	1.7
No. of observations	2139	836

Using data from UNPS 2009–2010.

**Table 4** shows marital status of FHHs. The institution of marriage differs across the country, notable in the prevalence of polygamous marriages. Almost half of the female household heads in both samples were widows while monogamously married, the status of the overwhelming majority of MHHs, represent only around 10% of FHHs.

**Table 4. Marital status of FHHs**

	Uganda	LVB districts
Married monogamously	11.2%	10.7%
Married polygamous	18.1%	13.7%
Divorced/separated	21.3%	27.4%
Widow	45.7%	44.1%
Never married	3.7%	4.2%
No. of observations	834	263

Using data from UNPS 2009–2010. The column on the right represents the districts of interest in this study.

**Table 5. Data for average land cultivated**

<b>GPS-measurement</b>	MHH	FHH
Land owned farmer GPS (acres)	4.1	2.6
Land rented farmer GPS (acres)	0.57	0.52
Land rented as share of land owned	12%	17%
<b>Self-reported</b>		
Land owned farmer est. (acres)	6.1	4.0
Land rented farmer est. (acres)	1.6	1.3
<b>Self-reporting bias / GPS-size</b>		
Self-reporting bias for land owned	49%	54%
Self-reporting bias for land rented	181%	150%
Number of observations	2139	836

Notes: Using data from UNPS 2009–2011.

**Table 5** reveals large differences in how much land MHHs and FHHs use for cultivation. The first rows show the number of acres measured by GPS coordinates. Land cultivated, owned and rented together, was lower for FHHs. Furthermore, the FHH relied more on rented land compared to the MHH (12% compared to 17%). This is in line with findings in previous literature. Turning to the self-reported numbers by farmers, it was shown that both FHHs and MHHs substantially overstated the size of their land, especially that which they rented. The analysis of this paper used self-reported numbers since GPS-measurements were not available for the treatment group. Since **Table 5** showed that there were no clear gender differences in the self-reporting bias, such estimates could still be used to draw inferences on the differences between genders.

Turning to data that was used in the main analysis of this paper, i.e. the matched sample of control and treatment groups, the differences between MHHs and FHHs at baseline are presented in **Table 6**. The variables are those that were available for both the treatment and control group (after some harmonization of variables outlined in Appendix 2). A first observation is that FHHs ate significantly more fruits at baseline. Second, the table shows that FHHs owned significantly less land and fewer non-dairy animals as well as had lower quality of their roof, indicating that FHHs had less access to productive resources and were generally less well off. Third, FHHs were shown to have higher participation in NAADS-groups and lower in cooperatives. Fourth, fewer household members of working age indicates that the higher FHH dependency ratio observed on



the country level existed in this sample as well. The significance of grand-parent headed could be driven by the large number of widows among FHHs as shown in the national sample.

**Table 6. Baseline variables by sex of household head**

	MHHs	FHHs	
	Mean	Mean	Difference
<b>Outcome variables</b>			
Meals per day	2.50	2.61	0.11
Protein	7.44	8.22	0.78
Fruit	4.02	5.03	1.01**
<b>Asset ownership</b>			
Land owned	3.04	2.48	-0.56**
Dairy animals	1.82	0.90	-0.92
Non-dairy animals	4.50	2.92	-1.58**
<b>House type</b>			
Quality of wall	2.30	2.34	0.03
Quality of roof	1.09	1.04	-0.04*
<b>Farm commercialization</b>			
Crop enterprises	2.72	2.58	-0.15
Vegetable enterprises	0.93	1.11	0.18
<b>Group membership</b>			
NAADS group	0.46	0.59	0.13**
Cooperative	0.20	0.07	-0.13***
<b>Household composition</b>			
Parent headed	0.98	0.87	-0.11**
Grandparent headed	0.06	0.21	0.15***
Child headed	0.01	0.01	0.00
Other adult headed	0.01	0.03	0.01
No. people 18-60 in hh.	2.52	2.05	-0.47**
No. of people with paid education	2.84	3.11	0.27
No. of observations	254	119	

Using data on matched sample used in the main analysis of this paper.

## 6.2 Treatment data

### 6.2.1 Manual linking of family cards to group records

Data on the treatment group had to be compiled from the two separate M&E tools that were used by Vi-AF. The variables of household level characteristics were found on the family card and the group level variables (having access to financial services or being part of a cooperative or NAADS group) were available on the group record. The family card and the group record could only be linked using group name. Linking had to be done manually since i) the spelling of the group names sometimes varied and ii) some generic names were reoccurring. The manual linking exercise was

conducted by sorting the group record and the family card files first by group name, then by location (roughly corresponding to sub-county), then division (roughly corresponding to district). The sorting gave around 20 potential farmer groups from the group records that were manually screened to identify each group name on the family card. In cases when more than one group could be considered to match the group name on the family card, the data from other years was consulted to see whether the name of the group has been entered differently in another year. In cases when no name resembled the names of groups in that location, the Luganda speaking staff were asked for advice on how to interpret the names, which enabled many of those groups to be linked too. To minimize the risk of typos, the linking was done by both authors of this paper independently of each other and subsequently cross checked.

#### 6.2.2 Unbalanced panel

The treatment data panel was unbalanced for several reasons. First, the stepwise recruitment of family card holders meant that some households were followed up from the first year of the programme and others from the second year. In order to capture the full effect of the program, only the ones who were followed up from the first year will be used for the analysis in this study and discussed more in detail below. In addition to this, the exercise of linking group records to family cards revealed that two more factors contributed to making the panel unbalanced. The two dimensions of missing data are presented in **Table 7**. The first dimension was to what extent the family cards were missing (presented in the rows of the table). The second dimension was to what extent the family cards were successfully linked to group records (presented in columns of the table).

**Table 7. Reasons for unbalanced panel**

Overview Family Card Linked to Group Records					Overview Family Cards Panel
Total	Never Linked	Linked some round(s)	Linked all rounds		
339 90.0%	18 4.8%	54 14.3%	267 70.6%	Continuous to the end	
35 9.3%	15 4.0%	0 0.00%	20 5.3%	Drop out	
4 1.1%	0 0.00%	2 0.5%	2 0.5%	Round missing	
378 100%	33 8.3%	56 14.8%	289 76.5%	Total	

Notes: This table outlines the reasons for why the treatment sample was unbalanced.

The top right cell of the table shows that 71% of family cards were continuous till the end (i.e. appear in the follow up for all the rounds from when they were recruited to the end of the programme) and were successfully linked to a group record in all the rounds they participated. These were the family cards used in the analysis. The remaining 29% of family card holders were inadequate in some regard for reasons which will be investigated below to see if there was any systematic attrition.

Considering the first dimension (rows in the table) it was clear that drop outs (9.3%) were the biggest reason for the missing values in the panel. Further investigation of the data showed that all these drop outs did so already after the first round in 2009. Interviews with Vi-AF staff indicated that the reason for this had been some initial doubt regarding the benefits of the programme (N Abdallah, personal communication, 28 March). A balance test at baseline was conducted between the households that had missing family cards (dropped out or missing rounds) and the ones that remained in the sample, using only variables available on the family cards (see Appendix 7). It revealed that the households who dropped out or missed a follow up round owned significantly less land than the ones remaining in the sample. This further underlines the importance of conducting the matching on the variable for *land ownership*. Given that the Vi-AF programme seeks to improve productivity on cultivated land, one explanation for this is that the benefits of the programme were clearer for those who owned relatively more land.

Turning to the second dimension (presented in columns in the table), there were 33 family cards that were never linked with a group record and 56 that could not be linked in at least one round. There were two reasons why the family card were not linked to a group: because the name on the group record and family card mismatched or because the group had not been followed up at all. A balance test (see Appendix 8) between these and the remaining treatment sample (only including the variables available from the family card) showed that the only two significantly different variables were *other adult headed* and *roof type*. The latter is only statistically significant on the 10% level. Furthermore, very few households are headed by a non-parent adult in either sample and the difference in this variable, while significant, is very small. The lack of other significant differences shows that the misreporting of names was largely non-systematic.

The only significant overlap between the two dimensions were the 15 family card holders that dropped out and were never linked to a group record. 13 of these dropped out after the first round, which indicates that the explanation lies in the time discrepancy between the group record follow up and the family card follow up at the time of recruitment. For these 13, the family card was likely filled before the group record was filled and when the group record was to be filled, the group had dropped out (N Abdallah, personal communication, 28 March).

### 6.3 Testing for field officer attention bias

One concern that was raised in interviews was that groups with family card holders could have received additional inputs compared to the other groups. However, this was deemed not to be the case since input distribution was demand-driven, so the discretion for the field officer to give more trees to groups with family card holders or individual farmers was very limited. Another concern was that groups with family card holders could have received extra attention from the field officers. To which extent this had happened was investigated in the data by using the time discrepancy for when farmers were recruited as family card holders.

When new family card holders were sampled in the second year, they were sampled randomly from the pool of treated households. This implied that households who received their family cards in 2010 had received the programme for one year without the field officer knowing that these would

later be followed up. By comparing the performance of households who were followed up from 2009 with those who were followed up from 2010, the field officer attention bias was measured.

**Table 8** shows a balance test for the outcome variables on the subsample of farmers in groups who received treatment from 2009. The outcome variable *protein* was significantly higher for the households that had been recruited early in the programme which indicate that this was an outcome variable that the field officers could impact by giving extra training to individual households. When this bias was evaluated in the context of the overall result in the discussion section of this paper, it was clear that it represented a relatively small part of the total program effect.

**Table 8. Testing for family card attention bias in groups recruited 2009**

	Followed up from 2009 Mean (Std. dev.)	Followed up from 2010 Mean (Std. dev.)	Difference Coef. (Std. err.)
Meals per day	2.67 (0.66)	2.65 (2.05)	-0.02 (0.13)
Protein	12.79 (10.38)	11.00 (6.95)	-1.79** (0.73)
Fruit	8.78 (5.97)	8.06 (6.60)	-0.72 (0.52)
N. of cases	303	277	580

Notes: Subsample of farmers in groups receiving treatment from 2009 using data from family cards in 2010.

#### 6.4 Time variable specifications

The data on the treatment group and data of the control group differed both in how often it was collected and in the exact time of the data collection. For the treatment group, data was collected differently for the baseline compared to the subsequent rounds. The baseline data was collected continuously throughout 2009, with no further specification on which date. Subsequently, data was collected on the farmers biannually in February and in August in 2010 and in 2011, with gave a total of five observations per farmer. The treatment data from August was used instead of the data from February to minimize the time discrepancy between treatment and control follow ups.

For the control group, data was collected annually with the first data point at any time of the year between September 2009 and September 2010 and the subsequent survey rounds took place

around one year after the previous one. In the main specification of this paper, the matching was conducted using baseline data on the control and baseline data on the treatment (**Figure 6**).

**Figure 6. Baseline time discrepancy between treatment and control group**

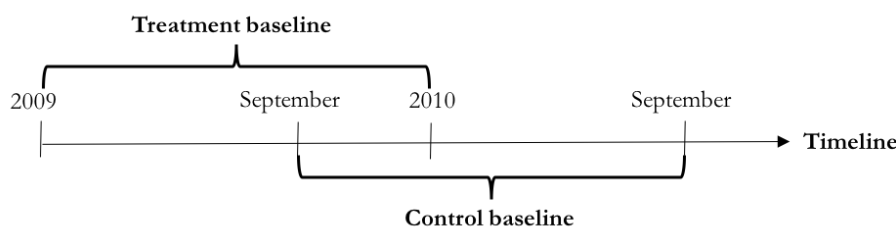


Figure 6. (Authors' own). This figure shows how the baseline samples were matched to each other.

The time discrepancy between the baselines raised two concerns that will be addressed. Firstly, systematic seasonal variations could cause errors in the matching. For example, a weak farmer who was followed up at a time when he/she had just harvested could be matched to a strong treatment farmer at a point of economic distress. However, for this to affect the matching, the variables used in the matching in this study would have to vary by season. One group of such variables, those relating to group membership, land ownership and access to financial services, have no direct link to the agricultural cycle and should therefore not vary seasonally. The remaining matching variables measure livestock ownership and is potentially more problematic. Livestock could be sold at times when food was scarce to enable households to smooth their consumption, which would have caused problems in the matching. The extent to which livestock is used for consumption smoothing is discussed below.

An earlier study using the UNPS paired with rainfall data found very few significant links between rainfall shocks and household welfare and suggested that rural households in Uganda generally managed to smooth their consumption. That study also showed that the use of credit services or sustainable land management practices allowed for smoothing but livestock sales were not mentioned (Asfaw et al., 2015). Furthermore, self-reported data from the shock-module in the UNPS showed that income shocks had been relatively common over the time of the programme, but that the sale of livestock was not a common way of dealing with them. Only 2–4% of respondents reported having done so as a first, second or third coping strategy in response to

irregular rainfall, drought or flood in the period of study. This indicates that seasonal variation in livestock ownership is limited and that for this reason, the time discrepancy should not have been a problem in the matching.

The second concern following from the time discrepancy between the treatment and control group data was that the treatment group could have been followed up during a time of year when food was relatively more accessible. The control group was followed up continuously throughout the year and would therefore represent points in time where food was relatively less accessible. To investigate if this was a problem for our study, **Table 9** shows a comparison of farmers that were followed up in August and those that were followed up in the rest of the year.

**Table 9. Balance test for seasonality in outcome variables**

	Followed up in August	Followed up rest of the year	Difference
	Mean (Std. dev.)	Mean (Std. dev.)	Coef. (Std. err.)
Meals per day	2.58 (0.61)	2.50 (0.61)	-0.08 (0.05)
Protein	7.19 (4.37)	7.50 (4.58)	0.32 (0.34)
Fruit	2.35 (4.41)	2.64 (4.28)	0.29 (0.34)
N. of cases	181	1860	2041

Notes: The table shows a balance test using UNPS data on all farmers in the LVB. There were no significant differences in the outcome variables depending on if farmers were followed up in August compared to at some other point during the year.

The farmers followed up in August represented a proportional share of the total population and were not significantly different in any of the outcome variables. This further supports the finding in Asfaw et al. (2015) and suggests that Ugandan households are generally able to smooth their consumption over the agricultural season.

The two concerns raised from the time discrepancy between the treatment and control group data do not appear to have had an impact on the identification used in this study. Nonetheless, matching using only the control observations which were followed up between Sept 2009 and December 2009 (compared to the full year) was carried out in a sensitivity analysis. This gave a more accurate matching in terms of the timing between the treatment and control group follow up, since they both occurred in the same cropping season. This specification did not alter the main results (see

Appendix 9). Restricting the period for the control group reduced the number of controls available for the matching from 589 to 204, and only 50 control farmers were chosen in the matching.

#### 6.4.1 Verification of Vi-AF's digitization process

Some data collected on the treatment group was of inadequate quality and therefore not used. To ensure that the digitization process from physical papers had been accurately carried out by Vi-AF in 2009–2011, a random sample of ten digital family cards were compared to the physical ones. The result showed that data had been adequately digitized with one exception; the sections capturing the number of children and their schooling. The detailed nature of the family card in this section (family members and orphans in different age and sex categories for several years next to each other) made this section challenging to digitize. See Appendix 2 for the family card.

### 6.5 The qualitative data

Following the sampling strategy described in the method section, eight group discussions and eight individual interviews were carried out. Seven out of eight of the interviewees were female and five, including the man, were heads of their household. Of the four FHHs, one was a widow, one was divorced, one was in a polygamous marriage and one was in a monogamous marriage. Thereby, members of each of the categories in **Table 4** were interviewed. The two female interviewees who were not household heads were in monogamous relationships.

Most group discussions were attended by 15–25 members. On two occasions, only three and seven people were present respectively. In both cases, the visit had taken place at the same time as many in the groups were attending other trainings. The most active participants in the group discussions were often, but not always, men. In many groups, the women were active and in others they were encouraged to contribute with direct questions. Transcripts of interviews and group discussions can be found in Appendix 11. Contact details and information which could be used to identify the respondents was removed.



## 7 Results

### 7.1 Quantitative results – main specification

The regression results were derived using the sample of family card holders who were part of the programme for three years. The control group was found using two preselection criteria and a matching based on propensity scores derived from baseline characteristics. Caliper matching with a caliper of 0.05 (0.2 times the standard deviation of the PS) was used. This means that the control observations used were a maximum of 5% less/more likely to be selected for treatment than their respective treatment observation based on their baseline observable characteristics. 15 treatment observations could not find a match within this radius and were therefore dropped from the sample. An alternative matching method which included these 15 observations was used in a sensitivity analysis. The matching was done with replacement of the control observations which allowed the same control to be used for several treatment observations. To account for how many times a control observation was used, a “weight” variable was constructed according to the inverse of the number of times each control was matched to a treatment observation.

**Figure 7** shows the PS distributions for control and treatment samples before and after matching. While the shapes of the distributions varied significantly between treatment and control, the area of common support covered the entire distribution.

**Figure 7. Propensity score distributions**

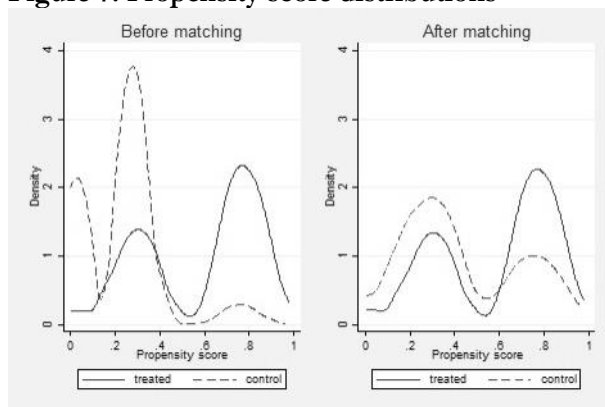


Figure 7. PS distributions before and after matching in main model specification.

The graph on the left shows that before the matching, many control observations were clustered in the bottom half of the PS distribution. A reversed, if not as extreme, pattern was present for the treatment observations. This reflects that the PS is defined by the differences between treatment and control in the matching variables. The clear difference in the location of the PS density peaks at high and low end of the x-axis and the relatively limited overlap

indicated that selection bias (as expected) was present in the sample. After the matching, the PS distribution for the control group had shifted to the right as only the most similar observations were chosen in the matching.

**Table 10** displays the extent to which the matching reduced the bias in each of the individual variables.

**Table 10. Bias before and after matching**

Variable		Mean Treated	Mean Control	% difference
<b>Asset ownership</b>				
Land owned	Matched	2.80	2.74	4.1
	Unmatched	2.78	2.31	29.0***
Dairy animals	Matched	1.02	1.65	-5.8
	Unmatched	1.08	1.48	-7.4
Non dairy animals	Matched	3.19	3.58	-4.3
	Unmatched	3.12	4.04	-10.5
<b>Group membership</b>				
NAADS group	Matched	0.53	0.62	-16.8**
	Unmatched	0.43	0.15	64.0***
Cooperative contact	Matched	0.16	0.16	1.8
	Unmatched	0.16	0.03	45.7***
<b>Credit access</b>				
Credit formal	Matched	0.28	0.29	-1.2
	Unmatched	0.28	0.24	8.1
Credit informal	Matched	0.08	0.15	-21.0***
	Unmatched	0.07	0.40	-82.8***

Notes: The matched sample included 359 households and the non-matched included 967 households. The third column in the table showed the bias in the variable between treatment and control.

Before the matching, four variables were significantly different in the two samples: both group indicators, land ownership and access to informal credit. After the matching, bias was reduced significantly across all four variables. Land ownership and cooperative became insignificant and bias reduced from 83% to 21% in informal credit and from 64% to 16% for NAADS group. For the latter, the coefficient also changed sign, and left the remaining difference between the two samples in favour of the control group. The dairy animal variable became slightly more unbalanced after matching, but the difference between control and treatment group remained statistically non-significant.

The selected controls and treatment observations in the matched sample were used to estimate a fixed effects model using the three different dietary indicators as dependent variables. Using the

matched sample means that the averages of the two groups are compared, not the individual matched pairs. This practice is outlined in World Bank's *Handbook on Impact Evaluation* (Shahidur et al. 2010) and has been used in earlier empirical work (Benin et al. 2019; Davis et al. 2012). **Table 11** shows the estimated model with time fixed effects and individual fixed effects. Factors that affect both outcome and treatment selection, but are not affected by program participation, should in theory be controlled for in the post-matching regression. In this case however, all factors that influenced selection and for which we have data (those included in the matching) are either i) likely to be affected by program participation or ii) time invariant. Therefore, no additional control variables were used.

**Table 11. Main specification**

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.711*** (0.0781)	8.242*** (0.564)	5.121*** (0.533)
FHH x Treatment x Post treatment	-0.386** (0.152)	-0.525 (1.057)	-0.139 (1.000)
FHH x Post	0.122 (0.114)	-0.745 (0.764)	-0.827 (0.723)
FHH x Treatment	-0.459** (0.228)	-3.890** (1.645)	-3.048* (1.557)
Constant	2.675*** (0.0490)	8.467*** (0.352)	3.790*** (0.333)
Observations	1,599	1,612	1,612
Control group mean	2.513	7.780	2.340
R-squared	0.076	0.313	0.240
Number of HHID	359	359	359

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects.

Across all three outcome variables, the treatment-post treatment interaction was positive and highly statistically significant. This means that programme participation was associated with increased food consumption and diversified diet. The number of meals eaten per day increased by more than half a meal (a coefficient of 0.71). The effect was driven by a decrease in the share of programme participants eating less than three meals per day (from 51% to 29%) and by a corresponding increase in farmers eating three times per day (from 45% to 64%). Eating four meals per day was uncommon both before (4%) and after (7%) of the programme.

Weekly intake of protein increased by around eight times. This can be compared to a control group mean for protein intake of 7.8 times per week. Thus, on average the programme participation allowed households to consume protein twice, rather than once, per day. As this increase could partly have been affected by the field officer attention bias discussed in Section 6.4, the size of the coefficient should be interpreted with caution and will be further discussed in Section 8.3. As expected given the direct impact of fruit tree distribution, weekly fruit intake also increased substantially. As a result of the programme, participants ate fruit around six times more per week. The triple difference estimator which interacted the double difference variable with a female household head dummy was also statistically significant and negative for the meals per day variable. At -0.39, the coefficient was large enough to reduce the increase in this variable by just over half (54%) for the subsample of FHHs compared to the sample as a whole. Hence, there was still, on average, an increase in the number of meals consumed for FHHs. For *protein* and *fruit*, the programme impact was not significantly different FHHs and MHHs.

Firstly, these results indicated that the programme had a large and significant positive impact on the nutritional variables for the sample as a whole. Secondly, the positive impact in meal frequency was smaller for the subsample of FHHs.

#### 7.1.1 Sensitivity of the quantitative results

Four sensitivity analyses were conducted to test the robustness of the results in the main model specification of this paper. In the first such analysis, the marginalised groups were excluded from the sample. As was explained in Section 3.1, this was a group that received explicit training on nutrition. If this type of training had been specifically impactful to increase nutrition, it could have been the case that improvements for this group was driving the overall results.

The results of the sensitivity analysis in **Table 12** on the next page show that excluding the marginalized groups from the treatment sample left the sign and significance of the coefficients for all of the outcome variables unchanged. The main difference compared to the main model specification was that the coefficient for the FHH triple interaction variable went from -0.39 to

0.76. This change meant that, in this specification, FHHs increased their meal frequency by only 0.12 meals per day on average compared to 0.89 for the sample as a whole.

**Table 12. Excluding marginalized groups from treatment sample**

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.886*** (0.0838)	7.468*** (0.587)	5.353*** (0.540)
FHH x Treatment x Post treatment	-0.762*** (0.161)	-1.498 (1.096)	-0.989 (1.009)
FHH x Post	0.351*** (0.118)	0.342 (0.785)	-0.0538 (0.722)
FHH x Treatment	-0.213 (0.256)	-3.114* (1.796)	-2.153 (1.653)
Constant	2.646*** (0.0535)	8.325*** (0.374)	3.660*** (0.344)
Observations	1,454	1,461	1,461
Control group mean	2.522	8.065	2.423
R-squared	0.096	0.295	0.229
Number of HHID	331	331	331

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects.

The robustness of the overall results to this sensitivity analysis indicated that the gains realized for the sample as a whole were not driven by gains from the subset of marginalized groups. However, the increase in magnitude of the FHH triple interaction coefficient suggested that the meal frequency gains realized by FHHs were in large part a consequence of an increase in meal frequency in this group. Put differently, this group was driving a big part of the increase in meals per day for FHHs seen in the main model specification.

The next sensitivity analysis that was conducted was to remove the pre-selection criteria to choose only farmers in the LVB and instead use control farmers from all districts in Uganda. This changed the number of control farmers available for matching from 589 to 2,167, which was an advantage since it allowed for more control farmers to be matched. Using this procedure, 145 control households were matched compared to the 88 in the main specification. **Figure 8** shows the distributions of the propensity scores before and after matching.

**Figure 8. Propensity Score distributions**

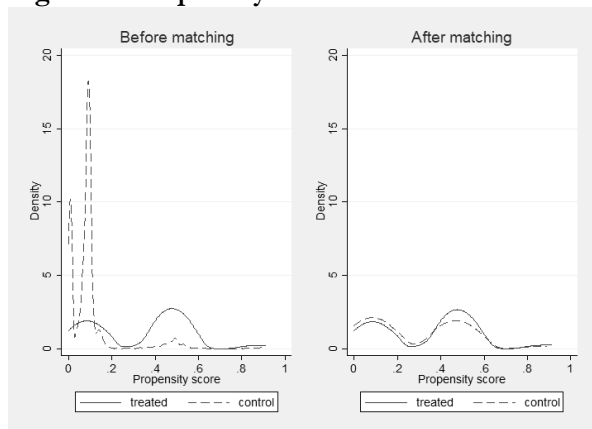


Figure 8. PS distributions before and after matching with the preselection criteria of LVB districts removed.

As in the main specification, some common support could be found across the PS distributions both before and after matching.

Before matching, the distributions looked even more different than the distributions before matching in the main specification. This reflected the fact that the LVB preselection criterion restricted the sample to districts that shared some traits with the treatment, such as more similar agroecological conditions. After matching, the distributions in **Figure 8** tracked each other very closely; the larger pool of potential control observations (2,167 compared to 589) allowed a closer matching on observable characteristics.

**Tabell 13. Bias before and after matching**

Variables		Mean Treated	Mean Control	%bias
<b>Asset ownership</b>				
Land owned	Matched	2.80	3.18	0.38**
	Unmatched	2.78	2.51	-0.26**
Dairy animals	Matched	1.02	5.21	4.18
	Unmatched	1.08	1.48	0.40
Non dairy animals	Matched	3.19	5.52	2.33
	Unmatched	3.12	4.28	1.15**
<b>Group membership</b>				
NAADS group	Matched	0.53	0.50	-0.04
	Unmatched	0.43	0.14	-0.29***
Cooperative contact	Matched	0.16	0.14	-0.03
	Unmatched	0.16	0.02	-0.14***
<b>Credit Access</b>				
Credit formal	Matched	0.28	0.26	-0.03
	Unmatched	0.28	0.21	-0.07**
Credit informal	Matched	0.08	0.17	0.10**
	Unmatched	0.07	0.29	0.22***

Notes: The matched sample had 431 observations and the unmatched sample had 2,545 observations.

The balance test in **Table 13** showed that the unmatched sample was balanced only in the *dairy animal* variable. This again reflected that the unmatched sample contained farmers that were very

different from each other since they were drawn from very different districts. The matched sample, however, was balanced in all but two variables, *land owned* and *credit informal*.

**Table 14** shows the panel regression using the matched sample with the preselection on LVB removed. Again, the significance and direction of the coefficients were the same as in the main specification. The magnitude of the coefficients differed somewhat: the average increase in meals per day in this specification was just below half a meal (0.46) compared to just above half a meal (0.71) in the main model. In terms of protein and fruit, the increase was somewhat larger in magnitude. The female triple difference estimator coefficients also increased in size for the meals per day variable to -0.51 compared to -0.39 in the main model specification. Thereby, the overall effect of program participation for FHHs was slightly negative.

**Table 14. Fixed effects regression – caliper matching (0.05)**

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.459*** (0.0772)	7.890*** (0.578)	4.522*** (0.527)
FHH x Treatment x Post treatment	-0.507*** (0.144)	-1.590 (1.059)	0.387 (0.966)
FHH x Post	0.231** (0.103)	0.289 (0.743)	-1.384** (0.678)
FHH x Treatment	-0.437* (0.224)	-2.753 (1.674)	-2.411 (1.527)
Constant	2.560*** (0.0465)	8.289*** (0.348)	3.671*** (0.317)
Observations	1,748	1,753	1,753
Control group mean	2.504	8.169	2.514
R-squared	0.044	0.281	0.228
Number of HHID	438	438	438

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects.

In a third sensitivity analysis, the potential problem of remaining post-matching bias in the *NAADS group* and *informal credit* variables was investigated. A set of new variables was created as the difference between baseline and end line values of each outcome variable ( $Nutr_{i,2011} - Nutr_{i,2009}$  in the equation below). Regressing the baseline membership in NAADS group and

access to informal credit on the new outcome variables gave an indication if baseline status of a farmer in these variables was of importance to change in outcomes of the programme. The empirical model, where  $T_i$  is the treatment indicator dummy, was:

$$\text{Nutr}_{i,2011} - \text{Nutr}_{i,2009} = \beta_0 + \beta_1 T_i + \beta_2 \text{NAADS group}_{i,2009} + \beta_3 \text{Credit informal}_{i,2009} + \varepsilon_i$$

The results from the regressions (presented in **Table 15**) showed positive and significant coefficients for the treatment dummy while the two covariates were not significant in any of the models. This indicated that baseline NAADS group membership and access to informal credit services did not influence the ability of a household to benefit from the programme. This suggested that the imbalance that remained in these variables between the treatment and control sample did not bias the results in the main panel data regression.

**Table 15. Effect of variable imbalance**

Variables	Change meals per day	Change protein	Change fruit
Treatment	0.543*** (0.166)	8.146*** (1.201)	6.078*** (1.027)
NAADS group	-0.220 (0.140)	1.007 (1.008)	1.156 (0.862)
Credit informal	-0.0320 (0.211)	-0.486 (1.530)	-0.852 (1.308)
Constant	-0.118 (0.158)	0.345 (1.145)	0.676 (0.979)
Observations	339	337	337
R-squared	0.031	0.136	0.113

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Lastly, the caliper matching method was changed to nearest neighbour matching and the analysis was rerun with this alternative matched sample (see Appendix 10). The main difference between the two methods was that the 15 treatment observation for which no close match could be found in the main specification now got matched to their nearest neighbour. Again, the signs and significances of the estimated coefficients of interest remained unchanged. The only difference of note was that the magnitude of the FHH triple interaction parameter increased from -0.386 to -0.659. This indicates that the 15 treatment observations which were excluded from the main specification were negative outliers in terms of programme impact. When included in the matching, they drove a more negative result for the FHHs. Given this and the non-normality of the PS distribution, the main specification should be a more accurate reflection of the sample as a whole.



## 7.2 Qualitative results

This section presents qualitative results from the interviews and group discussions. The questions posed to farmers were purposefully designed to investigate the alternative mechanisms behind the quantitative results. In broad terms, the mechanisms that could have explained the overall impact of the programme could be grouped into three categories: production, marketing and improved collaboration in household. The factors which explain the lower impact for FHHs are i) land owned/land rented, ii) gender differences when selling/growing crops or raising animals and iii) access to complementary inputs (time and labour). Two mechanisms from previous literature, fewer visits and gendered advice were deemed inapplicable to this setting since trainings had been given on group level. Transcripts can be found in Appendix 11 where interviews and groups will be referred to with a randomly assigned number of 1–8 as well as a “G” for group discussion and “I” for interview.

### 7.2.1 Reasons for overall increase in nutrition

Most farmers and farmer groups claimed that the programme had helped them diversify and increase their food consumption. The channels were summarised in the left column in **Table 16** in categories of i) production, ii) marketing and iii) improved collaboration in household.

On the production side, the Vi-AF programme had made several improvements with direct impact on food consumption. Firstly, increased yields had been brought about by the use of organic fertilizers (G3, G4 & G6). Many SLM practises had improved the resilience against drought and farmers had been taught to keep crops at different stages (e.g. some ready for harvest, some recently planted and some in the middle) which had increased food security (I5 & G5). Secondly, many groups described that kitchen gardens that had been promoted by Vi-AF had increased the consumption of vegetables (I8, G3 & G5). Third, the promotion of agroforestry trees and shrubs had increased the availability of nutritious animal feed. This, in turn, had increased the production of milk which had allowed for more regular protein intake. In addition to these extension-driven improvements, the planting of fruit seedlings was reported to have increased fruit consumption directly (G3, G8, I1 & I6).

The wood saving stoves were said to have impacted nutrition in two ways. First, by reducing the consumption of firewood, the farmers could afford to cook more often. Second, since the wood saving stove allowed to cook using several pots at the same time, this had also improved diet diversity (G2, G4 & G5).

The second category in Table 16 considers channels through which the programme had facilitated marketing of the produce. Several farmers said that collective marketing had increased their income through higher prices. However, one group emphasized that successful collective marketing required a strong savings and loan group where members could borrow money for school fees while they waited to sell (G7). Another marketing related improvement was that the programme had encouraged enterprise selection and specialization in activities such as bee keeping, poultry, piggery and seedling production (G2 & G6).

The third category of channels through which the programme seemed to have improved food consumption was improved collaboration within the households. Firstly, transparency increased thanks to collective marketing on group level and collective budgeting on household level. Before the programme, mistrust between spouses had been common and had caused spouses to hide money from each other. The husband was described to sometimes force the wife to leave the farm when it was time for selling. Men who were present during such discussions agreed that this was the case but motivated it with fears that the woman would spend the money on things not in line with his priorities. The more transparent system had built trust in both groups and households.

Secondly, collaboration had increased as a result of both spouses taking part in the programme and implementing it together. Before the programme, women often had a share of the husband's land that she was responsible for, but she did not have enough resources to implement the SLM practices there. Joint implementation improved the resource allocation on the household farm as a whole by shifting resources to female-controlled plots. Two women whose husbands were not part of their group described how they were struggling to implement SLM practices since their husbands were reluctant to help (I5 & I6). Interviews with Vi-AF staff revealed that they often

experienced that households were slower in implementing SLM practices if only one of the spouses was part of the Vi-AF group.

The mechanisms discussed behind the overall impact of the programme (research question 1.1) are summarized in the left column of **Table 16**. The following section will discuss the mechanisms through which the programme had differential impact on FHHs (answering research question 2.1). These mechanisms are outlined in the right column of **Table 16**.

**Table 16. Summary of qualitative results – direct or indirect increase in nutrition**

Overall increase in nutrition	Differential impact for FHHs
Production channels	
Sustainable Land Management practices (SLM) (+)	Time & labour constrained (-) Capital constrained (-) Land constrained (-)
Kitchen gardens & vegetable seeds (+)	
Fruit seedlings (+)	
Wood saving stoves (+)	
Marketing channels	
Collective marketing (+)	Reduced need for transportation (+) Reduced problem of lower bargaining power (+)
Enterprise selection (+)	Less likely to invest (in for example animals) due to lower security (-)
Collaboration in household channels	
Household budgeting and decision making (+)	Only one decision maker in household. No intra household bargaining needed. (+)
Encouraging both spouses to be part of group trainings (+)	

Notes: The left column outlines the channels through which the programme had its positive impact on food consumption. The right column outlines how the effect differed for FHHs, with (+) and (-) indicating if the differential impact was positive or negative.

### 7.2.2 Qualitative results on the gender difference

This part describes the reasons for why the channels described in the previous section work differently for FHHs and MHHs. Many reasons support that gains from the programme were lower for FHHs, but several reasons pointing in the opposite direction were also offered. The findings are presented in the right column of **Table 16**, with (+) and (-) indicating if the differential impact was positive or negative for FHHs.

In the production category, the qualitative study revealed that FHHs faced three main constraints (I4, I6 & G8). First, labour and time constraints often made it difficult to implement SLM practices. This followed from the fact that FHHs were often widows or divorced. Many of the ones who were still married lived in dysfunctional relationships (where husband was not contributing to the household) or relationships where the husband had several wives (I6 & I7). The time and labour-constraint could also have reduced the effect of the programme by making FHH miss out on trainings more often. Vi-AF staff explained that women were more constrained with chores in the households and men were more active in seeking opportunities for income (H Kansiime 2018, personal communication, 16 March).

Secondly, FHHs were said to be capital constrained. Lack of capital meant that FHHs could not hire labour to work on the farm (I1 & G1), invest in pesticides (I8) or build animal shelters to the same extent as male household heads (I1). Thirdly, interviews revealed that land ownership was a limitation for FHHs. The females who both owned and rented land said SLM practices would not be implemented to the same extent on rented land (I1, I6 & I3). One interviewee explicitly said that the reason was that if she would implement SLM on the rented land it would “only support the owner of the land” (I6, p. 18). In addition, implementation of some SLM practices would be seen as attempts to establish ownership of the land and therefore not allowed, especially for short term rental contracts (I3 & I6). Even practices requiring only minor investment, such as composting, could be sensitive to differences in the period of renting (I6).

Turning to the marketing channels presented in table 16, it was revealed that the collective marketing component of the programme had had even more positive impact for FHHs than MHHs (I1 & I7 & G1). Collective marketing had reduced cultural inhibitors for FHHs such having limited possibilities of getting to the market (women were considered not to be able to ride a bike) and low bargaining power when selling (G2 & G8). Traditional gender roles stipulated that women should take care of the household and that it was the husband’s role to sell. Due to limited market access, women missed out on information about prices, which put her in a higher risk of being cheated when selling at the farm gate (I3). These problems were reduced if the FHH was part of a group where she could get information about prices or, if the group was selling collectively, she

would not have to bargain the price individually at all (G1, G3, G8 & I7). By building strong groups the programme impacted FHHs positively.

The last channel in the marketing component was enterprise selection, the part of the programme that encouraged concentrated investments in the production of high-return goods. A result that came out of interviews was that security concerns would discourage FHHs from making such investments. For example, a lonely woman's animals could more easily get stolen since the thieves would know there was no man in the house who could deter the thieves (I3).

One hypothesis from previous literature was that females and males could have spent income gained from the programme differently. However, the results showed no clear gender preference in how to spend increased income. Some interviewees indicated that saving or paying school fees was more prioritised by FHHs than by MHHs (N Abdallah, personal communication, 20 March; I6). Others said that women prioritised food crops while the men sought to carry out investments on the farm (I6 & I7). In another case it was a woman who stated that she would invest in farming if she got higher income (I1). Another interviewee said that men would spend according to his priorities and women had to cover for the expenses he did not cover (I8). Men described as irresponsible would spend money on drinking (I7). In the case a man had several wives, he would likely give only limited or sometimes no support to the one(s) he was not living with (I7).

The quantitative analysis showed that there was a substantial difference in outcome between MHHs and FHHs for the quantity variable (*meals per day*) but not for the quality variables (*fruit* and *proteins*). Two possible explanations to this emerged from the interviews. Firstly, the time constraint among FHHs seemed to impact the meals per day directly. One FHH who explained that during harvesting season, she only had time to eat once per day said she could not afford go back to the house and cook. She had to stay on the farm and work (I7). In contrast, adding fruit or protein to the existing meals required little extra time.

Secondly, in a discussion with Vi-AF staff, we were told that in MHHs, the husband would want the wife to cook three meals if economically possible. Most husbands would not consider the work

effort it took for the wife to cook one additional meal. Vi Staff expected that in MHHs, the number of meals per day would more easily increase since the husband did not take full account of the additional work effort it entailed (N Abdallah, personal communication, 28 March).

### 7.3 Testing qualitative findings on FHHs in the data

In this section, two findings from the qualitative analysis were tested empirically. Data availability stopped other hypotheses from being tested.

Firstly, the proposition that land ownership was crucial to realizing the benefits of the programme, and that this could explain the lower gains for FHHs, was tested. Interviews showed that the tenure status was crucial for whether SLM practices could be implemented. To test this hypothesis, a dummy that took the value 1 for roughly half of the matched sample who owned less than 2 acres of land (the lowest interval) was created. The dummy was interacted with the double difference variable in the same way as in earlier specifications. **Table 17** shows the regression output.

**Table 17. Including interaction low land ownership dummy**

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.654*** (0.0865)	8.159*** (0.626)	5.579*** (0.593)
FHH x Treatment x Post treatment	-0.418*** (0.154)	-0.639 (1.073)	0.265 (1.016)
FHH x Post	0.187 (0.115)	-0.565 (0.772)	-0.816 (0.731)
FHH x Treatment	-0.473** (0.227)	-3.689** (1.647)	-3.160** (1.560)
Land owned <2 x Treatment x Post treatment	0.108 (0.141)	0.632 (1.017)	-2.057** (0.963)
Land owned <2 x Post	-0.261*** (0.0822)	-0.882 (0.591)	-0.0511 (0.560)
Land owned <2 x Treatment	0.0689 (0.126)	1.849** (0.914)	1.412 (0.866)
Constant	2.667*** (0.0535)	8.135*** (0.385)	3.575*** (0.365)
Observations	1,597	1,610	1,610
Control group mean	2.513	7.780	2.340
R-squared	0.084	0.315	0.245
Number of HHID	359	359	359

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects.

Including the low land ownership interaction in the fixed effects regression changed little in the first regressions where *meals per day* and *protein* were dependent variables. However, in the third model, the coefficient for the triple interaction on low land ownership was negative and significant. The coefficient of -2.1 meant that owning less than two acres of land reduced the positive effect of the programme on fruit consumption with around two fruits per week compared to those owning more land. Thus, the findings do not support the land ownership hypothesis.

The second qualitative finding that was tested in the data was the marketing channel. The qualitative results indicated that collective marketing had the potential of reducing many of the disadvantages that FHHs faced in marketing. To see whether FHHs who had access to collective marketing benefitted from the programme more, the cooperative variable was interacted and included in the regression in same way as the land ownership variable in **Table 18**.

**Table 18. Including interaction with cooperative**

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.712*** (0.0867)	7.914*** (0.625)	4.880*** (0.591)
FHH x Treatment x Post treatment	-0.398** (0.155)	-0.482 (1.073)	0.00554 (1.016)
FHH x Post	0.133 (0.114)	-0.785 (0.767)	-0.782 (0.726)
FHH x Treatment	-0.476** (0.231)	-4.265** (1.664)	-3.397** (1.576)
Cooperative x Treatment x Post treatment	-0.198 (0.219)	0.691 (1.564)	-0.311 (1.481)
Cooperative x Post	0.194 (0.158)	-0.808 (1.117)	0.949 (1.058)
Cooperative x Treatment	0.0978 (0.172)	2.014 (1.241)	0.574 (1.175)
Constant	2.672*** (0.0504)	8.395*** (0.362)	3.816*** (0.342)
Observations	1,593	1,606	1,606
Control group mean	2.513	7.780	2.340
R-squared	0.078	0.316	0.243
Number of HHID	359	359	359

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects.

**Table 18** shows that including the cooperative-triple difference interaction did not significantly alter any of the other parameters and that the coefficient of the variable itself was insignificant in all three models. This result indicated that access to collective marketing did not explain the heterogeneous distribution of programme benefits between FHHs and MHHs, nor did it appear to be a channel through which the programme itself delivered dietary benefits to the participants.

## 8 Discussion

The findings of this study are discussed separately on the first and second research question. A discussion of the limitations of the study and policy recommendations conclude the section.

### 8.1 Impact of AE on dietary habits

The first research question that this study set out to answer was whether AE has an impact on food consumption and diet diversity. The results showed that the programme evaluated in this study has high and significant impact on all three dietary outcomes.

However, the programme included both AE trainings and two other components, namely nutritional training to marginalised groups and the distribution of vegetable seeds and fruit tree seedlings. As outlined in **Figure 1** and further explained in Section 5.1.4, evaluations of AE programmes face a challenge in disentangling the AE effect from the other aspects of the programme.

In the case of this study, the nutritional training to marginalised groups could be disentangled in a sensitivity analysis by excluding those groups from the sample. It was shown that the programme effect indicators remained significant and similar in magnitude in this specification. This overall coefficient stability showed that the observed increases in *meals per day*, *protein* and *fruit* were not driven by high gains for marginalized groups. As this group was the only one to receive special nutrition training, this also meant that the part of the programme not directly related to nutrition was able to deliver dietary improvements.



The data did not allow the impact of the free distribution of vegetable seeds and fruit seedlings to be directly disentangled from the effect of the AE components of the programme. However, the bias is likely to be contained to the outcome variable *fruit*, as this variable was likely to have been directly affected by the tree seedling distribution. The qualitative results did not show that the number of meals had been affected by the establishment of kitchen gardens. The soil conservation benefits of the fruit trees could affect the number of meals through increased harvests, but most of these benefits would take longer than the programme period to be realized.

In sum, the two non-AE aspects of the programme (the nutritional training for vulnerable groups and the free distribution of seeds and seedlings) did not seem to have driven the result in the outcome variables *meals per day* and *protein*. Hence, we conclude that the AE component did successfully improve the average diet among participating households.

Turning to the mechanisms behind the quantitative results, three categories of channels were highlighted in the results section. Firstly, the production aspect of farming was positively affected by the programme thanks to the implementation of SLM practices. These contributed to improved soil fertility and yields which enabled the households to improve their eating habits. The second category of channels concerned marketing. Improved marketing had enabled farmers to get higher prices for their produce and facilitated the establishment of both crop and animal enterprises. Thirdly, increased collaboration in the household had improved food consumption through more efficient intra-household resource allocation and decision making.

Testing the qualitative findings quantitatively indicated that baseline access to collective marketing was not a significant determinant of subsequent gains. Similarly, limited land ownership was only found to impede improvements in fruit consumption. As this was likely closely connected to fruit tree seedling distribution, the insignificance in the other variables indicated that low land ownership did not change the impact of AE.

Spill-over effects were not expected to play a significant role in the quantitative analysis since no control observations were selected from the treatment districts. If some spill-over effects from the

treatment had occurred to the surrounding districts, and such households had been picked as control, this would have caused an underestimation of the programme impact. The quantitative analysis did not capture the long-term gains from soil restoration, which were an expected output from for example the tree-planting and crop rotation aspects of the programme.

## 8.2 The differential impact of AE on FHHs

The second research question that this paper set out to answer was if the impact of AE on nutrition was different for MHHs and FHHs. Following the reasoning in the previous section, the outcome variables *protein* and *meals per day* were able to capture the impact of AE while the *fruit* indicator was also expected to have increased thanks to the tree seedling distribution. The quantitative findings from the *meals per day* model showed that the programme had significantly lower impact for FHHs. The coefficient on the interaction for FHHs for *meals per day* was -0.39, which reduced the impact of the programme in this variable by 54%.

The sensitivity analysis on the subgroup of non-vulnerable households showed an even larger negative coefficient for the FHH triple interaction variable than in the main specification. FHHs in non-vulnerable groups experienced, on average, only a marginal improvement in meal frequency (0.12 meals per day) by participating in the programme. The special attention given to vulnerable groups thus seemed to have been a way of enabling FHHs to benefit from the programme. It also indicated that the AE programme given to non-vulnerable groups was even less effective at delivering improvements in meals per day for FHHs than the main regression results suggested.

The qualitative findings added to the picture, but not all results pointed in the same direction as the quantitative results. Collective marketing was brought up as a remedy for the weak individual bargaining power, transport limitations and security concerns that FHHs experienced, which was opposite to the quantitative results. The findings that were in line with the quantitative results concerned constraints for FHHs to implement the production side of the programme. Implementing SLM practices was where women faced time, labour, capital and land constraints. The quantitative result showed that these constraints outweighed potential benefits given by the programme through collective marketing.

Two qualitative results emerged to explain that there had been impact heterogeneity for *meals per day* but not for *protein*. Firstly, interviews revealed that FHHs were more time constrained than MHHs. The difference in time constraint was driven by i) the fact that many FHHs were single parent households (and thereby had less time and labour at their disposal) and ii) traditional gender roles. Traditional gender roles stipulated that women were responsible for all domestic chores, which likely made them more time constrained than men in the same situation. To quantify the impact of the gender component, studying single MHHs would be an interesting avenue for future research. The more severe time constraint for FHHs explained why there was a heterogeneous impact in *meals per day* and not in *protein* since time was necessary to cook an extra meal, but not to increase protein.

A second explanation behind the heterogeneous impact on *meals per day* and not *protein*, was the decision-making structure in the MHHs combined with the traditional gender roles. For the MHHs, there was a separation of responsibilities for decision making (the man) and execution (the woman), which meant that the labour and time cost of meal preparation was not fully taken into account by MHHs. Although MHHs and FHHs might value having an extra meal per day equally much, this explanation would mean that MHHs would increase their meals per day more since the husband would not take the wife's cost (in terms of labour and time) into account when increasing the number of meals. In the FHHs, there was no separation of decision making and execution and therefore such households chose, according to this explanation, the intra-family social optimum and cooked fewer meals. This difference in the decision-making structure for MHHs and FHHs impacted *meals per day*. As protein did not require as much additional labour and time it also increased for FHHs.

The two explanations outlined above differ in their policy implications. The former suggested that a lack of complementary inputs, in this case time and labour, was holding FHHs back. One policy response could be to combine complementary inputs with AE training to relax these constraints and better equip FHHs to benefit from programmes. Vi-AF could consider expanding the treatment given to vulnerable groups to all FHHs as the analysis in this paper found that the

aggregate gains for FHHs in *meals per day* was driven almost exclusively by this subgroup. However, given the heterogeneity of the FHH category and the fact that this study was only able to analyse the group as a whole, further investigations may be needed to establish if all types of FHHs really warrant such a classification.

The policy implication for the second argument would caution against using MHHs as a benchmark for the FHHs given that results from this group is the result of a different, and not necessarily preferred, decision making structure. It also indicated that a wider range of outcome variables need to be tracked so that a more complete picture of the programme outcomes can be painted, for example if the FHHs chose to spend the dividend of the programme differently. The degree to which differential diet improvements reflect differences in aggregate programme benefits and differences in household preferences is a key question for further research.

### 8.3 Internal validity

This section highlights factors that would have potentially affected the internal validity of this study. Firstly, the identification strategy in the quantitative analysis relied on an assumption of unconfoundedness, i.e. that the factors that determined treatment status could be accounted for in the matching. Mirroring the programme selection criteria, farmer group membership was inferred from a number of observable characteristics which were shown to be associated with group membership in the county at the time. While the characteristics that differed the most between group and non-group households were included, some characteristics could not be used in the matching due to data constraints. These include variables capturing household size and composition, as well as literacy rate. Their exclusion meant that control and treatment households may not have been comparable in this regard. This could have caused bias in the treatment effect if dietary indicators changed systematically for households depending on family size and literacy rates during the period. However, there is no indication that this was the case. In addition, as group membership could partly be captured directly (through the NAADS and cooperative indicators), this potential bias could have been somewhat reduced. The sensitivity analysis using only these two variables to mimic group selection did not alter the main result, which further supported the internal validity of the results.

Secondly, the data did not allow pre-programme trends in the outcome variables to be observed. If, for example, the districts in which the programme was rolled out followed a different trend in one or more of the dietary indicators, the estimates could have been biased upward or downward. However, due to the relative random choice of districts based on proximity to Masaka rather than specific characteristics, there was little reason to believe that trends in these districts differed much from those of other LVB districts.

A third potential threat to internal validity was that the field officers who had collected data and given the trainings had given extra attention to the farmers that had received family cards. A comparison between those who received their family card in 2009 and those who received it in 2010 revealed that those who had been followed up for longer ate protein significantly more frequently in 2010. The randomized recruitment process of farmers to be family card holders meant that this difference was most likely due to extra attention from field officers. However, the difference (1.8) was much lower than the overall increase from the programme (8.2), suggesting that, even for the protein indicator, substantial gains were made in the sample as a whole. Nonetheless, this finding suggested that the increases in protein might have been somewhat exaggerated with respect to increases for rest of the treatment sample.

The three concerns highlighted above called for some caution when interpreting the point estimates of diet improvement for the treatment group as a whole. However, there was less reason to believe that the concerns would cause systemic bias in the estimates of the difference between FHHs and MHHs. Firstly, regarding the selection process, similar shares of households in the treatment and control data were female headed, which meant that the selection did not alter the ratio of FHHs. Secondly, the potential issue of different pre-programme trends should have been equally problematic for the two groups given that it would be driven by district-level factors. Thirdly, there was no reason to believe that field officers would have given differential treatment within the group of family card holders, only between family card holders and the rest of the treatment households.

The time difference between the qualitative data collection and the quantitative data collection was another possible source of error for the results. As discussed in the method section, while many of the components of the programme had remained the same from the start of the programme until today, the methods may have changed over time. For the interviewees to separate what had happened in a certain period many years ago was probably not possible. The discussion likely reflected perceptions about the Vi-AF programme over the whole period (2009–2018) rather than between 2009 and 2011, which was when the quantitative data was collected.

The discussion above underlines that a few sources of uncertainty remain regarding the internal validity of the quantitative results. However, the size of the point estimates and the robustness of the results to changes in the regression specification indicates that the direction and general magnitude of the result can be considered valid.

#### **8.4 External validity**

The external validity of the channels through which AE impacted nutrition will be discussed in three categories below: production, marketing and collaboration in the household. The validity of the results in other settings depend on how similar the preconditions are to the ones in this paper.

Firstly, the extent to which the production category of channels would be applicable in an alternative setting depends on agricultural and environmental conditions. The area studied in this paper was the Ugandan part of the LVB. As the agricultural and environmental conditions are similar in the other countries that are part of the LVB, the production channels could be applicable in those countries too. Apart from Uganda, Vi-AF is active in three other LVB countries (Rwanda, Tanzania and Kenya) which makes studying the programme impact in those areas interesting for future research. The similarities between Vi-AF's country programmes could make it possible to disentangle country specific conditions that matters for the effect of an AE programme on nutrition.

Secondly, potential for improvements in marketing could differ between settings and countries. For example, the availability of infrastructure and the quality of institutions could interact in

different ways with the programme and make it more or less easy to sell crop. A cross country comparison of Vi-AF's programme could potentially separate and quantify the relative importance of these factors for programme performance. Furthermore, since the matched sample in this study was selected based on group membership and proxies for group membership, it was not representative of the rural population of Uganda, nor of the LVB, but could directly be applicable to other farmers that were member of groups.

The third set of channels through which the programme impacted food consumption related to intra-household collaboration. These channels are probably the ones that are most difficult to measure and quantify as they reflect non-tangible conditions closely tied to cultural norms and perceptions. Gender roles likely differ both within and across countries. Nonetheless, gender issues are prioritised both by the policy community at large and by Vi-AF which makes a closer study of these differences an important avenue of further investigation as well.

## 9 Conclusion

This mixed methods impact evaluation has shown that Vi-AF's 2009–2011 AE programme in Uganda led to substantial dietary improvements, both in quantity and quality of food consumption. The quantitative part of this thesis used a matching technique to find a control group that was comparable to the treatment group at baseline. It was shown that the three-year programme of group-level extension yielded an average benefit of over half a meal per day increase and that around one more meal per day included protein. Fruit consumption also increased but this could not be directly attributed to AE in this setting since the programme also included free distribution of fruit tree seedlings.

Furthermore, this study has shown that the programme was more effective for male headed households than for female headed households. The increases realised by FHHs in *meals per day* were only half of those of the sample average. These quantitative results became even clearer when the non-AE component was removed. One sensitivity analysis that excluded a subgroup that had been given additional training in nutrition showed that doing so made the differential impact for FHHs even larger. This indicates that the increase in *meals per day* for the FHHs in the main model

specification was largely driven by the differential treatment given to the vulnerable groups. No differential impact was found for *protein*.

The mechanisms behind the quantitative results were investigated through interviews and group discussions. The causal channels were grouped into three categories: production, marketing and intra household collaboration. The marketing channels were contradictory to the quantitative results and indicated that FHHs would have been more impacted by the programme through collective marketing and information sharing. The channels that supported the quantitative findings were the ones relating to production, which make us conclude that the constraints on the production side of the programme outweighed potential benefits of the programme for FHHs.

Two channels were discussed to explain the heterogeneous impact in the *meals per day* variable and not in the *protein* variable: that the time constraint was more severe for FHHs and that the decision-making structure in MHHs made them increase the number of meals beyond the intra-household social optimum. Two of the qualitative findings were tested quantitatively. The first test showed no support for the hypothesis that baseline cooperative membership impacted FHHs positively. The second test showed that low land ownership was only significant for the fruit variable and indicated that low land ownership was not an inhibitor for programme impact on nutrition.

In sum, the results of this study indicate that AE has the potential of playing an important role in combatting the problem of food insecurity and malnutrition. Even without directly targeting diet improvements, substantial gains in the food security and diet diversity can be obtained. However, more needs to be done to ensure that AE is an inclusive tool and that female farmers do not get left behind by policy initiatives. Ensuring equal access to AE is not enough, ways of improving the efficacy of AE for FHHs is equally important and a key to realizing the gender dividend in agriculture. Further research is required in order to fully understand what drives this difference, but a good understanding of the local context and the constraints that exist in both production and marketing will be key to delivering equitable AE.



## 10 References

- The National Agricultural Advisory Services Act* 2001, Uganda, Kampala, Uganda.
- Adamopoulos, T. & Restuccia, D. 2018, *Geography and agricultural productivity: cross-country evidence from micro plot-level data*, Working Paper edn, National Bureau of Economic Research.
- Adato, M. & Hoddinott, J. (eds) 2010, *Conditional cash transfers in Latin America*, Johns Hopkins University Press, Baltimore, MD.
- Adong, A., Mwaura, F. & Okoboi, G. 2013, "What factors determine membership to farmer groups in Uganda? Evidence from the Uganda Census of Agriculture 2008/9", *Journal of Sustainable Development*, vol. 6, no. 4, pp. 37.
- Alene, A.D., Manyong, V.M., Omany, G.O., Mignouna, H.D., Bokanga, M. & Odhiambo, G.D. 2008, "Economic efficiency and supply response of women as farm managers: comparative evidence from Western Kenya", *World Development*, vol. 36, no. 7, pp. 1247–1260.
- Asfaw, S., Mortari, A.P., Arslan, A., Karfakis, P. & Lipper, L. 2015, *Welfare impacts of climate shocks: evidence from Uganda*, 2015 Conference International Association of Agricultural Economists, Milan, Italy, August 9–14, 2015.
- Austin, P.C. 2011, "Comparing paired vs non-paired statistical methods of analyses when making inferences about absolute risk reductions in propensity-score matched samples", *Statistics in medicine*, vol. 30, no. 11, pp. 1292–1301.
- Buvinić, M. & Gupta, G.R. 1997, "Female-headed households and female-maintained families: are they worth targeting to reduce poverty in developing countries?", *Economic Development and Cultural Change*, vol. 45, no. 2, pp. 259–280.
- Carletto, C., Ruel, M., Winters, P. & Zezza, A. 2015, "Farm-level pathways to improved nutritional status: introduction to the special issue", *Journal of Development Studies*, vol. 51, no. 8, pp. 945–957.
- Clark, V.L.P. & Ivankova, N.V. 2016, *Mixed methods research: a guide to the field*, SAGE Publications, Inc., Thousand Oaks, California.
- Cohen, M.J. & Lemma, M. 2011, *Agricultural extension services and gender equality*, International Food Policy Research Institute Discussion paper, vol. 1094, pp. 1–44.
- Creswell, J.W. & Clark, V.L.P. 2011, *Designing and conducting mixed methods research*, SAGE, Thousand Oaks, California.

- Daniels, L. & Minot, N. 2015, "Is poverty reduction over-stated in Uganda? Evidence from alternative poverty measures", *Social Indicators Research*, vol. 121, no. 1, pp. 115–133.
- Davis, K., Nkonya, E., Kato, E., Mekonnen, D.A., Odendo, M., Miiro, R. & Nkuba, J. 2012, "Impact of farmer field schools on agricultural productivity and poverty in East Africa", *World Development*, vol. 40, no. 2, pp. 402–413.
- Deininger, K., Ali, D.A. & Yamano, T. 2008, "Legal knowledge and economic development: the case of land rights in Uganda", *Land Economics*, vol. 84, no. 4, pp. 593–619.
- Development Initiatives 2017, *Global nutrition report 2017: nourishing the SDGs*, Development Initiatives, Bristol, UK.
- Doss, C. 2006, "The effects of intrahousehold property ownership on expenditure patterns in Ghana", *Journal of African Economies*, vol. 15, no. 1, pp. 149–180.
- Doss, C.R. & Morris, M.L. 2001, "How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana", *Agricultural Economics*, vol. 25, no. 1, pp. 27–39.
- EAC 2003, *Protocol for sustainable development of Lake Victoria Basin*, Protocol edn, East African Community, Arusha, Tanzania.
- Ellis, A., Manuel, C. & Blackden, C.M. 2005, *Gender and economic growth in Uganda: unleashing the power of women*. Directions in Development, World Bank, Washington, DC.
- Fanzo, J., Marshall, Q., Dobermann, D., Wong, J., Merchan, R.I., Jaber, M.I., Souza, A., Verjee, N. & Davis, K. 2015, "Integration of nutrition into extension and advisory services: a synthesis of experiences, lessons, and recommendations", *Food and Nutrition Bulletin*, vol. 36, no. 2, pp. 120–137.
- FAO 2017, *Regional overview of food security and nutrition in Africa 2016. The challenges of building resilience to shocks and stresses*, Food and Agricultural Organization of the United Nations, Accra.
- FAO 2011, *The state of food and agriculture 2010-2011. Women in agriculture: closing the gender gap for development*, Food and Agriculture Organization of the United Nations, Rome.
- Farnworth, C.R., Baudron, F., Andersson, J.A., Misiko, M., Badstue, L. & Stirling, C.M. 2016, "Gender and conservation agriculture in East and Southern Africa: towards a research agenda", *International Journal of Agricultural Sustainability*, vol. 14, no. 2, pp. 142–165.
- Faure, G., Davis, K.E., Ragasa, C., Franzel, S. & Babu, S.C. 2016, *Framework to assess performance and impact of pluralistic agricultural extension systems: the best-fit framework revisited*, International Food Policy Research Institute (IFPRI), Washington, D.C.

- Gilbert, R.A., Sakala, W.D. & Benson, T.D. 2002, "Gender analysis of a nationwide cropping system trial survey in Malawi", *African Studies Quarterly*, vol. 6, no. 1-2, pp. 223–243.
- Godfray, H.C., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M. & Toulmin, C. 2010, "Food security: the challenge of feeding 9 billion people", *Science*, vol. 327, no. 5967, pp. 812–818.
- Goldstein, M. & Udry, C. 2008, "The profits of power: land rights and agricultural investment in Ghana", *Journal of Political Economy*, vol. 116, no. 6, pp. 981-1022.
- Gondwe, T.M., Alamu, E.O., Musonda, M., Geresomo, N. & Maziya-Dixon, B. 2017, "The relationship between training farmers in agronomic practices and diet diversification: a case study from an intervention under the Scaling Up Nutrition programme in Zambia", *Agriculture & Food Security*, vol. 6, no. 1, pp. 72.
- Holmes, W.M. 2013, *Using propensity scores in quasi-experimental designs*, Sage Publications, Thousand Oaks, California.
- International Food Policy Research Institute 2015, *Global Nutrition Report 2015: actions and accountability to advance nutrition and sustainable development*, International Food Policy Research Institute, Washington, DC.
- Johnson, N.L., Kovarik, C., Meinzen-Dick, R., Njuki, J. & Quisumbing, A. 2016, "Gender, assets, and agricultural development: lessons from eight projects", *World Development*, vol. 83, no. 1, pp. 295–311.
- Jones, A.D. 2017, "On-farm crop species richness is associated with household diet diversity and quality in subsistence- and market-oriented farming households in Malawi", *The Journal of nutrition*, vol. 147, no. 1, pp. 8696.
- Kabunga, N.S., Dubois, T. & Qaim, M. 2012, "Heterogeneous information exposure and technology adoption: the case of tissue culture bananas in Kenya", *Agricultural Economics: The Journal of the International Association of Agricultural Economists*, vol. 43, no. 5, pp. 473–486.
- Katungi, E., Edmeades, S. & Smale, M. 2008, "Gender, social capital and information exchange in rural Uganda", *Journal of International Development*, vol. 20, no. 1, pp. 35–52.
- Kilic, T., Palacios-López, A. & Goldstein, M. 2015, "Caught in a productivity trap: a distributional perspective on gender differences in Malawian agriculture", *World Development*, vol. 70, no. 1, pp. 416–463.
- Kyomugisha, E. 2008, *Land tenure and agricultural productivity in Uganda*, International Food Policy Research Institute (IFPRI), Kampala, Uganda.

- Lambrecht, I., Vanlauwe, B. & Maertens, M. 2016, "Agricultural extension in Eastern Democratic Republic of Congo: does gender matter?", *European Review of Agricultural Economics*, vol. 43, no. 5, pp. 841–874.
- Manfre, C., Rubin, D., Allen, A., Summerfield, G., Colverson, K. & Akeredolu, M. 2013, *Reducing the gender gap in agricultural extension and advisory services*, MEAS Discussion Paper edn, Cultural Practice, Washington, DC.
- Muller, C. 2009, "Do agricultural outputs of partly autarkic peasants affect their health and nutrition? Evidence from Rwanda", *Food Policy*, vol. 34, pp. 166–175.
- Ogutu, S.O., Fongar, A., Gödecke, T., Jäckering, L., Mwololo, H., Njuguna, M., Wollni, M. & Qaim, M. 2018, *How to make farming and agricultural extension more nutrition-sensitive: evidence from a randomized controlled trial in Kenya*, Discussion Paper No. 114. edn, Global Food Discussion Papers.
- O'Sullivan, M., Rao, A., Banerjee, R., Gulati, K. & Vinez, M. 2014, *Levelling the field: improving opportunities for women farmers in Africa (English)*, World Bank Group, Washington DC.
- Peterman, A., Behrman, J.A. & Quisumbing, A.R. 2014, "A review of empirical evidence on gender differences in nonland agricultural inputs, technology, and services in developing countries" in *Gender in Agriculture* Springer, pp. 145–186.
- Phalkey, R.K., Aranda-Jan, C., Marx, S., Hofle, B. & Sauerborn, R. 2015, "Systematic review of current efforts to quantify the impacts of climate change on undernutrition", *Proceedings of the National Academy of Sciences of the United States of America*, vol. 112, no. 33, pp. E4522–9.
- Quisumbing, A.R. (ed) 2003, *Household decisions, gender, and development: a synthesis of recent research*, International Food Policy Research Institute (IFPRI), Washington, D.C.
- Ragasa, C. & Mazunda, J. 2018, "The impact of agricultural extension services in the context of a heavily subsidized input system: The case of Malawi", *World Development*, vol. 105, pp. 25–47.
- Rajendran, S., Afari-Sefa, V., Shee, A., Bocher, T., Bekunda, M. & Lukumay, P.J. 2017, "Does crop diversity contribute to dietary diversity? Evidence from integration of vegetables into maize-based farming systems", *Agriculture & Food Security*, vol. 6, no. 1, pp. 50.
- RCMRD, RCMRD *Geoportal*. basemap: Mapbox dark, overlay: Lake Victoria Basin Boundary. [Homepage of Regional Centre For Mapping of Resource For Development (RCMRD)], [Online]. Available: <http://geoportal.rcmr.org/> [2018, 05/10].
- Rivera, W.M. 2001, *Agricultural and rural extension worldwide: options for institutional reform in the developing countries*, Food and Agriculture Organization of the United Nations, Rome, Italy.

- Rosenbaum, P.R. & Rubin, D.B. 1983, "The central role of the propensity score in observational studies for causal effects", *Biometrika*, vol. 70, no. 1, pp. 41–41.
- Ruel, M.T. 2003, "Is dietary diversity an indicator of food security or dietary quality? A review of measurement issues and research needs", *Food and Nutrition Bulletin*, vol. 24, no. 2, pp. 231–232.
- Ruel, M.T., Alderman, H. & Maternal and Child Nutrition Study Group 2013, "Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition?", *Lancet*, vol. 382, no. 9891, pp. 536–551.
- Saito, K.A., Mekonnen, H. & Spurling, D. 1994, *Raising the productivity of women farmers in Sub-Saharan Africa (English)*, World Bank Discussion Papers no. WDP 230 edn, World Bank, Washington DC.
- Stroud, A., Obin, E., Kandelwahl, R., Byekwaso, F. & Opondo, C. 2006, *Managing change: institutional development under NAADS [National Agricultural Advisory Services]; a field study on farmer institutions working with NAADS*, AHI Working Paper/African Highlands Initiative; no. 22.
- UBOS 2010, *Uganda Census of Agriculture 2008/09, volume III, agricultural household and holdings characteristics report*, Uganda Bureau of Statistics, Kampala, Uganda.
- UBOS 2009, *Basic information document, the Uganda National Panel Survey (UNPS)*, The Uganda Bureau of Statistics, Kampala, Uganda.
- UN 2017, *World population prospects: the 2017 revision, key findings and advance tables*, Working Paper No. ESA/P/WP/248. edn, United Nations, Department of Economic and Social Affairs, Population Division.
- Vi-AF 2012, *RESAPP Report 2009–2011 - Uganda Project*, Internal document edn, Vi Agroforestry, Masaka, Uganda.
- Vi-AF 2009, *Implementation guidelines Lake Victoria Regional Environmental & Sustainable Agricultural Productivity Program (RESAPP)*, Internal document edn, Vi Agroforestry, Masaka, Uganda.
- wa Githinji, M. 2011, *Land, poverty and human development in Kenya*, Economics Department Working Paper Series edn, University of Massachusetts Amherst, Department of Economics, University of Massachusetts Amherst.
- WHO 2017, *Nutrition in the WHO African region*, World Health Organization, Brazzaville.
- World Bank & IFPRI 2010, *Gender and governance in rural services: insights from India, Ghana and Ethiopia*, World Bank, Washington, DC.





## M&E tool – Group record (2/3)

GROUP ACHIEVEMENTS	Baseline	8/2009	2/2010	8/2010
Group has developed systems that help members to have access to capacity building (√ =yes, x=no)				
Group has developed systems that help members to have access to external service providers (not SCC-Vi Agroforestry) concerning farm inputs, marketing, training, processing etc. (√ =yes, x=no)				
Group that is appropriate linked to local, formal financial service institutions (√ =yes, x=no)				
Group members has during the last six months participated in a study circle (√ =yes, x=no)				
Farmer group network coordinating service provision for members (√ =yes, x=no)				
HOUSEHOLD ACHIEVEMENTS	Baseline	8/2009	2/2010	8/2010
No of households with SLM practices (take the total of households having any SLM practice on the next pages)				
No of households with SLM practices that have experienced increased food security				
No of households with at least 6 months of self-supply in firewood				
No of households that get capacity building through group contacts and arrangements				
No of households utilizing network/organization arranged services that support FED				

SLM practice	Definition
Improved crop variety	Use of improved seeds or improved planting material.
Cover crop or green manure	Cover crops are planted to conserve the soil on bare or fallow farmland. Green manure is a fast growing legume sown in a field several weeks or months before the main crop is planted and ploughed into the soil when flowering.
Intercropping	Intercropping is a cropping system of planting two or more crops in the same field at the same time.
Alley cropping	Alley cropping involves the growing of annual crops between rows of trees or shrubs as hedgerows.
Relay cropping	Relay cropping involves planting temporary crops (e.g. cover crops) within the main crop before it is harvested.
Contour strip cropping	Planting alternative strips (15-45 m wide) of grasses or grain together with other crops along the contour to conserve moisture and reduce erosion.
Earthing/ridging	This is raising of soil along the contours for planting tuber crops.
Broad beds and furrows	These are flat beds 1-1.2meter wide separated by furrows.
Contour bunds/catchment strips	These are areas where crops are planted behind the bunds and when it rains the flow is trapped by the contour bunds.
Half-moon micro-catchments	These are half-moon shaped catchments for water harvesting.
Reduced tillage	This tillage management practice involves reducing the number of times the land is ploughed before planting.
Zero tillage	No tillage, involves planting directly in the soil without ploughing (no soil disturbance apart from the exact planting spot) with e.g. spot preparation, sub-soilers, jab planters.
Residue management	Residue management means to use organic farm residues for soil incorporation or in compost or as fodder.
Assisted natural regeneration	Used to accelerate regeneration by assisting the natural processes. It involves cutting or suppressing the weeds around existing naturally occurring seedlings, protecting the site from fire and inter-planting with desired species if necessary.
Enrichment planting	Planting of valuable species in degraded forests without the elimination of valuable individuals already present.

## M&E tool – Group record (3/3)

BASELINE	AGROFORESTRY							EFFICIENT ENERGY				AGRONOMIC PRACTICES					NUTRIENT MANAGEMENT					TOTAL								
	Trees in agricultural systems	Boundary/hedges tree planting	Contour planting	Windbreaks	Woodlots (at least 20 trees)	Home or tree gardens	Trees & perennial crops	Trees & pasture	Fodder banks	Firewood production	Charcoal production	Biogas production	Solar energy use	Biodiesel production	Improved crop variety	Cover crop or green manure	Crop rotation	Intercropping	Alley cropping	Relay cropping	Contour strip cropping		Earthing/ridging	Integrated Pest Management	Mulching	Improved fallows	Manure	Composting	Careful use of fertilizers	Weed management
List of household																														
√ =yes x=no																														
1																														
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														
13																														
14																														
TOTAL																														

## M&E tool - Family Card (1/2)

Form 1 Family card

Name of head of household:	<input type="checkbox"/> Parent headed <input type="checkbox"/> Grandparent headed <input type="checkbox"/> Child headed <input type="checkbox"/> Other adult as head of household	When started to interact with SCC Vi-Agroforestry Month: Year:
Sex of head of household: F M		
Anyone living with HIV/AIDS (optional): yes no	Disability in household: (e.g. lame, blind, retarded) yes no	When recruited to RESAPP Month: Year:
Group name:	Zone/Division:	Ward/Location/Sub-county/Sector:

FAMILY MEMBERS - children	What to fill	Baseline	8/2009	2/2010	8/2010	Baseline	8/2009	2/2010	8/2010
		GIRLS				BOYS			
Children 0-5	(no of children living in household)								
Children 6-17	(no of children living in household)								
Orphan 0-5 (without parents)	(no of orphans living in household)								
Orphan 6-17 (without parents)	(no of orphans living in household)								
CHILD EDUCATION		GIRLS				BOYS			
Children 0-5 going to school	(no of children of those above)								
Children 6-17 going to school	(no of children of those above)								
Orphan 0-5 going to school	(no of orphans of those above)								
Orphan 6-17 going to school	(no of orphans of those above)								
FAMILY MEMBERS - adults		Baseline	8/2009	2/2010	8/2010				
Father (not grandparent, adult child, relative or guardian)	(no of father/husband living in household)								
Mother (not grandparent, adult child, relative or guardian)	(no of mothers/wives living in household)								
Grandparents	(no of grandparents living in household)								
Other adults	(no of adult children or relatives, guardians etc. living in household)								
FAMILY DIET/NUTRITION (last week)		Baseline	8/2009	2/2010	8/2010				
Meals per day	(no of daily meals on average last week)								
Protein (milk, egg, beans, peas, fish, meat)	(no of times eaten in meal last week)								
Fruit (banana, pawpaw, mango, guava etc.)	(no of times eaten in meal last week)								
ALL TREES OWNED		Baseline	8/2009	2/2010	8/2010				
Boundary planting	(no of trees)								
Trees in cropland	(no of trees)								
Woodlot	(no of trees)								
Trees in homestead	(no of trees)								
Fruit trees (of all trees above)	(no of trees of those above)								
Hedge-row/Alley cropping	(no of meters of hedgerows)								
INCOME GENERATING ACTIVITIES		Baseline	8/2009	2/2010	8/2010				
Crop enterprises	(no of crop enterprises)								
Vegetable enterprises	(no of vegetable enterprises)								
Non-dairy animals	(no of cattle, goats, sheep, pigs, donkeys)								
Dairy animals	(no of dairy cows and goats)								
Types of other animals	(types of other animals)								
Number of other animals	(no of other animals)								

### Definitions:

**Meals per day**=on average, the number of cooked meals per day during last week (eaten in household)

**Protein**=number of times during last week the household had protein intake during a meal (if several times/day – count all)

**Fruits**=number of times during last week the household had fruit intake during a meal (if several times/day – count all)

**Fruit trees**=fruit trees can be found in many places (boundary, crop land homestead etc.) How many of the total trees owned are fruit trees?

**Hedgerows/Alley cropping**=measured as number of meters of hedgerows

**Other animals**=hens, rabbits, guinea pigs, fishponds, beehives

## M&E tool – Family Card (2/2)

FINANCIAL ACTIVITIES	What to fill	Baseline	8/2009	2/2010	8/2010
Individual savings	(no of places you save money)				
Production investments	(no of production investments)				
Processing investments	(no of processing investments)				
Household investments	(no of household investments)				
Education investments	(no of persons with paid educations)				
GROUP MEMBERSHIP	What to fill	Baseline	8/2009	2/2010	8/2010
Informal group	Tick (✓) if you are member or (x) if not				
Formal (registered) group/organisation	Tick (✓) if you are member or (x) if not				
SOCIAL ENGAGEMENT	What to fill	Baseline	8/2009	2/2010	8/2010
Assisting another family	Tick (✓) if you do or (x) if not				
Community work	Tick (✓) if you are involved or (x) if not				
HOUSING CONDITIONS	What to fill	Baseline	8/2009	2/2010	8/2010
Having latrine within 100m	Tick (✓) if you have or (x) if not				
Having water within 500m	Tick (✓) if you have or (x) if not				
Using wood-saving stove	Tick (✓) if you use or (x) if not				
Using kerosene, gas or electricity	Tick (✓) if you use or (x) if not				
WALL TYPE	What to fill	Baseline	8/2009	2/2010	8/2010
Mud	Tick (✓) the type of walls (on main house)				
Bricks/Stones/Concrete					
Iron sheets					
Timber					
ROOF TYPE	What to fill	Baseline	8/2009	2/2010	8/2010
Grass	Tick (✓) the type of roof (on main house)				
Iron sheets					
Tiles					
TOTAL LAND OWNED	What to fill	Baseline	8/2009	2/2010	8/2010
< 2 acres	Tick (✓) the area you have				
2.1 – 3 acres					
3.1 – 4 acres					
4.1 – 5 acres					
5.1 acres or more					

### Definitions continued:

**Individual savings**=savings in bank, at home or e.g. co-save group

**Production investments**=investments in e.g. improved seeds, fertiliser, irrigation pump, wheelbarrow, a well etc.

**Processing investments**=investments in e.g. oil press, honey extraction equipment etc.

**Household investments**=new house, sofa, kitchen utensils, radio, TV, bicycle etc.

**Assisting another family**=to pay school fees for relative's or other's child, money assistance, labour assistance, food assistance etc.

**Community development**=road repair, borehole, classroom repair etc.

**All data refers to the situation during the last six months!**



## Appendix 3.

### Variables as defined in the treatment group data and control group data respectively

Treatment group	Control group
<b>Meals_per_day</b>	
The average number of meals eaten per day in the household in the past week.	Using the variable “How many meals are taken per day in your household”.
<b>Female_hh_head</b>	
Sex of head of household.	female=1, male=0. The 14 observations in 2011 where two people of different gender claim to be head of household are classified as 0.
<b>Proteins</b>	
<p>Number of times protein has been eaten in meal in the past week (eg.milk, egg, beans, peas, fish, meat).</p> <p>Most farmers did not know what protein was and would answer to the question based on the listed examples which is why these were used in the proxied variable.</p>	<p>Using the variable “how many days have you consumed X” and specifying X to be the protein variables exemplified for the treatment group, we get “How many days have you consumed protein in the past week”.</p> <p>The proxied variable does not capture if a farmer has eaten a specific type of protein more than once a day. This could overestimate the numbers of protein eaten by treatment farmers relatively to control farmers. We could also loose variation among control farmers who eat the same protein several times a day. However, this is expected to be adjusted for using the difference in difference estimator.</p>
<b>Fruits</b>	
Number of times fruit had been eaten in the past week. Farmers in the setting knew what fruit was and could estimate this number.	Using the variable “How many days have you consumed X” and specifying X to be all fruit variables available, we got “how many days have you consumed fruit in the past week”. The same drawback applies to this as the previous variable; that it did not capture if the farmer had eaten a specific type of fruit more than once in a day. See above variable for further reasoning on this.
<b>Dairy_animals</b>	
<p>The written definition of this was “Dairy animals are all cows, goats and camels that are producing milk for selling.”</p> <p>In practices, everyone that had cows/heifers would drinking milk from them.</p>	<p>Interviews with Moses (21/02/2018) indicated that from the point of view of nutrition, both the direct effects (via consumption of milk in the household) and indirect effect (from the selling of milk and the resulting nutritional income effect) were best proxied by creating the “dairy animal” variable by counting the number of cows/heifer owned by the household and treat the rest of the animals, including female goats/sheep, as non-dairy animals since goats were rarely used for milk.</p> <p>The equivalent variable in the treatment group was therefore how many cows/heifer are owned by your household now? In the 2010 UNPS, data was separated based on if the animals were own or raised. The sum of this variable was used.</p>
<b>Non-dairy animals</b>	
Non-dairy animals include all cattle (cows, bulls, heifers, calves), goats, sheep, pigs, donkeys, camels etc. that are kept and intended for selling (the whole animal is sold).	<p>Using the variable “How many X are owned by your household now? and specifying X to be bulls and oxen, calves, sheep, goats, pigs, mules, horses and donkeys.</p> <p>The data on the treatment group refers to animals that were kept and intended for selling. The data on the control group does not differentiate between animals that are intended for selling and not.</p>
<b>Cooperative</b>	
If one of the activities of the group had been recorded to be “cooperative” this was given the value one for the treatment group.	Using the variable “Did anyone in this household receive advice/information for about agricultural/ livestock activities from any of the following sources in the past 12 months?” and the specified alternative “cooperative”.
<b>NAADS-group</b>	

On the group record, the group was asked to rank the three most important institutions for the group. If NAADS was mentioned as one of them, the group was receiving support from NAADS.	Using the variable “Did anyone in this household receive advice/information for about agricultural/ livestock activities from any of the following sources in the past 12 months?” and the specified alternative “NAADS”.
<b>Credit_informal</b>	
On the group record, the group were asked to tick if VSLA was an activity that the group pursued.	<p>If the control farmer ticked yes for any of the following options, it was categorised as having informal credit.</p> <p>In the last 12 months, has any member of your household ...</p> <p>i)... used a SACCOS to save money?</p> <p>ii)... used other informal savings club (with a community or religious organization) to save money?</p> <p>iii)... borrowed money or taken a loan from a SACCOS or any other informal savings club?</p> <p>For the most recent time in the last 12 months that any member of your household applied for a loan or asked to borrow money: What was the source of credit?</p> <p>i) SACCO, ii) Local group</p>
<b>Credit_formal</b>	
Group that was appropriately linked to local, formal financial service institutions.	<p>If the control farmer ticked yes for any of the following options, it was categorised as having informal credit.</p> <p>In the last 12 months, has any member of your household...</p> <p>i) ...used a credit union, saving association or microfinance institution to save money?</p> <p>ii)... borrowed any money or taken out a loan from a Bank?</p> <p>iii)... borrowed any money or taken out a loan from any government agency?</p> <p>iv)... borrowed any money or taken out a loan from a credit union?</p> <p>v)... borrowed any money or taken out a loan from a micro finance institution?</p> <p>vi)... borrowed any money or taken out a loan from an employer?</p> <p>Does any member of your household have a savings account with formal institutions?</p> <p>Does any member of your household have a savings account with a bank?</p> <p>For the most recent time in the last 12 months that any member of your household applied for a loan or asked to borrow money: What was the source of credit? i) Bank, ii) Government, iii) Credit Union, iv) Micro-finance, v) Employer</p>
<b>Districts</b>	
As defined in RESAPP 2009.	As defined in LSMS data 2010. Districts in which VI-AF operated did not change between 2009 and 2010.
<b>People aged 18–60</b>	
Father/husband and mothers/wives, other adult (not grandparents)	<p>Proxy by sex and age (18-60) years old.</p> <p>The definition of this variable differs slightly between treatment and control in the sense that grandparents who are below 60 years old are not counted in the treatment group but they are counted in the control group.</p> <p>When looking at the percentage distributions of ppl_aged_18_60, the two groups are comparable.</p>
<b>Wall type</b>	
Material of wall on main house. Alternatives: Mud, bricks/ stones/concrete, iron sheets, timber	<p>Major material of wall of all the separate buildings of your household. Alternatives: Thatch/straw, mud &amp; poles, timber, un-burnt bricks, burnt bricks with mud, burnt bricks with cement, cement blocks, stone, other</p> <p>In interviews with Vi staff, it was explained which alternatives corresponded to the treatment. Many options in the control (un-burnt bricks, burnt bricks with mud, burnt bricks with cement, cement blocks, stone) were categorized as “bricks/stones/concrete” for the treatment. “Mud &amp; poles” for the control became “mud” for the treatment and the option “timber” was identical in both datasets.</p>
<b>Roof Type</b>	

Material of roof on main house. Grass, iron sheets, tiles.  No option for “other”.	Major material of roof of all the separate buildings of your household. thatch/straw, mud, wood/planks, iron sheets, asbestos, tiles, tin, concrete/cement, other. No observations were recorded either of the options “wood/planks” or “tin”. In interviews with Vi staff, it was explained which alternatives corresponded to the Vi options.  Three options did not have an equivalence for the treatment group (mud, asbestos, concrete/cement). We categorized these as other. Even when including these observations in the category “other”, it is less than 1% of the control group.
<b>Land owned</b> Land ownership was recorded in intervals of <2 acres, 2-3 acres, 3-4 acres, 4-5 acres or more than 5 acres.	For the control group, farmers were asked how many acres their main parcel was in the section current land holdings. The sum of the self-reported size of all the farmer’s parcels.
<b>Crop/vegetable enterprises</b> A crop/vegetable enterprise is a type of crop/vegetable which the farmer has grown and sold.	A “crop”/“vegetable” for which a farmer has sold a quantity >0. We define “crop” as crop codes: 111-340, 510-650, 810-890. We define “vegetable” as crop codes: 410-470 (see Interviewer's Manual of Instruction). Based on what farmers consider being vegetables/crops in interview with Moses 2018-02-23. Farmers were asked: “which crop/vegetable did you plant?”. Hence, missing value imply that the crop was not mentioned. Therefore, it is not problematic for us to replace this missing value with 0.
<b>Head of household</b> Child headed Grandparent headed Parent headed Other adult headed	If household head and the household head is <18 years old. If a household head has grandchildren. If a household head has children but no grandchildren. If household head is not child, grandparent or parent.
<b>No. of people with paid education</b> The highest value of the past two rounds for the variable “educational investment”.	The number of people for which money has been spent on education in the past 12 months (for school and registration fees and boarding fees).For the treatment group, this variable reflects any monetary expenses made on education, even school fees for public schools.

## Appendix 4.

### Characteristics that differ between farmer group members and non-members

Characteristic	% higher for group members	t-stat (difference members, non-members)	Individual/HH characteristic
Access to credit,%	439%	15,3	I
Owens livestock, %	90%	26,6	I
Manages a plot, %	41%	26,7	I
Land under cultivation	33%	3,6	H
Children 6-17 years	14%	7	H
Age in years	13%	16,7	I
Literacy rate	6%	3	I
Household size	5%	2,8	H
Children <=5	3%	0,9	H
% Males	3%	2,1	I
Male headed	1%	1,2	H
Years of schooling	0%	0,2	I
Adults	-4%	-2,6	H

Notes: Using data from Table 2 in the paper by Adong, Mwaura and Okoboi (2013) on variables separated per group members and non-group members, the table outlines how the two groups differ from each other.

## Appendix 5.

### Robustness- control group preselected on *NAADS & cooperative* instead of PSM

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.586*** (0.142)	8.086*** (1.113)	4.917*** (1.006)
FHH x Treatment x Post treatment	-0.614** (0.287)	-1.822 (2.230)	-1.129 (2.015)
FHH x Post	0.369 (0.266)	0.0613 (2.062)	-0.170 (1.863)
FHH x Treatment	-0.535** (0.236)	-2.694 (1.843)	-1.894 (1.665)
Constant	2.680*** (0.0711)	8.651*** (0.554)	4.840*** (0.501)
Observations	1,359	1,364	1,364
Control mean	2.600	8.623	3.067
R-squared	0.061	0.328	0.289
Number of HHID	595	594	594

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 This a fixed effects panel data regression, where the control group was preselected on cooperative or NAADS-group at baseline.

## Appendix 6.

### Script interviews and group discussions

#### Introduction script to group

Dear group members. We are students from the Stockholm School of Economics, Sweden, who write our thesis in collaboration with Vi Agroforestry. We would like to interview one farmer who is household head and who has been working with Vi agroforestry/[DFA in area] since the start (in 2009). The reason we want to talk to you is to find out how you have experienced the services so that Vi/partner can improve the services to you. Your answers will be confidential and used only for study purposes. The interview will take around 1 hour. The one of you who get selected for the interview will wait separately while the others will take part in a short group discussion. Since we want it to be random which one of you we could interview, we will draw one of your names. Is this okay for everyone? Do you have any questions? Those of you who has worked with Vi the longest and is the head of your household could you please raise your hand? We will now give you a number and then we will draw from this pile of numbers to select the person for the interview.

---

#### Questions for group discussion

This will be a short group discussion where we are interested to hear how you feel about a couple of questions. We will say the questions when we start and can repeat them whenever you want during the discussion. To make sure that we remember correctly, is it okay that we record the conclusion? Could you please sit close to each other so you can see and hear each other well? We will give seven minutes to discuss each question and then ask what you think about it.

Q1: Have you changed your eating habits (quantity, quality or type) since you started to interact with Vi/DFA? How have you changed them? Why have you changed them?

Q2: Is there a difference in how well women/men can perform income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?

---

#### Introduction read to interviewee

It is important that we are not interrupted and that you can answer the questions individually. Is this a good location for the interview or would you prefer to go to another location? Thank you for your time. We very much appreciate that you participate and your contribution is very valuable. Please answer individually and honestly to the questions. There is no right or wrong answer. We will not tell your name to anyone outside of this group and your answers will not be linked to you personally. To make sure that we remember correctly, is it okay that we record the interview? Thank you for participating! Do you have any questions before we start?

---

Name & group name: .....

Translator, interviewer: .....

District, Sub county: .....

#### 1. PERSONAL & HOUSEHOLD INFORMATION

##### 1a. Are you the head of your household?

☐ Yes

☐ No

1b. Gender.....

1c. Age.....

##### Are you part of a cooperative?

☐ Yes, since:... ☐ No

##### 1e. Current Marital status

☐ Never married

☐ Married

☐ Divorced/Separate

☐ Widow(er)

☐ Several wives

☐ Living separated from spouse

#### 2. INCOME GENERATING ACTIVITIES

2.1a. Do you think men/ women in your community face different challenges when growing crops?

2.1b. Do you think men/women in your community face different challenges when selling crops?

- 2.1c. Do you think men/women in your community face different challenges when raising animals?  
 2.1d. Do you think men/women in your community face different challenges as selling animal products?

## 2.2. Your income generating activities

- 2.2a. We are interested in if you face challenges when selling/trying to sell you produce or if there is something that has stopped you from selling. Which challenges have you experienced?  
 2.2b. So the challenges you have faced are [repeat the ones stated]. Which of them are the two biggest ones and how did they affect you?  
 2.2c. If you are selling anything, who in the family sells which produce? (Specify by gender & produce).  
 2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.

## 3. LAND & INVESTMENTS

### 3a. Do you cultivate any land that you do not own?

☐ Yes ☐ No ☐ Don't know

If no/don't know, move to 3d.

### 3b. I will read activities, and then you say if you would do it on the land that you rent [read and tick].

	Land rented	Land owned
a. Planting long term trees		
b. Planting short term trees		
c. Perennial crops (banana, coffee)		
d. Dig trenches and ditches		
e. Weeding		
f. Applying fertilizer		

### 3c. For [insert one or several options a-f] there is a difference between land that you rent and land that you own. Why?

### 3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SLM or if something has stopped you from trying. Which challenges have you experienced?

### 3e. So, the challenges you have experienced are [repeat the ones ticked], which 2 are the most important? How have they affected you?

## 4. CHANGES TO NUTRITION

Family diet/nutrition (last week)	What to fill	Number
Meals per day	(no of daily meals on average last week)	
Protein (milk, egg, beans, peas, fish, meat)	(no of times eaten in meal last week)	
Fruit (banana, pawpaw, mango, guava etc.)	(no of times eaten in meal last week)	

### 4b. Do these numbers vary depending on the month/season? How?

### 4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?

### 4d. I am interested in what has made you change your eating habits. Do you think any of the following is the reason?

☐ Increased harvest, ☐ More help from group, ☐ Income from enterprises, ☐ Being a member of VSLA/savings group, ☐ Grow more different types of food, ☐ Better harvests when rains are delayed/don't come, ☐ Received information about nutrition, ☐ Other reason, If not zero, which one and how?.....

### 4e. So, you think the following could be the reason [repeat the ones ticked]. Which 2 do you think were most important? How have they changed your eating habits?

## 5. OTHER

### 5a. Is there anything you would like to add?

## Appendix 7.

### Balance test of attrition bias

	Dropped out or missing	Always followed up		
	Mean	Mean	Difference	Std. err.
<b>Outcome variables</b>				
Meals per day	2.31	2.48	0.17	(0.14)
Protein	8.51	7.70	-0.81	(1.13)
Fruit	4.49	5.29	0.81	(0.63)
<b>Asset ownership</b>				
Land owned	2.26	2.84	0.58**	(0.27)
Dairy animals	1.00	1.09	0.09	(0.25)
Non-dairy animals	3.59	3.07	-0.52	(1.98)
<b>House type and location</b>				
Wall type	2.18	2.21	0.03	(0.07)
Roof type	1.05	1.03	-0.02	(0.04)
Water near	0.49	0.48	-0.00	(0.09)
<b>Farm commercialization</b>				
Crop enterprises	2.51	2.93	0.41	(0.25)
Vegetable enterprises	1.23	1.35	0.12	(0.28)
<b>Household composition</b>				
Female household head	0.31	0.35	0.04	(0.08)
Parent headed	0.92	0.94	0.02	(0.05)
Grandparent headed	0.03	0.04	0.01	(0.03)
Child headed	0.03	0.01	-0.02	(0.03)
Other adult headed	0.03	0.01	-0.02	(0.03)
No. people 18–60 in hh.	2.15	2.23	0.07	(0.19)
N. of cases	39	339	378	

Notes: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01

## Appendix 8.

### Balance test for unlinked sub-sample

	Not always linked to group record	Always linked to group record		
	Mean	Mean	Difference	Std. err.
<b>Outcome variables</b>				
Meals per day	2.39	2.48	0.09	(0.11)
Protein	8.71	7.50	-1.21	(0.78)
Fruit	5.42	5.15	-0.27	(0.47)
<b>Asset ownership</b>				
Land owned	2.90	2.74	-0.15	(0.20)
Dairy animals	1.35	0.99	-0.36	(0.26)
Non-dairy animals	4.33	2.75	-1.58	(1.16)
<b>Farm commercialization</b>				
Crop enterprises	2.81	2.91	0.10	(0.20)
Vegetable enterprises	1.56	1.27	-0.29	(0.22)
<b>House type and location</b>				
Water near	0.55	0.46	-0.09	(0.06)
Wall type	2.18	2.22	0.04	(0.05)
Roof type	1.01	1.04	0.03*	(0.02)
<b>Household composition</b>				
Female household head	0.35	0.34	-0.01	(0.06)
Parent headed	0.93	0.94	0.01	(0.03)
Grandparent headed	0.04	0.03	-0.01	(0.02)
Child headed	0.02	0.01	-0.02	(0.02)
Other adult headed	0.00	0.01	0.01**	(0.01)
No. people 18–60 in hh.	2.16	2.24	0.08	(0.14)
N. of cases	89	289	378	

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01

## Appendix 9.

### Preselection: LVB and 2009 follow up

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.446*** (0.0760)	8.773*** (0.565)	5.393*** (0.512)
FHH x Treatment x Post treatment	-0.399*** (0.151)	-1.446 (1.129)	-0.716 (1.022)
FHH x Post	0.135 (0.116)	0.243 (0.869)	-0.203 (0.787)
FHH x Treatment	-0.458** (0.219)	-3.949** (1.623)	-3.085** (1.470)
Constant	2.530*** (0.0482)	8.857*** (0.359)	4.575*** (0.325)
Observations	1,559	1,549	1,549
Control mean	2.494	7.987	3.208
R-squared	0.053	0.330	0.261
Number of HHID	324	324	324

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects. This model specification differs from the main model specification one way: it restricts the time span from which to choose the control group from to be only in 2009. In the main model specification, the selection of control was made from farmers followed up from August 2009–August 2010.

## Appendix 10.

### Matching method: Nearest Neighbour Matching

Variables	Meals per day	Protein	Fruit
Treatment x Post treatment	0.720*** (0.0754)	7.679*** (0.558)	4.418*** (0.521)
FHH x Treatment x Post treatment	-0.659*** (0.155)	-0.760 (1.072)	0.294 (1.000)
FHH x Post	0.384*** (0.120)	-0.542 (0.790)	-1.292* (0.737)
FHH x Treatment	-0.436** (0.217)	-2.749* (1.609)	-2.397 (1.501)
Constant	2.675*** (0.0473)	8.257*** (0.348)	3.629*** (0.325)
Observations	1,652	1,668	1,668
Control mean	2.494	7.987	3.208
R-squared	0.078	0.297	0.235
Number of HHID	374	374	374

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Using household and time fixed effects. This model specification differs from the main model specification one way: the sample used is matched using nearest neighbour matching instead of caliper matching. The result is that an additional 15 treatment households can be included.



## Appendix 11.

This Appendix contains the transcripts for the 8 individual interviews and the 8 group discussions that were carried out for the qualitative part of this thesis. The questions are in bold type and the answers from the respondent are in normal type. The transcripts reflect the answers as translated by the translator. Sometimes the translator referred to the respondent as he/she, sometimes as I.

Any information which could be used to identify the respondent has been removed. In the interview with the male household head, all “he” has been replaced with “she” to assure anonymity. Names of geographically specific district farmer’s associations (DFAs) have been replaced with “DFA”.

The interview ID numbers were randomized and do not reflect the chronological order in which the interviews were carried out. The template in Appendix 6 acted as a starting point for the interviews but follow up questions were asked when necessary. Questions were sometimes skipped when answers to them were provided in other question, they were deemed less relevant or too sensitive in the context of that specific interview or if other questions took a lot of time.

---

### Interview ID: I1

#### **1d. Are you part of a cooperative?**

☒ Yes, since: 10 years back. She used to rear chicken & eggs in the group, but not anymore. Now farming. Having trenches, fodder, trees and other SALM practices. They also bought chairs that they rent out to ceremonies.

#### **2.1a. Do you think men/women in your community face different challenges when growing crops?**

Women face a lot of challenges. First of all, they don’t have the strength to work in the garden. The men can work harder. So the female production is less. At least women should have had some start-up capital. But women don’t have enough start-up capital to reinvest but men have.

**2.1b. Do you think men/women in your community face different challenges when selling crops?** Almost the same challenges: lack of market for the produce is the same. Example: premature selling. Selling at low price affects both. Another thing that is the same challenge to both is that they can get cheated by the buyer. If they don’t have a collective centre where they are able to bargain.

**2.1c. Do you think men/women in your community face different challenges when raising animals?** They face the same challenges: diseases for the animals, lack of capital to do management of those animals. Capital is very important for animals. Without capital you cannot build somewhere for them and you need to tie a rope. Sometimes the animals break the rope and go onto people’s garden.

**Q: Do you sell your produce in the market / home / coop?** Sell at farm gate. The challenge is that they sell at low price, they don’t have an established market.

**Q: Difference at farm gate between men and women?** No difference. Same challenges. The buyer is the same who buys from men and from women. The buyer determines the price.

**Q: Anything that can help you get higher price?** She would want somebody in the area to buy higher price. Collective selling could help them. If they are in a group they could get one person to sell at a higher price. They could make a plan with that buyer and decide so that buyer pays a lot.

**Q: This is what you do in the cooperative?** Yes the group has a joint project, there they have been selling beans and maize. There they help each other with the price. But sometimes the price of maize drops.

**Q: What is the reason you need to sell prematurely?** Poverty. You have a challenge to pay school fees but you don’t have the money, then you sell what you have. She is recommending that you should rear some animals, so you could have sold some animals instead.

**Q: Do you have any animals?** She has the interest to get them. She has a few broilers and some pigs. She does not have a raising unit. One of the animals broke the rope and went to some people’s garden. She buys the young broilers and sells at higher price. At 20 000 you can sell a broiler instead of selling crops prematurely.

**2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.** I would invest in farming. Examples of where she can invest: investing in banana is profitable.

**3a. Do you cultivate any land that you do not own?** She has inherited land. She and her brother got some inherited land each. Also, the husband had some land but it was taken when they divorced. but her children is still utilising the husbands land.

**Q: Is there a difference in which activities she has on different types of land?** The husbands land that the children are cultivating, they have maize and

some coffee. At her's she has coffee banana and maize. Most SALM practices are practiced on hers. The children are not aware of the SALM practices.

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Which challenges have you experienced?** Apart from less strength, it requires some capital. For example mulching, you need to get grass and slash and you need to hire someone to help you.

**Q: How does the cooperative help you?** They have a universal project (together in the group) where they implement SALM. But in the homes they work independently. If you have someone to hire that's good.

**Q: Comment:** she has a small garden where she plans to do banana since they are good money in the area.

**4a. Nutrition habits, how have they changed?**

**Protein:** Beans is the most common here. But sometimes the lack of firewood kicks them out of the everyday consumption. Over the weekend she can sometimes buy meat but never fish. She also eats vegetables. **Fruit:** Very common, at least 4 times a week. **Meals per day:** She feels that she gets enough food to eat 3 meals and still have some to sell for income.

**4b. Do these numbers vary depending on the month/season? How?** Season when there is a lot of mangoes she eats a lot of fruit.

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?** Eating habits has really improved. They were provided with fruit trees so now they can just go and pick. For example oranges. Also including vegetables: 2 types that they are a planting now.

**Q: Did you receive any training about nutrition?** Yes.

**Q: Who trained them?** Member of parliament trained some women and trained them on nutrition and how to feed children.

Training also on how to harvest bananas.

**5a. Is there anything you would like to add?** She has some challenges. Especially to establish an animal unit but she does not have capital for that.

---

**Interview ID: I2**

**1d. Are you part of a cooperative?**

☒ Yes, since: 2007 ☐ No

**2.1a. Do you think men and women in your community face different challenges when growing crops?** The woman suffers a lot since she is responsible for all of the crops. Her husband is a retired teacher and so she is responsible. Women are in general responsible for all of the crops.

**Q: is this more so because her husband had a non-farm job?** It is common. As a woman you are responsible for sowing etc. The man gets time to rest.

**2.1b. Do you think men and women in your community face different challenges when selling crops?** In the community, women are suffering. The woman is responsible for everything and then the man sells. If the woman is lucky, the might get something of the money from the sales.

**2.1c. Do you think men and women in your community face different challenges when raising animals?** In the community, men don't allow their wives to own animals. Because they fear that the woman will get empowered and the man loose power. She thinks debate in the community should be brought about so that this can change.

**2.2c. If you are selling anything, who in the family sells which produce?** (Specify by gender & produce). If the seller finds her at home, she sells. If the buyer finds her husband, he sells.

**2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.** There is no difference because they would have agreed on the price and quantity before. They sell to a central place.

**Q: Does the central place decide the price.** The price is determined by the buyer.

**3a. Do you cultivate any land that you do not own?**

☐ Yes, ☒ No, ☐ Don't know, If no/don't know, move to 3d. Her husband owns all of the land that

the family cultivates. They are both responsible for looking after both of the land. When the coffee buyer comes to follow up, they do not want to be ashamed that one of them looks bad, so they take care of both.

**Q: do you do the same activities on both her and her husbands' land?** For example, when it comes to spraying. It is better for her that they work together, because the husband owns more of the land and the resources and can choose not to support her if they do not.

**Q: What can be the reason for you not working together?** When they don't work together, there is disunity in the home. They would hide the income and that would hinder development. They have educated all their children.

**Q: was there a division of labor on the farm when her husband was still working?** The husband used his income to buy help for her on the farm.

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Which challenges have you experienced?** There is no problem. At home, the biggest challenge is to collect water.

**Q: what is the challenge with collecting water?** The biggest challenge is distance and she does not have energy to go long distance.

**Q: who in the community are responsible for collecting water?** It is women and children. It is really a challenge to women, then they have to go deep into the swamps to find water.

**4a. Dietary habits. Meals per day: 3, protein: 14, fruit: 4**

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?** Yes, they have increased.

**4d. I am interested in what has made you change your eating habits. Do you think any of the following is the reason?** The numbers have changes because of trainings. Most especially the trainings on the establishment of vegetable gardens. The vegetables have boosted her immune system. She has been trained by health workers (in her group) on nutrition, she eats better now.

**Q: You mentioned you talk to the women in the community. Do you think there is something**

**they would want to add if they were asked these questions?** The women who are not in group, they eat poorly. Also, their men don't let them go to trainings. She is very grateful that you are coming. She will be even more happy when the report comes out and the suffering of women is exposed.

**Q: The suffering of women outside the group or also in the group?** The women who are outside the group are really suffering. We must have some follow up sensitization.

**Q: Which are the most pressing issues?** That they are eating poorly. Secondly, the men take the proceeds from the sale of produce. The woman is responsible for the children's schooling etc. but does not have the resources to meet them.

**Q: In what way does the group help with these issues (if it is not a cooperative)?** No answer.

**Q: Is there a difference in how men/women prioritize if they get a little additional income?** In my home or in the community?

**Q: Both?** Ok, in her home, they put the income together and they have collective priorities. For example, this year they are going to construct a house. So any additional income will be put toward that. In the community, if the man gets a little additional income, he will pocket it.

---

## Interview ID: I3

**1d. Are you part of a cooperative?**

☒ Yes, since:2011

☐ No

**2.1a. Do you think men and women in your community face different challenges when growing crops for selling?** They face the same challenges. Middle men that cheat them and pay too low prices. They are not benefitting from selling much because they get cheated.

**Q: is there a difference in how often men/women get cheated?** Yes, it is easier to cheat a woman. Because the men have market information and so she does not know what the right price is. I sell at the farm gate.

**2.1c. Do you think men and women in your community face different challenges when raising animals?** They face different challenges. Thieves can come and steal her animals, a man would wake up and stop them. Because of security, a woman would not. Even in acquiring them, women are more likely to be cheated. A woman does not go

to the market, but sends somebody else for her, that person can cheat the woman.

**Q: Why do you think women do not want to go?**

Men are more courageous. Also, the woman normally does not know about which breed is good and so they would rather trust somebody else to make that judgement. Also, I am short on cash and would rather spend the money on the animals than on transport to the market.

**2.2. Your income generating activities**

Crop enterprises: 3, vegetable enterprises, 0, non-dairy animals, pigs, 2 goats, types of other animals : chicken

**2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.**

Buying cattle, paying school fees, finish the house, investing in the garden and in farm inputs.

**Q: What is the reason for prioritizing cattle?**

Because she would be able to get milk for both income and consumption. She knows the benefit of having cattle from before.

**3. Lands owned/Rented.** < 2 acres owned. She only rents 1 acre.

**3b. I will read activities, and then you say if you would do it on the land that you rent [read and tick].** Would do all on owned land. Would do mulching only on perennial crops on land rented and apply fertilizer on all crop on land rented.

**3c. For [insert one or several options a-f] there is a difference between land that you rent and land that you own. Why?** The rented land can be hired only for two seasons so the landlord will not allow me to plant any of the tree-types or dig trenches/ditches.

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Have you experienced any of the following challenges?** SALM practices are expensive (for example application of fertilizer). They are labor intensive. Also, drought affects the planted trees and make them dry out.

**4a. Food habits. Meals per day: 2, Protein: 7, Fruit: 0**

**4b. Do these numbers vary depending on the month/season? How?** I am not eating fruit now because of the season. She has not experienced any change in nutritional habits since starting to interact with Vi/DFA.

**5a. Is there anything you would like to add?**

If I get better income I can invest in my garden, invest and provide better nutrition.

**Q: What is the biggest challenge since your husband passed away.** Not enough money to pay school fees, or buying food, my family experiences hunger due to drought. I have no assets that I could sell in case of money scarcity. There is no security now that my husband is gone.

**Q: Are there many female headed households in this area?**No, there are not so many female headed households in this area.

---

**Interview ID: I4**

**1d. Are you part of a cooperative?**

☒ Yes, since: 2010 ☐ No

**2.1a. Do you think men and women in your community face different challenges when growing crops for selling?** Yes, they are having challenges. The biggest challenge is drought, then access to market and then pests. These challenges affect us all the same.

**2.1b. Do you think men and women in your community face different challenges when selling crops?** Some families, they don't believe each other when they are selling crops. For example, a man and woman is owning different enterprises, they don't trust each other.

**Q: what is the consequence of this?** The man sells things but does not share the proceeds with the community. This has also been a challenge in the cooperative. When they do not agree within the family, it can happen that one member of the family sells some of the produce outside the cooperative which makes the cooperative not reach its targets.

**2.1c. Do you think men and women in your community face different challenges when raising animals?** Yes, sometimes a man can leave

animals to the woman, but since the woman does not own them, she neglects them.

**2.1d. Do you think men and women in your community face different challenges when selling animal products?** The challenge is in the market access. First the roads, then the market and then drugs. The drugs are very expensive, some cannot afford to buy the drugs. These challenges are not different between the genders.

**2.2. Your income generating activities.** Crop enterprises: 3, vegetable enterprises 0, non-dairy animals 8, dairy animals 1, types of other animals, 1, number of other animals, 15

**2.2a. We are interested in if you face challenges when selling/trying to sell you produce or if there is something that has stopped you from selling. Which challenges have you faced?** Price fluctuation. Processed coffee is today 4500, as it reaches the market, the price has already reduced. Finding a good market is very difficult. Another is the pests (coffee twig borer, coffee wilt). This has reduced the yields by around 40% (10 bags to 6 bags). The drought has also been a big problem. Middlemen are a large challenge. They come and buy at a low price from the members, who are forced to sell to afford school fees. Giving advances to members is hard to afford for the cooperative. Price is also low. And transporting the produce to the market is expensive (hired car).

**Q: How do you get the price about the price in the market?** We communicate with the buyers. We sell it in [nearby town]. They process and sell processed coffee.

**2.2b. So the challenges you have faced are [repeat the ones ticked]. Which of them are the two biggest ones and how did they affect you?** Low price is the biggest challenge.

**2.2c. If you are selling anything, who in the family sells which produce?** The spouse remains at home, but they weigh the coffee together so that they know how much there is. Then she sells it and she knows how much money to expect.

**2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.**

Biggest expense right now is school fees. I would finish my house, then buy a van.

**Q: why would you buy the van?** Because I will retire at some point and want to be comfortable.

**3a. land owned/rented**

3.1 – 4 acres owned

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Have you experienced any of the following challenges?** There is no challenge in doing that. Planting trees gives timber, feed for animals. It does not take much labor.

**3e. So, the challenges you have experienced are [repeat the ones ticked], which 2 are the most important? How have they affected you?** The challenge might be when you plant them close to the home. If the wind comes and blows them down on the house.

**4b. Do these numbers vary depending on the month/season? How?** Fruits are not constant. Meals per day should be constant.

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?**

Meals per day: Not clearly one way or the other, goes up and down. Protein: It has increased. Because of increased milk production [which came] because of more feed for animals. Fruit: I grows my own fruits, so I has more of those, this has also gone up.

**4d. I am interested in what has made you change your eating habits. Do you think any of the following is the reason?**

☒ Increased harvest (generally increased, but right now it is down due to drought.)

☒ More help from group (taught them how to plant vegetables)

☒ Income from enterprises (they aided me in setting up the piggery and the nursery bed)

☒ Being a member of VSLA/savings group (Vi set up the VSLA, I use it for school fees, scholastic material. People also use it to buy, fertilizer, animal feeds, or materials for the farms)

☐ Grow more different types of food

- ☒ Better harvests when rains are delayed/don't come (**the trenches for conserving water have helped a lot**)
- ☒ Received information about nutrition (**no, we get it from school and grandparents. Vi's intervention helped us keep that diet by helping us to setup vegetable gardens**)
- ☐ Other reason, If not zero, which one and how?.....

4e. So, you think the following could be the reason [repeat the ones ticked]. Which 2 do you think were most important? How have they changed your eating habits? We received seeds and seedlings for planting trees. This was a big change with working with Vi.

5a. Is there anything you would like to add?  
I would like to thank Vi. Especially [names two Vi staff] who helped us with seminars about birding etc.

## Interview ID: I5

### 1d. Are you part of a cooperative?

X Yes, since: 2014 ☐ No

2.1a. Do you think men and women in your community face different challenges when growing crops? For women they are affected more. Example: when you want to grow crops you slash and spray grass but the women have to dig because they don't have the money for spray. As much as the men also face the same problem but it becomes bigger for women since they don't have money.

When I asked about challenges for men, She could not bring out one. But for her: she belongs to two groups they are growing crops in a group and sell in a group. But she is not aware of the challenges.

**Q: What is the reason women have less money?**

They don't have any income generating activities

**Q: What is the reason women don't have income generating activities compared to men?** She was saying men have coffee. They can harvest and get money. And the government has so far given them 3 times coffee seedling but they have been drying.

**Q: Did the government give seedlings to men or women?** The first and the second distribution was made for women. Because the area MP is women. And she talked about someone who has contested. 2 contestants had given women seedlings. The 3<sup>rd</sup> time it was meant for both.

**Q: Is it common that women grow coffee?** It is very common. The only challenge they have is drought too much sunshine.

**Q: Do men/women get same price from coffee?** They will get the same price for coffee but she says that the plants is not the stage at harvesting. (the one of women). The husband offered a small part of 50 plants to her she will harvest and get school fees. Even with raising animals they can survive.

2.1b. Do you think men and women in your community face different challenges when selling crops? Similar problems: determining the price for produce. Example of maize: the problem they are facing is now [is] prices. They are only offering flat price 500 for maize. This affects both of them.

2.1c. Do you think men and women in your community face different challenges when raising animals? Not aware [of any differences]. The personal experience [is that] at [her] home if an animal is sick you need to mobilise some money. The [she] was also bringing the issues that if they can sell the animal she will not know where the money has gone [the husbands sells].

**Q: Does she sell anything?** An example of hens: she would sell but other like cows she would sell with the husband. Previously he had sold without consulting her and that resulted [in] that they called the elders to resolve the issue. Both the man and woman sell in their farm: yellow bananas,

**Q: Men and women have different priorities if increase in income ?** For women ... but she was giving the own example. She would pay school fees and make sure they have bathings but for the man he would buy boda-boda and other investments: and farm inputs such as hoes. The men: They become coffee brokers. Start buying coffee from farmers and selling. Women are still school fees. Women are struggling to pay school fees and clothing. Men are not interested in paying that.

3. Land owned/rented. they work as a family on the farm, they do all there together. She has not started the other SALM practices. She has a wood saving stove. She has discussed with the husband to have the SALM practices in place. But not yet started, he is lazy they have also done mulching.

**Q: Have they done water conservation practices?**  
Does not have water conservation practices

**Q: Is the husband part of the group?** Not  
**Q: Why does she think the husband does not want to implement SALM practices?** Laziness, but no other reason why. and if the man remains not wanting to have it [s]he will tell the son and he will have them constructed. Having soil and water conservation.. the reason the husband is not participating is laziness. If he does not respond and does not come up to do it she will talk to the son who can construct it.

**4a. Food consumption.** Meals per day: 3, **Protein:** Beans only, **Fruit:** pawpaw, avocado, bananas

**4c. Do you experience that these numbers have increased/decreased or remained the same since you joined the group ?** not see any change [but there is change for quantity] she's now looking at quantity: previously she did not have enough food. But now they have 3 levels of food production: food they eat right now. and as food is growing and they have the ones they just planted. Cassava and sweet potatoes.

**Q: how did husband sell without her knowing?** He sold it from home the first place. But the husband had some debt that he had to clear. That's what he told the family members [who tried to resolve the conflict] and since then they resolved the matter. He had started hiring people to come and work on the land. And she did not have enough space to grow crops. He had to refund people who had hired.

**Q: Why did he have to refund those who hired his land?** No, He was hiring land without her knowledge. So he had to refund money back to those.

**Q: What is the biggest challenge she has right now?** She does not have any big challenge.

**5a. Is there anything you would like to add?**

For women who have taking care of the children paying school fee and don't have income. What can they do? Children with disabilities were registered since they should receive some support but they have never received any support.

Interview ID: I6

**1d. Are you part of a cooperative?**

☒ Yes, since: not know ☐ No

**2.1a. Do you think men and women in your community face different challenges when growing crops?**

Normally women & men have separate gardens. Challenge to invest in garden for women since they don't have money compared to men. The consequence of this is that they sow the seeds late.

**Q: How does men get more money than the women?** When a man sells coffee, he takes the whole amount himself. Women gets money and shares it with children.

**Q: Who normally owns the land that women cultivate?** Men own. Normally husband.

**Q: In your home how do you share the land?** In her home it is not easy to work together. The biggest part of land is for the husband. But she hires other land. And she was also allocated some land in forest reserves – but now they are evicted from the forest reserve. And even worse the husband drinks and this has brought misunderstanding in the family.

**Q: Do you make different investments on those kinds of lands?** Yes. Especially I forest reserve: focusing on maize since fertile soils. But in the husband's garden they have coffee and maize. All SALM practices are established on the husband land, especially the soil and water conservation and compost. Tree planting too.

**Q: Reason that you do not do it on the land that you rent?** The owner on the rented land will not allow to practice SALM practices.

**Q: Not even composting?**

It depends on the period of renting. Those who have long periods: she can make some compost, especially on tomatoes and beans. If just for a short time you don't want to do it since you only support the owner of the land.

**2.1b. Do you think men and women in your community face different challenges when selling crops?**

They don't face same challenges. Example: both harvest maize. Women will sell at lower price since she will not hold the produce till the time when price is high since she has more commitments at home to pay for. Man can wait till the price is high.

Example of herself: men has grabbed the cash crop, especially the coffee. Vi gave her coffee seedlings but now the husband does not allow her to sell the coffee, she cannot go and harvest.

When they used to sell maize in the group it was better (now the group stopped selling maize): when they brought maize to the group they got higher prices. Husband was not in the group and did not

know what was happening there, which allowed her to get higher price.

**Q: Do you sell at the market?** No. sells at the farm gate. She has most authority when she sells maize. But for other produce she does not have authority. For maize she has permanent customers.

**Q: On how many acres do you grow maize?**

The previous season she had 1 and a quarter acre of maize in forest reserve and also 1 acre of maize of the husband. But this season the husband has taken over this land. Now he has planted maize there.

**Q: Who does she not feel she has the authority to sell other produce?** The husband does not allow.

The other crop is for the husband. The man harvests all the coffee and says she cannot have any to sell.

The man can say "I have a loan to repay with this coffee" but he says this when she has not seen money from the loan in the first place.

In the coffee planting she participate in clearing...

and .... But when it comes to harvesting he says she does not have authority. Maybe the man says he paid school fees, but he cannot account [for spending that money on school fees].

### **2.1c. Do you think men and women in your community face different challenges when raising animals?**

Different challenges. Most community members have a split: either the man or the woman owns it and then only the ones who own the animal takes care of it. Women has the animals and if the animal get sick the man cannot get the money to treat the animal.

**2.2d. If you experienced an increase in income, what would you spend it on? Please state as many things you want in the order you would buy/invest in them.** School fees. If she get more income she will send them to boarding school.

**Q: Would a man make different priority?**

Different priority. Most women focus on paying school fees for children. Man focus on investment more in the gardens and construction. But there are also other women who only focus on food crops they are not part of any production for cash. For these families: the men do not care about the food.

### **3. Land owned/rented**

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Which challenges have you**

**experienced?** Since the husband is not in the group, she has a challenge to accomplish all duties: then it is not easy. Soil and water conservation requires combined effort. So husband does not participate in establishing those. She remains alone.

**4a. Food habits, Meals: 3, Protein: 3 fish in period of scarcity.** Normally beans too but this time beans are rare. Pork too! it is common here, **Fruit:** If season she eats avocado. And others she eat 4 times each week.

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?**

They have been trained on fruits, they were given fruit seeds and trained to eat more so that's why it has changed.

**5a. Is there anything you would like to add?**

She has many challenges. Since husband is not in group he is not supportive. She wanted to construct a wood saving stove but husband refused to construct a kitchen where she could have such a stove. Problem that husband is not participating and aware of the trainings.

---

### **Interview ID: I7**

**Q: Do you take decisions about what to do on the land? Salm etc?** Yes when to plant and where to plant

**Q: Experienced any challenges when implementing SALM?** She has not had any problem. The man will just look on it. He will not participate.

**Q: Is there a special reason why the man does not participate?**

They have another land. Where she does the work it is on 1 acre. Now the man works on the bigger land. She is here and doing her thing. They are married but they do it on different land.

He has two households and has another family. Stays with the other family

**1d. Are you part of a cooperative?**

☐ Yes, since...yes but she also has another group for saving. 3 years..... ☐ No

### **2.1 Conditions in your community**



**2.1a. Do you think men and women in your community face different challenges when growing crops?**

They face different challenges. 1: women have smaller plots of land on which they plant for home consumption since they are the ones looking after the children. They would like to have bigger land to do commercial farming.

Men and women think that during the planting and growing that they want to plant improved varieties. But they encounter delays to improve the seeds because they rely on government inputs. This challenge affects both men and women, but the women also look at feeding the family but the women also like improved seed.

**2.1b. Do you think men and women in your community face different challenges when selling crops?**

When you're selling like a HH the ladies don't know how much it has .. in terms of money... how much has costed the produce. But the man gets the buyer and negotiation and after getting the money from him he will put money in pocket. Women only knows the 20 bags but does not know the price for them. Families where this is happening: where the man takes over the selling and the women does not know, the women have resulted to have their separate gardens where they are responsible for the selling.

**Q: Do you sell from your garden?**

When she has planted the garden she determines whom to sell and she sell herself. Also the cow or other animals she raise. She sells from home.

**Q: Is there anything you think can solve the problem about the price not being known to women?**

For her, the way she determines what to plant and when and how to sell she gets information from group meeting she attends. But when you compare with the women who work on the farm together with their men they do not only want to know about the prices. Some only want to stay home and they are not easy to help.

**2.1c. Do you think men and women in your community face different challenges when raising animals?**

She gives a scenario about men with bad authority. Ex: when you have an animal (a woman has it) when it is time for selling you share profits 50/50. A neighbour has a hen, and 2 chicks are for the lady and

2 are for the men but the lady is taking more time to take care.

There is also a problem that cuts across: feeding animals. Because the area for raising has reduced. Get food from far away.

**Q: If a women vs a man received more income in your community, what would they spend it on?**

Men will prioritize school fees if they are responsible. The second option is to reinvest the money gotten into the farms. And developments at home. But there are men who are not responsible: they get money and remarry and spend it on bars.

Women will always try to start small businesses. Selling something in the market: clothes etc. will try to start.. and others go hire land to maise growing and take care of the home.

**Q: If man has several wives and lives mainly with one. Would he send/give money to the first one?**

For her, at times when for instance the husband has harvested he sends some money. But she also gave an example about a man who marries 6 women. The man would build for you house and then leave you to take care of yourself. The support is rare it is not often. That's why the women have to work hard nowadays.

**Q: Women sometimes rent more land. Does it ever happen that they buy land? Yes.**

**Q: Common?** Few people has done it.

**4a. Food habits**

**Meals per day:** 2, **Protein:** Fish, gnuts, beans , pork. Eggs ones a month. **Fruit:** Banana o pawpaw whenever they are ready.

**4b. Do these numbers vary depending on the month/season? How?** This season she wants to do a lot she is in the garden so they only eat 1 time per day. But other times when they are not so busy they eat 2 times a day. In weekends they eat better.

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?**

**Meals per day.** They have greatly improved because the field officer keep reminding them bout to have vegetable gardens.

**5a. Is there anything you would like to add?**

She would wish to have their lives improved, someone should at least have the poultry products, they would want to eat eggs and have a banana plantagion so she could go eat all the time. She needs nutrition. She knows she has not reached.

## Interview ID: I8

### 1d. Are you part of a cooperative?

☐ Yes, since:...recently she is part of a group that buys coffee and sells coffee. Different group from the DFA group.

### 2.1a. Do you think men and women in your community face different challenges when growing crops?

No difference .

### 2.1b. Do you think men and women in your community face different challenges when selling crops?

Some scenarios the men are more in selling and might decide not to bring the money back money. Men are more active in selling. But in her home she sells what she grows by the farm gate. She grows on the husbands land. There are some crops that they plant together but she also has her own share.

**Q: Who takes decisions about salm on the land?** She takes responsibility because the man has some other work he does. She decides.

**Q: What is his other work?** He is an engineer constructing paves on the road.

**Q: The men are more active in selling, why?** Men want quick money and are more involved in selling. Also a scenario in her home: when they have grown a lot the man comes and want to pay school fees.

**Q: What?** Both. He wants to know how much they have harvested and how much money they will get from the harvest. Because he has invested in the planting and want to see if he has made profit.

**Q: The husband takes crop to market?** The husband does not sell at the market but he only comes in during the harvest period

**Q: What does he do when he comes during harvest season?** In most cases she does the planting and everything and when it comes to harvesting the husband will do it well because she cannot carry heavy things.

**Q: Men and women have different priorities in your community?** People spend income different.

**Q: In what way would the man / women spend it different?** Example from her husband: the first priority for him is to pay school fees. Investing in property such as cows and goats. You can grow something from sell instead of eating to get other things. And saving: her and the husband they save together and when they get the savings they plan on what to use it on. But some other members in the

community: some men want to just have fun with other women and what what. When it comes to her savings: her priority no one is paying school fees. But if the husband brings the money so she can get the refund. And she can also buy her personal things and some small hen. But in case the husband has failed to have the money. Then she would leave her money to get to school fees.

If the man does not have the money she can take care of the family to buy things that the husband cannot buy. Nowadays men don't care about children's cloths. When she gets money she takes responsibility.

**3d. We are interested to hear if you ever experienced challenges when implementing/trying to implement agroforestry/SALM or if something has stopped you from trying. Which challenges have you experienced?** Not experienced challenges when trying to implement. Previously she did not how to do salo salo. They got training now and don't have challenges.

**Q: Does she do the same salm practices on all the land?** She does it on her land.

**Q: ALSO ON the husbands land?** They do it on the banana land.

**4a. Meals per day: 3 Protein:** The husband brings meat every day from a hotel that a sister runs.

**Q: Who makes decisions about cooking?** Me

**Q: Does your husband and you have different opinions about food?** Ones in a while he comes and says let us eat this thing. But then he would provide.

**4c. Do you experience that these numbers have increased/decreased or remained the same since you first met Vi Agroforestry/DFA?**

Greatly ! back in the days they did not have vegetable garden. Now they have a variety. Improved greatly. She is hoping that the feeding habits will improve even more because recently she has received training in poultry and she has some chickens that are doing better and better.

**Q: Did she also receive training about nutrition and how to eat at some point?** Yes but time has passed since that training. One of the members in the group gave them the training.

---

## Group ID: G1

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them?**

**Why have you changed them?** After the trainings, they were taught to make balanced diet. They no longer cook only one type of food. Greens, dodo, carrots, fruits (mango, orange, guava, pine apple, pawpaw). Cabbage, water melon. The trainings have given them more knowledge of how to use veg. gardens.

Due to the nature of the area, they do tea for morning, then lunch, then dinner.

**Q: What are the biggest challenges when it comes to nutrition?** During the dry season, the water is not enough. Dry season, and in the rainy season when the rain is much. Pests also, banana-wilt is big challenge. Soil is losing nutrients (others say they are trained to make fertilizer).

**Q: Have the SALM practices helped when it comes to nutrition?** Yes, but pests are still there.

**Q: What has been the biggest challenge when it comes to implementing SALM?** For example, material to use for mulching is far away and they have to get it. Also, digging terraces is costly.

When they are still with Vi, they were trained to keep nurseries. Now they do not get seedlings anymore and so they are not able to plant as many trees.

Especially the agroforestry trees.

**Q: Is there something you would like to add?** Nutrition is not only about eating, but also animals (e.g. cows) to drink milk, get fertilizers and so on. Population pressure is increasing which makes plots smaller.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** The problem is, if women sell alone, they get cheated.

**Q: How?** Sometimes they fail to read the weighing scale or are not aware of the price.

**Q: Why are they not aware of the price?** They tie the weighing scale so that it shows the wrong thing.

**Q: How come are women more exposed to this?** Men have experience in selling so they know.

**Q: which things are weighed?** Crops, not vegetables or eggs. Women work with their husbands, when it is time to sell, the man goes with the money. He does not come back until all the money is spent. If

they have given produce to the men for selling. They do not say how many kg they took. So the women get cheated on the money.

**Q: Where does the man sell?** At the farmgate, but he deceives her anyway. He can chase the woman away.

**Q. Do the men in the group agree?** He says the money will be spent on luxurious good instead of spending the money on the children. That is why they sideline the women. Because they got training, things are not at loggerheads anymore. Trainings have made a change.

**Q: Are there special challenges for the female headed households? Not only themselves but also in the community.** It is on management.

Paying school-fees alone is difficult when you are the only one. For those who are single mothers, they get cheated more often. They lack market information, so they get cheated more.

The men go in town and get the information, but the single mother has to stay in the farm.

For singles, they have nobody to discuss the decisions with anybody and so they take the wrong decisions sometimes.

**Q: How does the group sell?** Collectively.

**Q: so why does one individual member need market information?** Each and everybody has their own farm. At harvest, they collect info on how much each has produced.

**Q: so the market info problem is for female headed households outside the group?** Yes.

**Q: Have we missed something?**

If they could get their weighing scale that works the same for all that would help them a lot.

---

## Group ID: G2

**Q1: What are the biggest changes you have seen in your lives since starting to work with Vi/DFA?**

One of the biggest changes in their lives, adopting energy efficient tech (wood saving stoves). Also VSLA approach to save and loan. 75% think school fees are the most important thing to borrow money for.

**Q: How about the rest?** About 50% have taken loans for investments in the farm.

**Q: Ok, do you borrow money for anything else?** Side-businesses such as retail shop, restaurant etc. Another big change is the water harvesting structures (tanks) and Calliandra (fodder and firewood)

**Q: what is the water that is collected in tanks used for?** Feed animals and domestic use. If you

don't have tank, you have to go far to collect water for the animals. And if you buy it is expensive. Someone appreciated the team for bringing them trainings, tree seedlings etc.

**Q: Have you experienced any difference in nutrition (what and how much you eat) before and after starting to work with DFA/Vi?** Very significant change. Trainings have pushed up yields. Also they have been given seedlings for vegetables. They grow a range of foods, which has helped them have enough and also to sell. The money is then normally put in the VSLA. Person who joined in 2017 says it has already helped him save his forest. By helping him to buy biogas. Bee keeping also helped him get more balance in his life. The house that we are sitting in is a hen-house that the group has constructed together. The support when it comes to income generating activities They have a background as HIV-group. Because they were an HIV-group, they were supported with a poultry project.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** As women they are challenged, carrying a bunch of matooke is hard, they are heavy. A man can take it on the bicycle. If they could take it to the market they could get a better price. Women cannot ride bicycles for cultural reasons.

**Q: And how big Is the price difference at the farmgate compared to at market?**

For example, if you can get 15.000 at the farmgate, you could get 20-25.000 at the market. If a woman suggests to get a motorcycle to get the matooke to the market, she has to pay fuel which takes a lot of the profit. Some market dynamics: prices can go down (if you grow the same as everyone else). The biggest problem is the middle men. They just want profits and give much too low prices. Perishable crops are extra sensitive to this problem. When they find in some seasons, when the sun shines too much and for longer, they have decline in productivity. This is because 1) they dry up 2) productivity is lower. Irrigation systems at a subsidies price that would make a good system. 1000 meters of drip-irrigation costs 1.8 million which is more than they can afford.

---

### Group ID: G3

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them? Why have you changed them?**

Formerly they use not to keep food. But after training from SEDFA, they now store food which they can access in times of drought.

**Q: what do they store and how do they store it?**

They store cereal crops, individually, not in the group. DFA gave them improved banana-suckers, cassava. Now they have a lot of food, and even have surplus for them to sell. They got improved seeds, fertilizers which has improved the yields, especially the fertilizers. DFA introduced the savings culture, now when they get some income, they can buy for example cows, which has changed their diet. They also got a training on balanced diet. After DFA's training they are now aware of that. Their income has been improved. STH about a coffee machine. The machine is for DFA members. I got a demonstration from DFA, based on the demonstration, I could increase the yields which makes sure more food is available in the household. They got fruit trees from Vi which is improving the nutrition, especially for the children. They used to have a worry that the trees that Vi supplied would be taken from them by Vi when they were grown, but now they are enjoying them.

The received vegetable seeds from DFA and now they are eating the vegetables that were planted.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?**

There is no difference, they work together in production and harvest. When it comes to marketing, however, the men take over. This has caused conflicts since the profits from the farm is not shared within the household.

**Q: why is it like this?** The man is the head of the household, therefore he decides what to do with the proceeds. Sometimes they beat the woman so that she leaves the homestead so that they can sell the produce when they are away. Sometime men are selfish when they take the proceeds to the market, instead of taking the money home, they use it on the way back on drinking, other women etc.

Man: sometimes the men are suspicious of the women running away with the money, therefore they

keep it to themselves. It is cultural, women do not want to come to go to the market.

**Q: Why do they say this?** Sometimes they do not want to go to the market with their man because they do not want conflicts on the way back about the proceeds. Women have an inferiority complex and shy away from the market because of it.

It is a sign of disrespect if you let your woman go to the market and stay behind yourself.

They don't want to know what happens when the man gets money (see how he is cheating).

**Q: What are the most important things for man/women to spend money on?** Women prioritize education for kids, then utensils for kitchen, then thing that bring well-being for the whole family. Men have social responsibilities, some of his friends has a wedding for example. They may see a beautiful lady, on the street, women are not interested in that.

---

#### **Group ID: G4**

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them?**

**Why have you changed them?** Now, they are able to take 3 meals per day. They eat like kings, they eat lunch like bosses and supper like slaves. They take proteins. Now, they have enough fire wood so now they can cook the food.

**Q: Why do they have more firewood?** Vi trained them in tree growing, but most of all, Vi trained them in construction of wood saving stoves. So now they cook more since not as much firewood is spent. Quality of meals have also increased, they can eat chicken, fruit and vegetables.

**Q: Do they buy or rear chickens?** Mostly they rear them.

**Q: What is the protein that they eat?** Mixed views, some suggest posho but others point out that's not protein. Eggs for example.

**Q: have they received trainings on nutrition or is the change due to the fact that they can eat more/better now?** They got such trainings from Vi and other actors.

**Q: who are the other actors?** There are also health workers (government, nutrition and public health). Village health trainers are trained by the government and work in the village. (four people in the group were such trainers.) (program started in 2012 according to Moses and field officer).

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** There is no difference, they sell together.

Although there is no difference, women are more involved in the selling process. They received trainings, all the family now works together.

**Q: how about in the wider community?** When you look at those who are not in the groups, the issue is different. Especially for coffee, men are selling.

**Q: do both the men and the women go to the market?** For them, they all participate. The buyers come and find them at home.

**Q: does anyone go to the market?** No, in this group, nobody sells in the market.

**Q: Do you see a difference in when the man is the one who is selling or when the woman does?**

In the family, if it is coffee, the man has his, the man has hers, children have theirs. Each member of the family has his/her own coffee.

**Q: How do they decide who owns what?** The man plants his, the woman hers and the children theirs.

**Q: on what land do they plant?** The land belongs to the household head, but they all discuss and decide who should get which land.

When you allocate a certain part to a woman, she will be motivated for work. Ex: had coffee that had been neglected, when he gave it to the wife, they were able to rehabilitate the land. All of the income will support the development of the family. But if she sends it back to her side of the family, there will be problems. The trainings have been very good. Gender training from another org. This has benefitted the group a lot.

**Q: How does deciding where to implement SALM practices work? Is each family member responsible for implementation on his/her land? Or does the family decide to start with one?**

There is no difference, they all work together.

Decisions are made collectively. However, when it comes to implementation, he is unable so his children support him in implementing them.

Each is allocated his/her part of the land. And he/she is responsible for implementing SALM practices on his/her own farm. We bring our income together and buy fertilizers together and focus on all the land. In their group, we can come with the wife. So they are attending trainings together, that really helps with implementation.

**Q: is there anything you want to add?**

Termites are destroying trees, especially the *Grevillea robusta*. How can we respond to this?

### Group ID: G5

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them?**

**Why have you changed them?** There are a number of views in the group. The situation changed because they got training in vegetable growing and now they are growing and eating those vegetables. So now they are having them in their gardens, unlike before. Formerly the situation was ok, but now the vegetables have been drying up which causes them to lose both the harvest and the seeds. Because of dry spells they are no longer getting enough to eat. Vi trained them to use smaller lands to use for e.g. vegetable gardens for home consumption. This way they do not need to go to the market to get vegetables. Now they have climate resilient crops (sweet potatoes, yams, etc.) compared to before when they only grew banana. Vi trainings made them change to these crops. They were trained in how to make wood saving stoves and those stoves can cook a variety of foods. The wood saving stove has allowed people to cook more meals each day and also more kinds of food for each meal as the wood saving stove allows for cooking several different things at the same time (2 or 3 places to put pot/pan). Before, some people preferred to cook fewer meal to save on firewood.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** *(The initial reaction of one woman was to shake her head as she heard the question).* Number of views.

Before Vi, women were not so much involved in the decision making. After gender training, they are cooperating within the family, involving both genders in the production and marketing.

The activities at home are also shared more equally than before, if one is cooking, the other one may to get water. Even other members are copying this outside the group. There the men and women are working separately still.

**Q: How come there are fewer women in this group?** Women somehow are not active in groups.

**Q: If it was a VSLA?** Then it would be a majority of women in the group.

---

### Group ID: G6

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them? Why have you changed them?**

Yes, there has been change. Now they have veg. gardens which allows them to eat vegetables.

Now they eat three meals per day. Lunch usually with veg. They can do this because the production is high, which in turn depends on i) the use of bee keeping and ii) that the soil is now more fertile.

The planting of Calliandra allowed them to keep goats as it provided more and better feed. The goats, in turn, gave natural fertilizer.

They now plant more types of food which leads to a more varied diet.

Their income has increased which gives surplus food. Local climate has changed, the winds are now cooler. Vi supplied them with new varieties of cassava, banana and more. The new varieties are higher yielding and more drought resistant.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?**

Both women and men do about 70% more income generating activities.

Now, they work together, plant together. They work together because of land pressure which has forced them to maximize the land.

They do collective budgeting in the family.

Domestic violence has reduced as a result of the transparency of income that comes with collective marketing. Now the wife knows how much the household earns.

They now have more money for school fees.

Collective marketing gives a price of 5500 per kg of coffee compared to 5000 when sold individually.

Fake seeds and fake herbicides are big problems. A changing climate is also a challenge.

Poor technology in harvesting and post harvesting (drying in tarpoline and storing in bags (in which the moisture increases over time)) are also challenges.

They want to thank Vi for all that they have done for them.

Group ID: G7

**Q1: Which are the biggest changes in your lives since you started to interact with Vi/DFA?**

Since DFA/Vi: have started concentrated on coffee not a lot of other things. This has increased the yields. But still missing other kinds of training.

**Q: Which trainings does he feel like he is missing?**

Has already gotten trainings on agronomic practices (mulching, spacing, digging trenches ditches) Want in future: fertilizer application for coffee. He has planted agroforestry trees which has made the soils more fertile.

**Q: How much have the yields increased as a result?**

Before he planted maize, with low yields. Now he has switched to coffee and the coffee is looking very good. When they have collaborated with VI, the group became strong. The VSLA made them able to pay school fees and so on. However, after some time, many members joined without any basic knowledge. They borrowed and did not want to pay back. This disorganized the group and was due to the fact that they had not gotten any trainings.

**Q: can anyone join the group or are there criteria you have to meet?** The problem was that people joined who were not farmers. They joined, borrowed money for riskier, non-farm projects, and when they failed, they did not pay back. The solution, he thinks, is to have more trainings to strengthen the group.

**Q: Is there some sanction for not paying back the money?** They had the constitution, they should have shares and two guarantors. After time, however, they started giving out bigger loans, diverting from the constitution. This is what brought about the problems. Older woman says she has not seen any change.

**Q: did she join trainings?** The problem is that the trainings they teach techniques that she cannot implement. She has implemented some things.

**Q: Which parts did she implement?** She has been able to plant banana and coffee (intercropping). And she has been able to dig some trenches (her in-law did it).

**Q: so, if she implemented some of them, how come she has seen no change?** The trainings concerning banana and coffee, she implemented. But for the trees, she was not around when they were given out, so she has not planted them.

**Q: But she did not see the yields increase?**

No, because the coffee is not old enough to yield harvest yet. That's why.

**Q: Is there anything you want to add?** For them to attain more benefit from the group, they would need to access input credit from GODFA.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** Since all of them grow and sell the same crop in the same market, they face the same challenges.

**Q: Do they sell individually or collectively?**

They have not started selling as a group. Cassava and sweet potato is sold at farmgate. Maize, beans coffee they either take to the market or buyers find them at their home. At times they get bodabodas or they negotiate with truck-drivers, both women and men.

**Q: are they happy with this way of doing it?**

They are not happy with it, since prices are fluctuating too much for their products. Selling collectively would be an answer, but this would require the VSLA to function well enough so that they can borrow from it to cover school fees and store the coffee to sell when the price is high.

**Q: is there anything they would like to add on this question?** What brings them to sell in small quantity, is that they do not know when to sell and that they have to sell when they think the price is ok, but really it is too low. Collective marketing would help this challenge.

---

Group ID: G8

**Question 1: Have you changed your eating habits (quality/quantity) since you started to interact with Vi/DFA? How have you changed them?**

**Why have you changed them?** We have changed the way we eat. Now three meals per day. We now eat different foods, veg. and fruits. They provided seedlings for fruit trees and so then they can access fruit to eat. On top of seedlings, they also received trainings to increase soil nutrition.

**Q: Have you faced any challenges with SALM?** SALM practices are not challenging them. It helps them. With SALM not any challenges.

**Q: what are the biggest changes that they see?** We can sell more now because soils are more fertile. Pay school fees. Planting trees, coffee and fruits.

**Q: Is eating more or selling more more important?** Having more food and they look healthier. As a first step they take care of their own nutrition, sell surplus.

**Q: Do you sell individually or collectively?** Individually, but will start collectively soon.

**Q: Which crops does the group plan on selling together?** Coffee.

**Q: Where do they sell?** They sell at a coffee hulling machine close by. They have seen that selling together gives higher prices.

**Question 2: Is there a difference in how women/men can get involved in income generating activities (such as selling crops/vegetables/eggs/milk/animals)? If so why?** First of all, they all agree that selling collectively gives equal opportunity. Bulking gets rid of all gender related challenges. Among the challenges women encounter. When she harvests a lot of bananas and will sell at the farm gate. The husband will always request for money, and you have to give him because he owns the land.

**Q: Do you sell at farmgate or in market?** Farmgate.

**Q: Any different challenges when it comes to producing?** The land is too big, investment to produce is big. For women, they may find the land too big and they have to get help to manage. Women spend more time at the farm than men. They have responsibility for the farm. One man says he engages in construction work to bring income. Husband goes to ride a bodaboda, takes the animals out for grazing.