KTDA
Sustainable Agriculture Project

Monitoring & Evaluation the Impact of Training Modalities for Sustainable Tea Production: Rainforest Alliance Training and Farmer Field Schools

Baseline Report

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Content

1. Introduction

This chapter explains the aim of this report and the overall project in which it is embedded. Under the Kenya Tea Development Agency (KTDA) Sustainable Agriculture Project, two streams of activities are undertaken to prepare farmers to enhance sustainability of tea practices and to contribute to sustainable tea value chains (i) Rainforest Alliance (RA) training and certification and (ii) Farmer Field Schools training (FFS). LEI Wageningen UR developed an M&E plan to monitor the training modalities, and to generate data to track the impact of both of these training models. This report is the first report in the M&E cycle and represents the baseline situation in Kenya, e.g. the situation in which the farmers have not yet received training, but the facilitators have. For the RA program, the facilitators are Lead Farmers supported by KTDA extension staff while in the case of the FFS methodology, the facilitators are the KTDA extension staff that will work more intensively with farmer groups.

1.1 Aim of KTDA

In Kenya most smallholder tea farmers are organized through the Kenya Tea Development Agency (KTDA) Ltd and deliver to one of the 63 KTDA tea factories in Kenya. KTDA's mission is to provide effective management services to the tea sector for efficient production, processing and marketing of high quality teas and investing in related profitable ventures for the benefit of shareholders and other stakeholders (KTDA website 2011: http://www.ktdateas.com/). KTDA is constantly on the lookout for new ways to promote smallholder tea production. Certification of tea helps to maintain current markets and tap into new markets and is thus one of the ways KTDA uses to maintain and improve her market share. The RA certification was introduced to KTDA by Lipton (a company of Unilever) who started a sustainable sourcing program for their brands in 2007. Four factories attained RA certification in 2009. Several KTDA factories are certified for Fairtrade (FLO) and another five factories are currently being prepared for the UTZ certification.

Next to tapping into certified markets, KTDA aims to increase production quantity and quality of the tea without harming the environment by promoting better tea production practices. To do this KTDA developed a list of Sustainable Agriculture Good Agricultural Practices (GAP) together with Unilever (see Annex 1). The aim of the GAPs is to increase product quantity and quality, prepare the farmers for RA certification, and to enhance market recognition of responsible farming.

1.2 Aim of Rainforest Alliance

Rainforest Alliance works to conserve biodiversity and ensure sustainable livelihoods by transforming land-use practices, business practices and consumer behavior. Within agriculture this means: Less water pollution**,** Less soil erosion**,** Reduced threats to the environment and human health, Wildlife habitat is protected, Less waste, Less water used, More efficient farm management, Improved conditions for farm workers, Improved profitability and competitiveness for farmers, and More collaboration between farmers and conservationists (RA website 2011: http://www.rainforest-alliance.org/).

The RA label can be used on processed tea products if at least 30% of the used tea is RA certified; however RA obtains commitments to scale up to 100% certified content over time. Smallholders are usually certified as group and not individually for cost and capacity reasons. Auditing bodies check the compliance by examining the groups' internal management system, the processing unit and other infrastructure as well as a random sample of selected farms (usually the square-root of the total number of farmers).

1.3 The Project

This study focuses on the effect of two activities within the KTDA Sustainable Agriculture Project that provide training to prepare for adoption of GAPS and RA certification:

1. Direct training by RA to achieve the RA certificate to achieve the RA Certified Status in a specific set of factories according to market demands.
2. Training through Farmer Field Schools (FFS) in all factories to eventually reach all farmers.

FFS training

Every KTDA tea factory is expected to start a minimum of six FFSs in 2010. FFS are organised by Tea Extension Services Assistants (TESAs) and Field Services Coordinators (FSCs) employed by KTDA. FFS training covers a large range of aspects including, RA principles, GAPs for tea production, empowerment, sources of income, as well as other social and non-social issues. Part of the training is given by the TESAs. Other parts are given by invited resource persons. The FFS approach is based on learning by doing through experiments (PTD), special topic sessions, group dynamic activities, field days and study tours, experiential learning etc.; farmers are not taught which practices are best, but are helped to experiment with different practices and compare the outcomes. The FFS approach has proven to be very effective in the KTDA setting; in the pilot project, farmers got a higher income from tea due to higher product quality (Hiller, Onduru and the Jager, Sustainable tea production: an assessment of farmer field schools in Kenya. LEI. 2009). Product quantity also increased and the four pilot factories were RA certified in 2009.
However the FFS approach is also very intensive and requires much time from the TESA. Consequently this approach needs more time to reach a large number of farmers. Dissemination of knowledge by the FFS farmers ("FFS farmer facilitators") to other farmers in the area can overcome part of this problem. A difference of the current FFS approach with the pilot experience lies also in the possibility to use external resource persons. With only four FFS for tea in Kenya in 2008, people felt honoured to be resource persons and handle FFS special topic sessions. However with an expected 300 FFS starting in 2010 it will become much more challenging to work with external experts, making the extension staff (TESAs and FSCs) and staff in each tea factory the prime source of training to the FFS-trainees.

Training by RA

RA is working with a number of factories, agreed between KTDA and Unilever/Lipton, where all farmers in the catchment area of the factory will be prepared for RA certification within a period of -12 months. The training is given by Lead farmers, assisted by the TESAs and FSCs. Lead farmers are farmers from the same factory with above average tea management capacities who volunteer to support the farmers to prepare for the RA audit. Though the RA-training model aims to reach every single farmer, in the short-term for the concerned factories, the training is limited to applying the Sustainable Agriculture Network (SAN) standard. This approach is less comprehensive, compared to the FFS approach. Due to the requirement for all farmers to be included under the certification and therefore be trained, the training is completed as a one-time effort over the course of just a few months.

The two training approaches have different objectives:

1. The FFS training is designed to deliver comprehensive and participatory training on GAPs, farmer empowerment issues, social and non-social issues, and to initiate collective action activities. As such, the training is more comprehensive than the RA training. The training on the different topics may help with complying with the SAN standard in the future, but will not in itself deliver the requirements for certification. Since much of the curriculum focuses on tea production techniques (e.g. plucking, tipping in). It is expected that productivity and quality will increase on the farms, and that farmers should obtain a higher income.

2. The RA training is designed to help farmers specifically achieve certification. This involves both compliance at farm level and an internal management system at group level to provide training and internal auditing services. Since the SAN standard is based on general good agricultural practices, TA certification should over time increase the productivity of farms. According to Rainforest Alliance, a higher market demand for certified products may translate into higher tea prices, which should get passed on to farmers. The combination of these two elements makes Rainforest Alliance believe that the trainings and certification will also lead to higher farm incomes over time.

It is expected both training models are effective for meeting the standards for RA certification. However, it is also expected that the RA training will translate in less knowledge by the farmers involved than the FFS model, e.g. on the ecological and agronomical reasons why they should implement the sustainability practices. On the other hand, more farmers will be (directly) reached by the RA trainings. It is an open question, which of the two models leads to more adoption of the sustainable good practices in tea.

1.4 Aim of the study

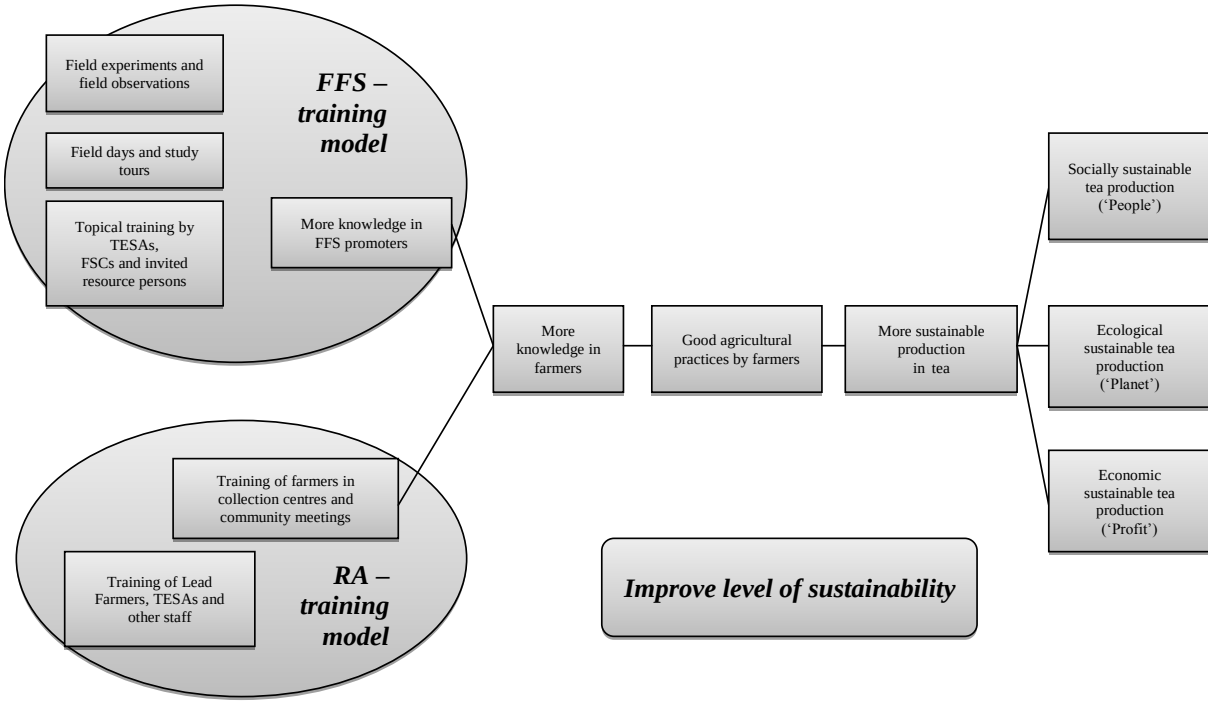
The objective of the study is to collect baseline information and to analyse the impact of differing training modalities on GAPs, by:

a. Measuring the outcomes of the respective training models (RA & FFS) on farmers' livelihoods (knowledge levels, sustainability practices and income from tea).
b. Testing the assumptions in the logic models that provide the rationale behind the two training models.
c. Assess the 'trickle-out'-impact of training of FFS farm leaders on surrounding farmers

The study further aims at providing baseline information to compare with a future situation and to test for initial differences between the groups ('selection bias').

1.5 Logic Model

The rationale ('program theory') behind the two training modalities can be depicted in a logic model with two models of training aimed to change agricultural practices. One strategy is the RA training with special emphasis on those practices that are required for RA certification and compliance with SAN standards. The other model is based on a more intensive FFS training with a broader impact on good agricultural practices besides those which are required for RA certification.



1.6 Research design

Data was collected for the baseline and will be collected for a second time after one year of training to evaluate the immediate impact of the training. The questionnaire used can be found in annex 2. During the impact evaluation we will first compare the comparison group near and far. If they do not differ significantly we use the whole comparison group. If there is a significant difference this can be due to the proximity of the FFS. In this case we will use only the comparison group far as a comparison group for the analyses.

The impact of the training is assessed as the change in the selected indicators over the time period of the project taking into account the change in indicators without the project (see formula below). The latter is established as the change in the indicators for farmers that produce under the same circumstances but have not participated in training. To do so, differences in group characteristics due to non-random assignment (sample selection bias) will have to be controlled for.

$$Y_{1,2,\ldots,n} = \left(X_{U,t} - X_{U,t-1}\right) - \left(X_{n\text{-}U,t} - X_{n\text{-}U,t-1}\right)\Big|_{Controlled\ for\ selection\ bias}$$

Where;

$Y_{1,2..n}$	Are the indicators selected for establishing the impact. For instance; the quantity of production per tea bush, time spend on tea production, the average quality of the tea, number of other income generating activities and self-assessed welfare, the scores achieved on audits performed by Africert (the auditing body) in the process of certification. Africert's audits measure the compliance with 10 principles of the SAN standard (which is RA designed).
$X_{U,t}$	Value of indicator for a farmer after training (t=1)
$X_{U,t-1}$	Value of indicator for a farmer before (t=0) training
$X_{n-U,t}$	Value of indicator for an untrained farmer on moment t=1. (comparison group)
$X_{n-U,t-1}$	Value of indicator for an untrained farmer before (t=0) training (comparison group)

The tables presented in this report give average, median and sometimes minimum and maximum values. Significant differences are described below the tables, using a confidence interval of 95% indicating that there is only a 5% chance that this difference registered in the sample has happened by chance. Significance depends to a large part on the variation within the group.

1.7 Outline

In chapter 2 the characteristics of the interviewed farmers will be described with special focus on the training they have followed so far. In chapter 3 we describe the knowledge level of the different groups of farmers (block 2 and 3 in the logic model) on good agricultural practices. In chapter 4 we analyse the implementation of key sustainability practices by the farmers (block 4 in the logic model). In chapter 5 we focus on input use in tea production (block 4 in the logic model), as efficient input use is an important part of this implementation. In chapter 6 we analyse the production level of the farmers (block 6). In chapter 7 we analyse the livelihood aspects and how satisfied the farmers are with them (Block 6). In chapter 8 we draw some conclusions from the analysis of the baseline information and describe the most important aspects to be considered in the subsequent indicator monitoring exercise.

2. Descriptive statistics

2.1 Household characteristics

The interviewed farmers supply to four different factories. See Table 2.1 for distribution of selected farmers over these factories. Firstly, a distinction was made between A) East of the Rift Valley and B) West of the Rift Valley, due to spatial differences. Secondly we selected 1) farmers that will be trained directly by Rainforest Alliance to prepare for certification and 2) farmers that will be trained through the farmer Field School system. In factories selected for FFS (Ndima and Litein), the farmers were selected from two buying centres. Similarly for factories selected for RA (undertaking both RA and FFS activities), farmers were selected from two buying centres within the factories where there are no FFS activities. In the factories where farmers will be trained directly by RA, no comparison group of untrained farmers is available within the same factories. The scores of the trained farmers are considered to be representative of the whole community of farmers on the factory catchment. In the factories where only selected farmers will be trained through FFS, the impact on these farmers are most probably higher than the impact in the average farmer in the area of the factory. To generate a representative group of farmers, we also selected control farmers. And, as one of the aims of the FFS is dissemination of knowledge we split the group of control farmers into two different groups that can help us assess the impact of FFS 'trickle-out': a) farmers in the same buying centre (collection area) as the FFS and b) farmers from other buying centres.

Table 2.1 Distribution of farmers over factories

Number of interviews	**RA training sites**		**FFS training sites**		
East of rift valley	Factory Kinoro	60 farmers to undergo RA training	Factory Ndima	58 FFS farmers	178
				30 control farmers near	
				30 control farmers far	
West of rift valley	Factory Nyankoba	60 Farmers to undergo RA training	Factory Litein	58 FFS farmers	178
				30 control farmers near	
				30 control farmers far	
		120		236	**356**

The enumerators are asked to speak to the person in the household who was more knowledgeable on tea production. Table 2.2 shows the distribution of respondents by gender and position in the household. More than one third (38.2%) of the respondents are female. In more than 60% of the cases the enumerators interviewed the household head and in nearly 30% of the cases the spouse. In a few cases one of the children was interviewed or another person who was more knowledgeable or in charge of the tea.

Table 2.2 Gender and position in the household

	Female	*Male*
Hh head	32	208
Spouse	97	7
Child older than 18	4	2
Other	3	3

2.2 Earlier Training

Although this report is a baseline report for the coming training the situation is by no means a situation where farmers have not received previous training. Farmers have received quite a lot of training from different sources. 59% of the farmers have followed training in the last year alone. Of the 31% who didn't follow training, the following reasons where given; 22% said that no training was offered, 8% did not have transport or other resources to attend training and 12% was not interested enough by the topic or did not have time to attend the training. This shows that 78% of the farmers were offered some kind of training in the last year indicating that this is a group with a history of training in production and management (primarily by the factory and government) where both direct training and FFS-training can build upon. As the history of training can be different per factory, and this can influence our assessment of impact, we analyze the 'start-up' differences between the different groups.

Table 2.3 Training followed and training providers

Topic	*Number of farmers who followed training on this topic*	*Training providers*
Crop production training	148 (42%)	Factory (64%), Government (24%) NGO (9%) Don't know (3%)
farm management skills	119 (33%)	Factory (75%) Government (15%) Don't know (10%)
health and safety	117 (33%)	Factory (23%) Government (33%) NGO (38%) Don't know (7%)
Chemical application	116 (33%)	Factory (84%) Government (8%) Don't know (8%)
Other training	30 (8%)	Factory (40%) NGO (20%) Don't know (40%)

Most farmers who followed training attended several training occasions. One third of the farmers attended only one training and 4% attended more than 5 training meeting in the last year. Table 2.3 shows the topic of the trainings followed and who provided the training. The trainings most often followed are 'cover crop production', 'farm management skills' and Health and safety'. The factory is the main provider of training for all topics except 'health and safety' which is often offered by NGO's. In

many cases the training is offered by multiple providers. The factory for instance sometimes invites someone from the government to give a training.

Table 2.4 Training per factory

		Kinoro	*Litein*	*Ndima*	*Nyankoba*
Crop production	No	40%	42%	71%	85%
	Yes	60%	58%	29%	15%
Health and safety	No	68%	63%	69%	70%
	Yes	32%	37%	31%	30%
Farm management	No	33%	61%	83%	78%
skills	Yes	67%	39%	17%	22%
Safe handling of	No	32%	64%	88%	68%
agrochemicals	Yes	68%	36%	12%	32%
Other training	No	87%	92%	92%	93%
	Yes	13%	8%	8%	7%

Table 2.4 shows quite some difference between the factories and the training topics that were followed. The following section describes only the differences between the factories that are statistically significant.

- *Crop production*: Farmers in Litein and Kinoro have followed more crop production training than Ndima and Nyankoba.
- *Farm management skills*: Farmers in Kinoro have followed significantly more farm management skills training than all other factories. Farmers in Litein have followed more farm management trainings than farmers in Ndima.
- *Safe handling of agrochemicals*: Kinoro farmers have followed more training on this topic than farmers from any other factory. Farmers from Litein and Nyankoba on their turn have followed more training of safe handling of agrochemicals than farmers from Ndima.
- *Health and safety*: No differences between the factories
- *Other trainings followed*: No differences between the factories

This leads to the conclusion that Kinoro Factory (East of Rift) and Litein (West of Rift) seems to have received relatively more training in the year prior to this study compared to other factories in respective Regions. Kinoro had an earlier start with RA and FFs, but trainings were still at infancy stage by date of baseline study. Some remarks about the implication of this for future inferences on training impact:

1. Kinoro has different buying centres within the factory. Only buying centres without FFS were selected. Two suitable buying centres were found. Thus the presence of FFS in *some other* Kinoro buying centres will not confound the analysis.
2. Kinoro has started RA activities two months up front, prior to data collection, while Nyankoba started one to two weeks prior to data collection. The study therefore wanted to capture if farmers interviewed had heard about RA in the selected buying centres. As Kinoro started the implementation earlier, data for Kinoro might show some noise that will be factored in the interpretation.
   Similarly, farmers chosen for FFS interviews have been those who had some awareness on FFS and formed a group already. But again, with an implementation of the FFS curriculum at infancy stage.
3. Overall averages between East- and West of Rift sites, nor between factories with RA-trained and FFS-trained farmers, do differ significantly in terms of trainings received in the past one year prior to this study.

4. This study of specific farms and their extension environment can never take place in a "zero-control" situation. As well in the pre-project phase as in latter phases, farmers from any of the four farms can be considered to have received any kind of training. The study cannot assume that impacts to be measured can only be attributed to the FFS/RA activities.
5. For every factory we may measure changes/impacts if the survey is repeated at the end of the project period. "Difference in Difference" approach, comparing these changes with changes of the comparison group, may need additional parametric statistical analyses to control for some of the above issues of selection bias.

3. Farmer knowledge base on Good Agricultural Practices

The logic of training for certification assumes a positive link between training and knowledge of farmers, and between knowledge and implementation of practices. The RA certificate is issued when farmers and the factory have implemented the minimum requirements. This chapter analyses the knowledge level of the different farmers in the different groups to create a baseline of existing knowledge for estimating impact.

3.1 Knowledge questions

The farmers were asked 15 questions on sustainable production. The questions covered topics on good agricultural practices and are part of both RA and FFS training. The farmers scored points on each question by the amount of pre-defined correct answers. Often the questions were multiple response type and gave different (sets of) motivations for the particular sustainability practice.

We compiled one construct for 'knowledge on good agricultural practices'. To derive this, a gross average was taken of all the 15 questions. The answers on each question were recalculated so that the maximum score on each question was 10. Table 3.1 shows these score on the different questions.

Table 3.1 Knowledge questions related with good agricultural practices in tea

	SAN relevance	*Mean*	*Median*	*Minimum*	*Maximum*
The best height for tipping-in tea	No	8.3	10.0	0	10
The main benefits of infilling	No	6.8	5.0	0	10
Benefits of maintaining a plucking table	No	6.1	5.0	0	10
Benefits plucking frequency 7-8 days	No	5.4	6.7	0	10
Benefits fertilizer	No	5.1	5.0	3	10
Dangers agro-chemicals and water	Yes	4.9	3.3	0	10
Methods to improve yield and quality	No	4.8	5.0	0	10
Reasons to prune tea	No	4.8	3.3	0	10
Reasons not to remove prunings from field	Yes	4.8	4.0	0	10
Benefits PPE	Yes	4.7	5.0	0	10
Benefits of soil conservations methods	Yes	4.4	5.0	0	10
Methods to handle weeds in your tea	Yes	4.1	5.0	3	10
The benefit of a riparian strip	Yes	3.3	2.5	0	10
Best pruning height	No	3.2	3.3	0	10
Reasons to not use agrochemicals in tea	Yes	3.2	4.0	0	8

The questions are ordered according to the level of the score. The average score for knowledge on the best tipping-in was highest of all questions. Questions on the benefits of infilling and benefits of maintaining a plucking table also score higher than 5.5. All the other questions scored lower. As the logic model states farmers first have to know the benefit of a practice before they will apply it. Table 3.1 shows that the knowledge on many of the practices is insufficient. There is a lot of room to improve knowledge which is expected to lead to increased implementation of GAPs and thus a more sustainable production.

3.2 Knowledge score

The knowledge score constitutes the average on all 15 knowledge questions. The higher the score the more knowledge the farmer has on the questions presented in section 3.1. For further analyses during impact evaluation, we present the baseline knowledge indicator for each of the four groups: Farmers who will be trained by RA, farmers who will be trained by FFS and the comparison group farmers split up in farmers near to FFS and further away from farmer field schools. The comparison group is split to test if farmers near to the FFS benefit from the knowledge of the FFS farmers.

Table 3.2 knowledge score comparing different groups

	Mean	*Median*	*Minimum*	*Maximum*
FFS farmer	4.89	4.53	2.04	9.09
RA farmer	5.22	5.23	1.73	7.88
Comparison group near	4.31	3.96	1.08	8.59
Comparison group far	4.95	4.68	2.43	8.16

Table 3.2 shows the knowledge score per group to see if it is necessary to control for difference in baseline knowledge between the different groups of farmers. The results show that all groups of farmers can make a large improvement during the coming period. There is one significant difference when all groups are compared (using One-Way ANOVA): Farmers to undergo RA-training score significantly higher on the knowledge score than the comparison group near farmers. The differences between the other groups are not significant at a confidence interval of 95%. This has to be taken into account during future analyses. Very informative is the fact that the FFS farmer at this moment do not have significantly more knowledge than the comparison groups.
As mentioned above, it is also possible to merge the two comparison groups into one comprehensive comparison group. Thus, there are just three different groups to compare. Among these three groups there is only one significant difference: The comprehensive comparison group scores significantly lower on the knowledge questions than the RA farmers.

Table 3.3 Knowledge score comparing different factories

	Mean	*Median*	*Minimum*	*Maximum*
Kinoro	5,71	6,14	1,73	7,88
Litein	4,53	4,52	1,08	7,49
Ndima	5,00	4,33	2,04	9,09
Nyankoba	4,74	4,55	3,40	7,00

To know more about the source of these initial differences between the farmers on the knowledge of sustainable tea production, we explored the differences between the factories. Table 3.3 shows the knowledge score per factory to see if it is necessary to control for difference in baseline knowledge between the factories. There is one important significant different between the factories: Kinoro scores significantly higher than all other factories. Kinoro and Nyankoba are both factories where farmers will undergo RA training, so this confirms that the specific characteristics of the location in Kinoro might be the reason that farmers that are/have been undergoing RA training score higher than the other farmers. As table 2.4 shows Kinoro farmers have followed more training in the last year than all other farmers

which can explain the difference in knowledge. This aspect has to be taken into account during the future analyses. Annex 3 shows the score on the different questions for the different groups. It shows that Kinoro scores higher (or the same) than average on knowledge of all practices except, the best height for tipping-in and methods to handle weeds in tea.

3.3 Dissemination of information

If farmers share the information they have gained during training or experiments with the people around them, information has a much larger reach than if people do not share information. Stimulating the sharing of information is an explicit goal in FFS training. We collected information to assess the extent to which knowledge sharing is improved as a result of the training sequences. At the moment 74% of the farmers indicate they shared information on good practices with their neighbours in the last year. 7% indicate that their neighbours share information with them on a daily basis. 17% indicates that they receive information from their neighbours on a weekly basis, 39% share information on a monthly basis. 12% of the farmers state that other farmers share information with them on a yearly basis and 25% indicate their neighbours never share information with them. Both sharing information with neighbours and receiving data from neighbours are expected to improve, especially as a result of the FFS training.

4. Sustainability practices

4.1 Introduction

Where chapter 3 showed the *knowledge* of the farmers this chapter goes one step further in the logic model (chapter 1) to present the resulting *practices*. The indicators are developed to measure the practice; or how sustainable the farmers act**.** None of the farmers have received FFS or RA training so far, except Kinoro that had an early start but was still at infancy stages of training during the baseline study. As explained in the former chapter, as a result of history, knowledge by preceding training may have created difference in knowledge on sustainable tea production between the groups of farmers and factories. In this chapter we will explore if there are also differences in the practices implemented. We hope that all groups score the same on the sustainability practices indicators, so we can use the base-line averages to assess impact in the future.

This chapter presents the sustainability practices of the farmers on the different indicators and shows where there are differences between the groups, at the end of the chapter we show the average scores on the sustainability indicators.

4.2 Scores on the different sustainability indicators

Table 4.1 presents how the farmers score on the different sustainable practices. The questions on GAPs that are most implemented are presented at the top. The median is used for comparison here. The further down the list, the lower the score on the questions on the implementation of these practices. All the questions are relevant to FFS, but only some are related with the SAN standards and included in RA training. See Annex 4 for the questions, answering options and the respective scores. Differences between the farmers selected for RA or FFS school training and the comprehensive comparison group are also investigated and represented in table 4.1.

Table 4.1 Scores on the different indicators (1.0= maximum score)

	Relevant to SAN?	*Mean*	*Median*	**Difference groups?**
Production indicators (Profit)				
How often do you prune the same tea plot/block?	No	0.96	1	No
When do you prune your tea?	No	0.86	1	No
What is the % of crop cover?	No	0.84	1	Farmers who will be trained by FFS score higher than farmers to be trained for RA
What height do you tip in?	No	0.76	1	No
At what height do you prune?	No	0.61	1	No
Who prunes the tea and have they been trained?	No	0.54	1	Farmers selected for RA score significantly lower than all other groups
How frequently do you apply fertilizer?	No	0.54	1	No
Do you use a plucking stick or wand and is the table firm?	No	0.48	0.8	Farmers selected for FFS score higher than the other groups
How often do you pluck a plot per month?	No	0.62	0.7	No
What tools are used to prune your tea?	No	0.52	0.6	No

What is the success rate of your nursery?	No/Yes	0.54	0.5	RA farmers score significantly lower than farmers that will not be trained
When do you plant VP plants?	No	0.49	0.5	RA farmers score significantly lower than the other two groups
Do you experience leaf spillage?	No	0.43	0.3	Farmers to be trained for FFS score significantly higher than farmer to be trained by RA
Do you keep records?	Yes	0.28	0	RA farmers significantly more often keep records than the two other groups
How often do you apply composted manure?	Yes	0.13	0	RA farmers score significantly better than the two other group
Social indicators (People)				
Do your workers have access to potable water and latrines?	Yes	0.83	1	No
Do you turn to KTDA if you experience any problems in your tea?	No	0.82	1	No
Do you have a fixed agreement with employees?	Yes	0.77	1	Farmers to be trained by RA score significantly lower than the other farmers
Do you group together with others farmers to carry out activities?	No	0.75	1	No
How often did your family or workers need medical attention?	Yes	0.75	1	Farmers who will be trained by RA score significantly higher than the other groups
Are your local suppliers reliable?	Yes	0.6	1	No
Do your children go to school?	Yes	0.76	0.8	Farmers selected for RA training score significantly lower than the two other groups
Who plucks your tea?	No/Yes	0.64	0.8	No
Do you use any personal protective equipment (PPE)?	Yes	0.3	0.5	No
Do you use locally manufactured farm inputs/ implements?	Yes	0.23	0	No
Environmental indicators (Planet)				
When do you apply fertilizer to your tea?	Yes	0.91	1	No
How do you spray?	Yes	0.89	1	Farmers to be trained for RA score significantly higher than other groups of farmers
Do you collect prunings from the field?	Yes	0.84	1	No
Do you infill open areas?	No	0.67	1	Farmers to be trained for RA significantly less often infill open areas than the other groups
Do you have indigenous trees on you farm; if so how many?	Yes	0.49	0.6	Farmers selected for RA score significantly higher than the other two groups
What is your main source of energy for domestic purposes?	Yes	0.62	0.5	Farmers to be trained for RA score significantly lower than the comparison group
How many eucalyptus trees are growing within 10 meters of your stream?	Yes	0.58	0.5	FFS farmers score significantly higher than farmers to undergo RA training
Does your farm border a river or water body? If so, do you have a riparian strip?	Yes	0.47	0.5	No
How do you manage household waste water and effluent from livestock?	Yes	0.4	0.5	RA farmers score significantly higher than the two other groups
What is your main source of water for domestic use?	Yes	0.51	0.4	No
How much area of the total farm is conservation area?	Yes	0.49	0.4	No

If all farmers adhere to the best practice both the average and median score should be 1. All indicators with a median average of 1 indicate that at least 50% of the farmers already implement this best practice. In some indicators the possible values are only one or zero, increasing the likelihood to get a median of one. The average shows how much improvement is still possible. Indicators with a median lower than one show that most farmers do not yet use the best practice. Indicators with a median of zero show that most farmers do not implement the practice.

4.3 Indicators where most impact can be expected

Based on the sustainability scores we identified 9 indicators where most impact of training can be expected. We will follow-up all sustainability practices in future monitoring but present these 9 in this report with more detail. The selection of these nine indicators was made considering the expected usefulness to track impact due to training and farmer action and the importance of the indicator for signalling improved sustainability practices. As could be expected in a baseline, we did not yet detect any significant difference in sustainability that might exist between the comparison group near and far. Therefore this distinctions in not made in the analyses below; they are grouped into one group 'non-trained farmers'.

We grouped the questions in three 'blocks' that represent sustainability practices most related with intended impacts in production ('profit'), most related with intended impact in the environment ('planet') and those most related with impacts in social wellbeing ('people'). Later on, after further monitoring surveys, this enables us to present in the future attractive spider-maps where changes between groups can be observed 'in one glance'.

4.3.1 Profit: economic sustainability practices

We selected three indicators for 'profit'-related sustainability practices, based on the importance on these indicators, the usefulness of the question and the possible increase on the outcome.

Figure 4.1 Application rate composted manure

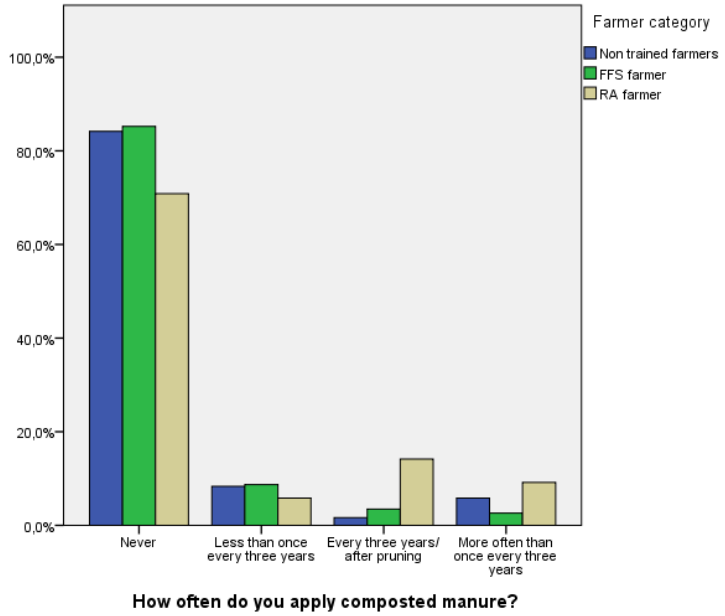
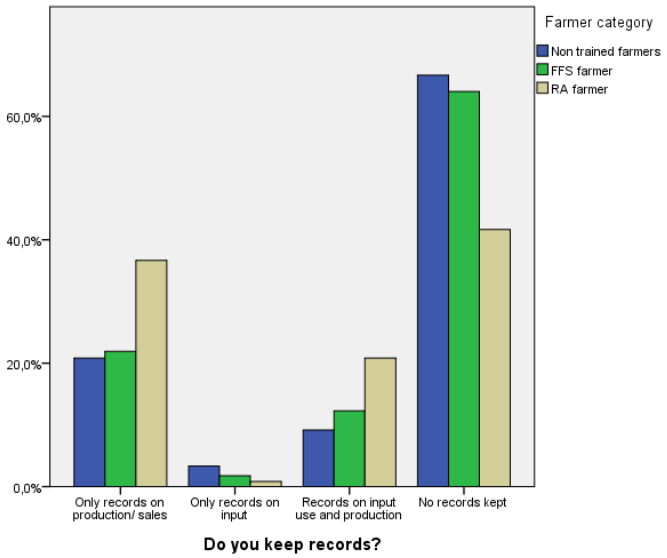


Figure 4.1 shows the application rate of composted manure for the three different groups of farmers. Ideally farmers apply composted manure after every pruning. Pruning is recommended every three years. However the figure shows that only very few farmers apply manure at all. RA farmers score significantly

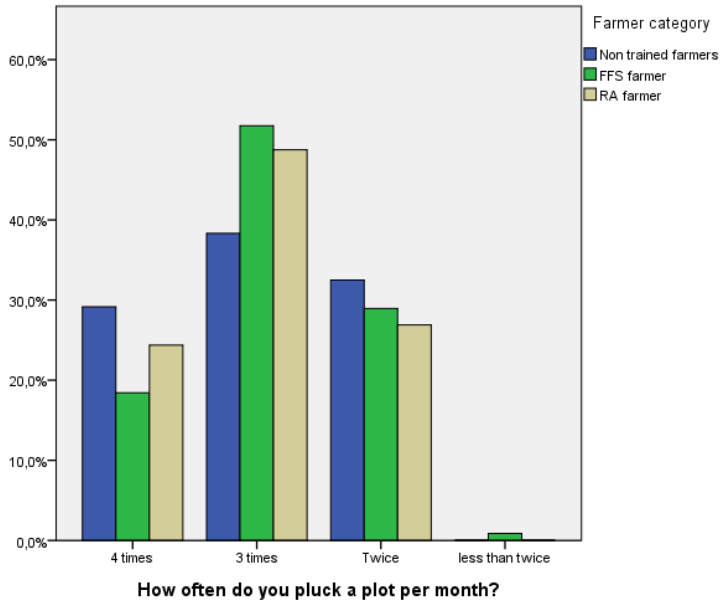
better than the two other groups, but their overall score is still very low. This figure gives an interesting starting point for training in the coming years; a lot of progress can be made here.

Figure 4.2 Record keeping



Record keeping is important for the learning and understanding of the farmer and requisite for RA certification. Especially when applying new practices the farmer needs to be able to see the change in outcome by keeping clear records on inputs and output. Farmers selected to undergo RA training more often do keep records on production and sales than the other groups. But in general, most farmers do not keep any records at all. A lot of progress can be made on this issue.

Figure 4.3 Plucking frequency



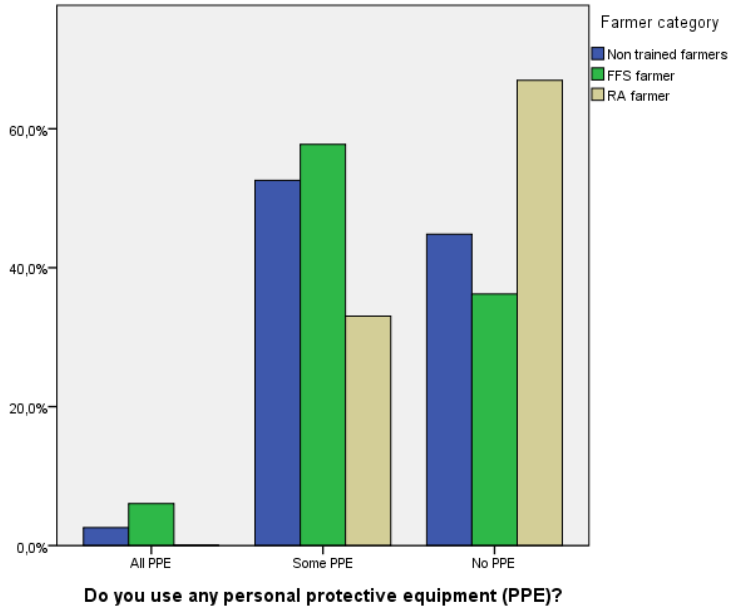
A higher plucking frequency increases the quality and quantity of production as younger leaves (two leaves and a bud) are plucked and less tea leaves need to be thrown away. In the most productive months a plucking frequency of 3 to 4 times a month is considered the best practice. As the figure shows, approximately 50% pick three times a month and around 25% plucks four times a month. Approximately

30% pluck only twice a month. We expect that the training will convince farmers of the benefits of a higher plucking frequency. Although the figure demonstrates differences in the implementation of this practise between the three different groups, these differences are statistically insignificant.

4.3.2 People: social sustainability practices

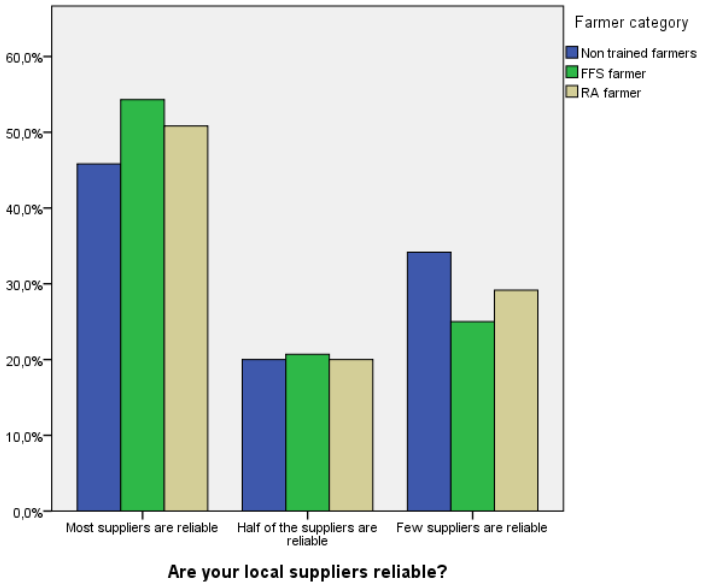
Social indicators are difficult to monitor. We selected two indicators for good agricultural practices linked to social sustainability, based on the importance on these indicators, the clearness of the question and the expectation to track impact with it. Based on the outcomes of the analyses the two indicators below deserve special attention.

Figure 4.4 Usage of Personal Protective Equipment



For tea production the use of gum boots and an apron is prescribed. One of the requirements of the RA program is that no agrochemicals (including fertilizers) should be applied without protection. As Rainforest Alliance only certifies if farmers adhere to this practice in all relevant activities in their entire production system (i.e. the scope of the RA program is the whole farm), all tea factories encourage farmers to have full PPE sets. This question thus refers to the whole production system; this included for instance wearing a mask when spraying the cows. Only few farmers indicate using all PPE and, in general, nearly 50% indicate using no PPE at all. A lot of progress can be made here in the coming training.
As the figure demonstrates, farmers to be trained for RA score the worst for this indicator. The percentage of RA farmers not using PPE is significantly higher than the percentages for the two other groups. Simultaneously, a lower percentage of farmers to be RA trained indicated that they use some PPEs.

Figure 4.5 Reliable local suppliers (relationships)

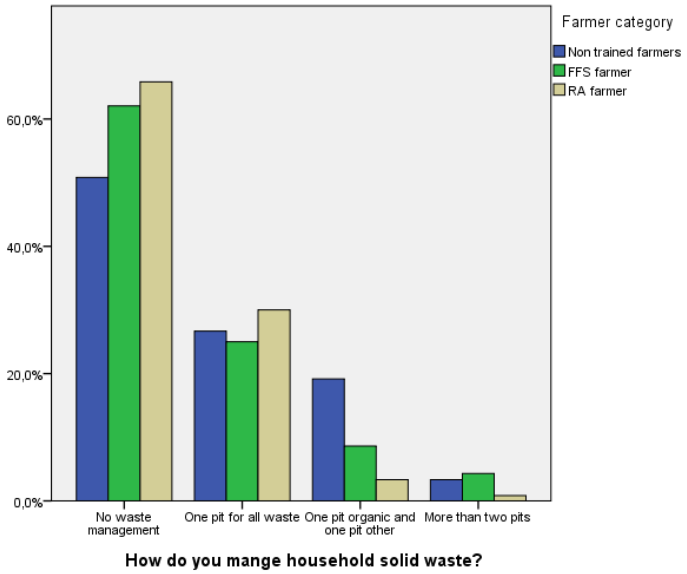


Relationships and trust are important prerequisites for building sustainable (trading) relationships as it reduces transaction costs and thus increases efficiency. Relationships are always two-way processes so training from only the farmers will have only a minor impact 50% of the farmers indicate that most suppliers of Inputs of plants, fertilizer, credit are reliable. In general, 20% feel only half of their suppliers are reliable and 30% indicate that only 30% of the suppliers are reliable. There are no significant differences between the three groups, as is indicated by figure 4.5 as well.

4.3.3 Planet: environmental sustainability practices

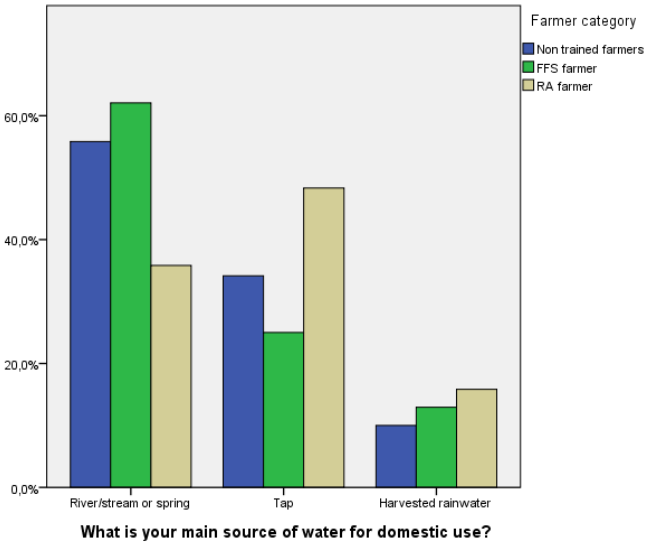
We selected four indicators for good agricultural practices related with environmental sustainability. Environmental aspects are very important for Rainforest Alliance which motivates for an increased attention to identify proper Planet indictors.

Figure 4.6 Management of household solid waste/ waste pits



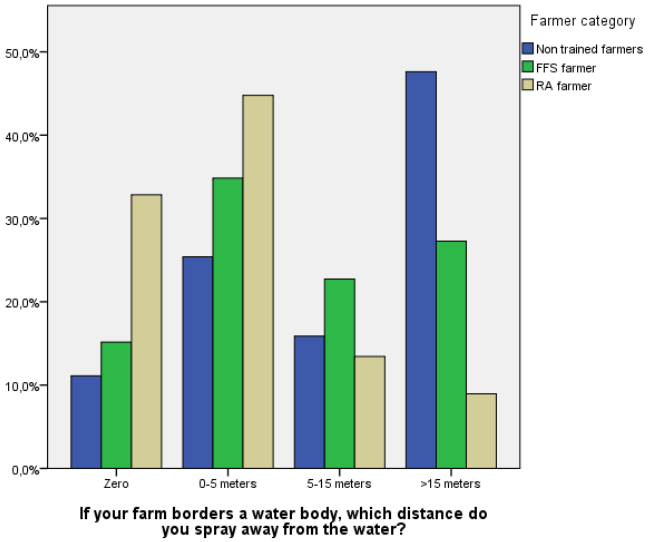
According to the Rainforest Alliance standard, farmers have to manage three main waste streams; one for organic waste, one for polythene papers and one for empty chemical containers (in farms that use chemicals). Waste is seldom collected at the moment, but different stakeholders are looking for opportunities to do so in the future. Farmers are encouraged to collect their waste in a waste pit and separate organic waste to create compost. The figure shows that 55% of the farmers have no waste pit at all. The waste is spread over the area around the house and maybe sometimes swept together and burned (Rainforest Alliance discourages the burning of waste). 30% of the farmers has one pit to collect waste and do not separate organic from inorganic waste. About 10% of the farmers do separate; however this number should increase significantly over the coming years. Training on responsible waste management strategies needs to be considered.

Figure 4.7 Main source water for domestic use



The most sustainable source of water for domestic use is harvested rainwater. This is not only best for the environment, but also cheap, cleaner, and easy for the farmers to source. Where available, tap water is, of course, a good way of provisioning. Collecting water from rivers or streams takes farmers' time and effort and the water is often contaminated. Overall, 50% of the farmers rely on rivers and streams for their domestic water however. The awareness on the benefits of harvested rainwater may increase the use of this option, and will be monitored. We expect a difference according to the factory as this is an issue in which the factory can provide subsidies or other stimulants.
There are some significant differences between the different groups of farmers as well. Rivers, streams and springs are less used by farmers to be trained for RA; the farmers intended to be trained for RA significantly use tap water more than farmers to be FFS trained as main source for water.

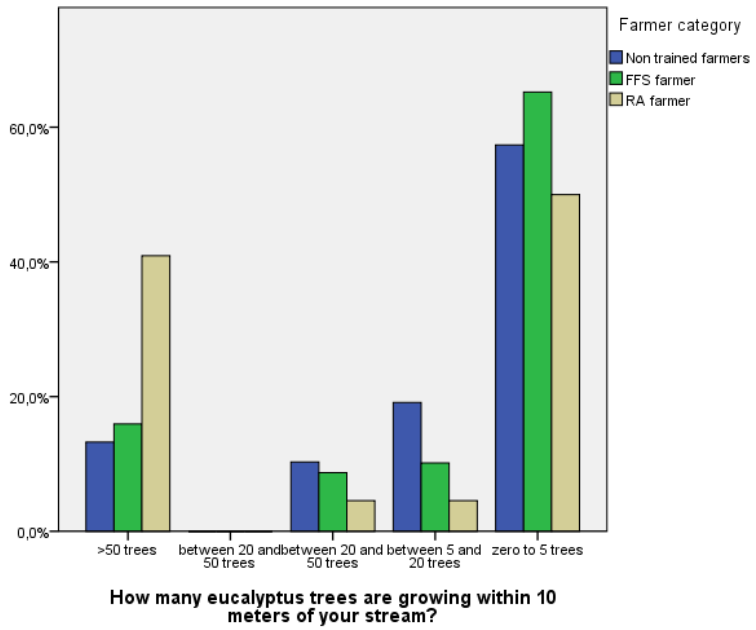
Figure 4.8 Spraying distance to water



To prevent chemicals from reaching water bodies it is important to keep 15 meter distance between chemical application and the water body. Farmers are often not aware of the negative effects of chemical application and the risks of chemicals leaking to the natural water bodies. For 45% of the farmers the questions is not applicable as their land does not border a water body. About 55% of the

farms border a water body. Of this last group, a share of 28% spray at a distance of 15 meters. There is however a large variation here between the different categories of farmers. The farmers who will not be trained seem to better in keeping the correct distance. The difference is significant between the farmers who will not be trained and the farmers to undergo RA training. Also the farmers to participate in FFS significantly keep the correct distance better than the farmers to undergo RA training. A lot of improvement needs to be made on this point, especially considering most farmers source water from rivers and streams.

Figure 4.9 Number of eucalyptus trees in proximity of streams



Eucalyptus trees grow fast and provide the farmers with a lot of wood. However they have an almost inexhaustible thirst for water. Planting Eucalyptus trees in and near river beds reduces the water streams enormously. Clearing eucalyptus trees is one of the measure that increase water in the rivers. Certified factories mention this practice as an important benefit to the households livelihoods. Although a large part of the farmers indicate they have less than 5 eucalyptus trees in the proximity of the river a lot of progress can still be made.

4.4 Overall sustainability

Figure 4.10 shows the average score for the three different groups of farmers on People, planet, Profit questions. As the lines are very similar, the averages are also presented in table 4.4.

Figure 4.10 Average score on PPP for the different groups

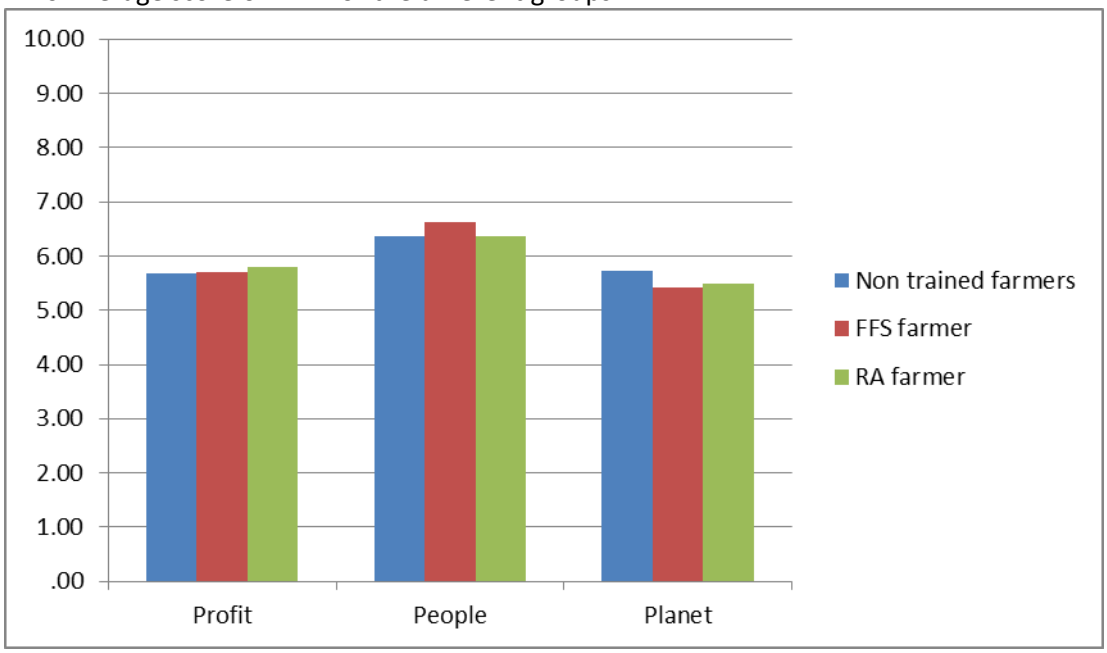


Table 4.2 Average score per group per sustainability aspect

	Non trained farmer	***FFS farmer***	***RA farmer***	***Overall average***
Profit	5.69	5.70	5.81	5.37
People	6.37	6.62	6.37	6.45
Planet	5.71	5.42	5.48	5.54

Both Figure 4.10 and Table 4.2 show there is quite some room for improvement, as the average scores on the social, environmental and economic indicators are between 4.9 and 6.6 on a scale from 0 to 10. The three different groups score similar averages. There are no significant differences between the different farmer groups on the three sustainability aspects.

5. Input use

5.1 Introduction

Good Agricultural Practices are based on the notion of minimising the impact of tea farmers on their environment. This means a prudent use of inputs and using only those inputs prescribed by the factory. In this chapter, we analyse which fertilizers are used, which chemicals are used and the amount of labour and other inputs used by the farmers. We also analyse the costs of the inputs used to construct tea income in the following chapter.

5.2 Fertilizer

Table 5.1 fertilizers used by farmers on tea

	Frequency	*Percentage*	*Kg per bush*
NPK 26:5:5	260	73,0	.09
NPK 25:5:5	90	25,3	.09
NPK 10:26:10	1	,3	.04
NPK 26:0:0	1	,3	.05
No fertilizer	4	1,1	.00
Total	**356**	**100**	

The KTDA recommends the use of NPK 25:5:5. Table 5.1 shows the fertilizers applied by the farmers. All farmers use NPK. 73% uses NPK 26:5:5, 25% uses NPK 25:5:5. We may assume that farmers refer to the same product, covering a total of 98%. Only two farmers use another NPK mixture and four farmers could not report any type of fertilizer used. There is a large variation in the quantity of fertilizer used per bush. The factories recommend the use of 1 bag of NPK per 700 bushes (0.07kg per bush). These figures show that the farmers use slightly more NPK than recommended.

Table 5.2 Cost of fertilizer application

	Mean	*Median*	*Minimum*	*Maximum*
Total fertilizer costs	6080,90	5400,00	1750,00	57600,00
Fertilizer costs per bush	3,12	2,88	,45	12,00

The 352 farmers that apply fertilizer spend a median of 2,9 Ksh per bush of tea on fertilizer.

5.3 Organic fertilizer

Organic fertilizer is widely available and does not negatively affect the environment as chemical fertilizers do. Therefore, the use of organic fertilizer is recommended. It is the recommendation to apply composted manure once every three years after pruning. More frequent application can lead to soils becoming more alkaline (high PH) which is not conducive for tea growing. Only 66 (18,5%) farmers used manure on their tea fields in the last year. However it is common for farmers to prune just a share of their bushes each year. The next year, they will prune other parts of their fields. Because it is assumed that manure is used on the pruned parts, you would expect them to use manure each year too. A lot of improvement can thus be made on this indicator. As manure is mostly used from the own farm, cash expenses are considered to be zero.

Chemicals

KTDA prohibits the use of chemicals on tea. The tea growing conditions in Kenya are almost ideal and attack by pests and diseases are not of significant economic importance. Application of agro chemicals is expensive and not much output can be gained by applying them. Hence KTDA has banned the use of chemicals by smallholders. Estates are only allowed to use chemicals against grasses on the field edges.

Table 5.3 Chemical used by farmers on tea

	Frequency	*Percentage*
Round-up	61	17,1
Touch down	11	2,6
Mamba	4	1,1
Weed Out	2	,6
Glyweed	1	,3
Weedall	1	,3
No chemicals	200	78,1

22% of the farmers use some kind of chemical. 6.2 % use two different types of chemicals. Table 5.3 shows the names of the main chemicals used by the farmers. Round-up is the most used chemical. It is a herbicide with the active ingredient glyphosate. Touch down, a herbicide, is used by 11 farmers and Mamba is used by four farmers, both are also herbicides with glyphosate as active ingredient. The other products also seem to be glyphosate-based herbicides. Glyphosate is generally applied on weeds on the sides of the tea plot, not for spraying on the tea crops. The farmers who use chemicals spent a median of 0,37 Ksh per kg of produced tea on fertilizer costs. Only three farmers use bio-pesticides.

Table 5.4 Chemicals used per factory

	Kinoro	***Litein***	***Ndima***	***Nyankoba***
Glyweed	0	1	0	nd
Mamba	0	4	0	nd
Round-up	1	56	4	nd
Touch down	0	7	0	nd
Touch Down	0	2	0	nd
Weed Out	0	2	0	nd
Weedall	0	1	0	nd

Only one RA-trained farmer uses chemicals compared to 35 FFS farmers (both out of 120 farmers), 42 out of 120 comparison group farmers use pesticides. If we look at table 5.4 we see that this difference is due nearly entirely to the high usage of chemicals in Litein. In other factories the few farmers that use chemicals only use round-up. In Litein the diversification of chemicals is much larger. And the number of farmers that use chemicals is much higher; 62% of the 118 farmers interviewed here use chemicals. The data gathered on use of chemicals in Nyankoba proved unreliable and thus not presented here.

5.4 Other inputs

From a cost calculation perspective we are interested if any other costs are made, besides chemicals, fertilizer and organic fertilizer. Few farmers bought other inputs; 18 farmers bought new plants in the last year. The price paid was between three and 10 Ksh per plant. Other costs made for certification are the purchasing costs for personal protective equipment (PPE).

Table 5.5 Number of farmers buying PPE and the average cost per PPE

	Number of farmers who bought	***Median costs (Ksh)***
Overall	34 (9,6%)	700
Hat	24 (6,7%)	100
Mask/respirator	14 (3,9%)	50
Set of gumboots	161 (45,2%)	600
Pair of goggles	7 (2%)	600
Apron/plucking cape/raincoat	66 (18,5%)	150
Full PPE set	2 (0,6%)	950

The use of Personal Protective Equipment (PPE) is an important part of the social sustainability aspects of RA. It is difficult to measure the use of PPE, but we can measure the number of PPE bought. Table 5.6. shows the number of farmers who have bought PPE. Only two farmers bought a full PPE set. 45,2% bought gum boots. 18,5% bought an apron or a plucking cape. The costs of a PPE item are between 50 Ksh (or 50 euro cents) for a mask to 1800 (or 18 euro) for a full PPE set.

5.5 Labour

The costs for labour are hard to construct as many farmers use only family labour. Another difficulty is the unit used for measuring labour. Most farmers pay their farmers per kg of green tea leaves plucked, however there are also farmers who pay for a certain plot weeded etc. The most common measures have been used in the questionnaire. To include the household labour costs, the price paid to workers will be used as an approximation to account for the costs of household labour. To exclude the effect of outliers on the averages we look at the median.

Table 5.6 Labour costs for tea related activities

	Median
Plucking	
Labour cost per kg of green leaves (Ksh)	6
Weeding	
Days per year weeding	3
Days weeding per bush	,01
labour costs per day weeding (Ksh)	150
Pruning	
% pruned in 2009	,33
Labour costs per pruned bush (Ksh)	3

Table 5.6 shows the components used to construct the costs of tea production. The cost of plucking are 6 Ksh per kg of green leaves. Questions on the costs of weeding and pruning were not asked in the questionnaire, but based on other studies we use the figures presented in table 5.6. We assume farmers can weed around 100 bushes a day and that a day weeding costs 150 Ksh. We assume that the farmer prunes one third of his bushes each year and that the costs of pruning are 3 Ksh per bush. This leads to the following calculation of the labour costs:

Labour cost = 6*kgtea+0,01*number of bushes*150+1/3*number of bushes*3

6. Production

6.1 Tea production

During the training in the coming year a lot of attention will be paid to improving production quantity and quality in FFS. Production increase on each farm cannot only be directly attributed to training and associated implementation of practices. However, monitoring the production levels can give us food for thought. Differences between groups may only be partly attributed to training. The production indicators for the baseline are presented below. As 2009/2010 was an especially good year due to abundant rains it would be interesting to compare the 2009/2010 production with years before and, ideally, with associated season-weather indicators. Still it will be important to distinguish the East and West of Rift on this matter because the weather patterns in both regions differed from each other with the West receiving more rain. Consequently, this will have to be dealt with in the following analyses. The gross income is calculated as the price and the bonus received (Ksh/kg) from the factories times the production quantity given by the farmers.

Table 6.1 Production indicators

	Count	***Mean***	***Median***	***Standard Deviation***	***Minimum***	***Maximum***
Tea area in acre	356	,74	,50	,58	,12	5,50
Number of tea bushes	356	2245,15	1800,00	2108,34	150,00	21000,00
Kg green tea leaves 2009/2010	356	2693,83	2000,00	2529,03	130,00	18500,00
kg per bush 2009/2010	356	1,29	1,20	,63	,21	3,80

Table 6.1 shows that farmers have a median tea area of 0,5 Acre (or 3023 m2). The farmers have a median of 1800 tea bushes. Rule of thumb here is 4000 bushes per acre, so this figure seems quite accurate. The kg per bush is 1,2 which is within range for smallholders. The MOARD (2002) estimate the production of green leaf per bush per year at between 0.45 and 6 kg. The Kenya national Bureau of the Statistics (2008) estimates the production at 1.2-1.5 kg per bush per year. Kamanu (2008) gives an estimate for smallholders of between 0.27 and 1 kg green leaf per bush per year. The high median production, considering Kamanu's smallholder estimate, could be explained by the exceptional good rains in 2009/2010. Farmers produced a median of 2000 kg of green leaves in 2009/2010. The data in table 6.1 is based on the data collected in the questionnaire. Once the data from the factories on number of bushes and production per farmer is complete this analyses can be re-run for the new data.

Figure 6.2 Production indicators per farmer group

	FFS farmer		*RA farmer*		*Comparison group near*		*Comparison group far*	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Tea area in acre	,76	,73	,75	,50	,65	,50	,76	,75
Number of tea bushes	2573	2000	1860	1450	2131	2000	2494	2000
Kg green tea leaves 2009/2010	3256	2500	1795	1200	2436	2200	3597	2750

kg per bush 2009/2010	1,36	1,29	1,10	1,00	1,25	1,27	1,55	1,46

Table 6.2 shows differences between the different groups. The median tea area varies from 0,5 (RA farmers and comparison group near) to 0,75 (comparison group far). The median number of tea bushes varies between 1450 (RA farmers) to 2000 (all other groups). Total production of green tea leaves is lowest for the RA-trained factories with a median of 1200 and highest for the comparison group far with a median of 2750. On average the RA-trained factories score significantly (95% confidence interval) lower on production per bush than the FFS farmers and the 'comparison group far' (using ANOVA). The 'comparison group near' also has a higher production per bush, but this difference is not significant. How can this be explained? Possibly by the difference in agri-ecological location of the factory, which we shall study below. The difference between comparison group near and comparison group far are not significant.

Table 6.3 Production indicators per factory

	Kinoro (RA)		*Litein(FFS)*		*Ndima(FFS)*		*Nyankoba (Ra)*	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Tea area in acre	,86	,50	,83	,75	,64	,50	,65	,50
Number of tea bushes	2390	1500	2764	2000	2123	1600	1330	1000
Kg green tea leaves 2009/2010	2112	1450	3527	2700	2759	2300	1479	1156
kg per bush 2009/2010	,98	,90	1,30	1,22	1,47	1,42	1,22	1,13
Price per kg		12		12		12		12
Bonus per kg		36,64		26,30		29,51		27,95
Total gross tea income		70528		103410		95473		46182.2

Table 6.3 shows the difference between the different factories. The tea area in acres is between 0,5 for Kinoro, Ndima and Nyankoba and 0,75 for Litein. The number of bushes varies from 1000 for Nyankoba to 2000 for Litein. The two RA-trained factories have less bushes than the two FFS factories which explains the lower number of bushes for farmers to undergo RA training in table 6.2. The total kg of green tea leaves per year varies between 1156 for Nyankoba to 2700 for farmers in Litein. Production per bush per year varies between 0,90 in Kinoro to 1,42 in Ndima. This overview shows that the RA-trained factories both score lower on all these indicators than the selected FFS factories. The price per kg and the bonus are data collected from the factory. Kinoro paid the highest bonus by far. The bonus is determined by the actual amount earned by the factory. Please note that production is influenced by other factors like rainfall, temperatures, clones, age of the bushes and management practices. Prices are functions of quality, which depends on quality of green leaf and processing efficiency. Prices and quality seem to be higher for RA factories and maybe be explains why these factories were picked by the buyer.

Nyankoba has significantly (95% confidence interval) less tea bushes than Kinoro and Litein. Total production in Nyankoba is significantly lower than in Litein and Ndima. Kinoro has less tea per bush per year than Litein and Ndima. The origin(s) of these differences will be investigated in the subsequent studies. One possible explanation can be better management for example.

6.2 Tea income

Income from tea consists of the factory price and the bonus paid per kg of green tea leaf. The costs made to produce tea are based on the price paid for hired labour and the costs of other inputs like fertilizer. As the input quantity and costs are not always entered in the questionnaire we use index number based on the data collected in this and other questionnaires in Kenya. See paragraph 5.3 for the labour cost formula. To this formula we add the input costs of fertilizer at 2.88 per bush from table 5.2. This results in the following formula:

Input cost= 6*kgtea+0,01*number of bushes*150+1/3*number of bushes*3+2.88*bushes

Tea income can be calculated as gross income from tea minus the input costs. This means that the costs for plucking, weeding, pruning and applying fertilizer are deducted from the income derived from tea. The cost for weeding, pruning and applying fertilizer are based on the number of bushes, not the volume of production. This calculation may improve if we receive the factory data on production of each supplying farmer.

Table 6.4 Net income in 2009/2010 (in Ksh)

	Mean	*Median*	*Minimum*	*Maximum*
FFS farmer	95637	72635	3236	439320
RA farmer	60122	39571	3896	675860
Comparison farmers near	71106	69995	1619	191232
Comparison farmer far	108040	80254	1778	537814
Total	**81950**	**63530**	**1619**	**675860**

Table 6.4 shows the average income of farmers in the different groups. The median income for the group as a whole is 63530 Ksh (or 635 Euro). The median income per group varies from 39571 Ksh for farmers to undergo RA training to 80254 Ksh for the comparison group far. Both farmers who will participate in FFS and the comparison group far score significantly higher than the farmers to undergo RA training. This difference cannot be explained by differences in the bonus paid as farmers in Kinoro, an RA-trained factory, received the highest bonus. This clearly did not compensate for the lower production. A comparison of the number of bushes of the different farmer groups does not provide significant differences. Therefore, the productivity per bush, being the kg of tea yielded from one bush is a plausible cause of the significant differences between the farmers to participate in FFS and the far comparison group on the one hand and the farmers to undergo RA training on the other hand.
It is important to realize that the numbers used in the above-mentioned formula are index numbers. This implies that the numbers are also partially based on focus group discussions. Consequently, caution is needed when using this results.

6.3 Other sources of income

The analysis below is only indicative of the other income sources and the quantity of income from these sources. To give a completely accurate overview of household income, more time is needed to construct all income sources and the costs incurred for this income. However, this is out of the scope of this research. Tea accounts for a median of 70% of total household income. This is a large portion. The other sources of income also tell us something about the relative importance of tea for household income.

Table 6.5 Total household income and share of tea

	Median Total household income (Ksh)	*Mean Total household income (ksh)*	*Mean Share tea income*
FFS farmer	111231	142129	72%
RA farmer	87682	112083	64%
Control farmers near	87877	106102	71%
Control farmer far	124631	158255	74%
Total	**100074**	**129059**	**70%**

Table 6.5 presents the median and mean household income of the farmers in the different factories constructed as the income from the income sources they mentioned plus the net income constructed from tea. The mean share of tea is the net income from tea divided by the total household income. We use mean here instead of median as the median is 100%; this is the most given answer if all 100 answering options are possible. The median household income for tea farmers is 100074 Ksh (or 1000 Euro) including tea.

Diversification, more sources of income, makes farmers less vulnerable to risks. It is interesting to see if training reduces the number of income sources as more attention is needed for tea or if it stimulates other sources of income as possibly more money is available to invest in other income sources. 74 (21%) (farmers rely only on tea, 111 (31%) farmers have one additional source of income, 80 (22%) farmers have two additional source of income, 62 (17%) have three additional sources of income, 29 (8%) have four or more additional source of income. For the full list of the first, second and third most important sources of income including the mean and median income, see annex 5. This annex shows a large amount of different income sources.

Table 6.6 Most important additional source of income and average income per source

	Count	*Mean (Ksh)*	*Median (Ksh)*
Dairy production	88	37080	28800
Coffee	42	15333	10000
Business	31	63375	50000
Vegetables	27	26635	6000
Employment	21	83300	82000
Pineapples	19	50053	25000
Milk sales	13	26692	20000
Grains	11	22429	16000
Coffee	10	26000	25000
Calf production and sales	6	18417	12750

Table 6.8 shows the activities that are mentioned by 5 or more people as their most important source of income excluding tea. Dairy is mentioned most often with a median income of 28800. Coffee production is mentioned by 42 farmers. 31 farmers get the most additional income from business. 27 farmers sell vegetables and 21 get additional income from employment. The highest median income from the list is for employment.

Table 6.6 Second important additional source of income and average income per source

	Count	*Mean*	*Median*
Dairy production	44	26759	20000
Vegetables	24	18000	10000
Grains	15	10980	9000
Coffee	14	19536	20000
Bananas	14	14979	10000
Fruits	12	18125	10000
Pineapples	10	23880	22000
Business	10	84500	36000
Chicken	8	33817	11750
Calf production	6	18400	14000

Table 6.6 shows the second mentioned additional source of income. Dairy is again mentioned by most people, vegetables come second and grains third. The highest median for second income source is for business.

6.4 Loans

It is common for farmers to take loans. There are signs that the number and amount of loans closed are taking a huge flight. Taking loans, especially when interests are high, leads to less net-income from tea and may even reduce the benefits of additional tea production to next to nothing. We want to see if indeed loans taken by farmers are a problem. As loans are a delicate subject we have decided not to ask details on the interest paid and the satisfaction with the credit, but only on the creditors and the amount borrowed. On the other hand, creditors are important as they can provide farmers with the means to invest in their production and to intensify and specialize to create more income.

44% of the farmers indicate that they have a loan running at the moment. 90% of these farmers were willing to give us details on their loans. These are presented below. 133 farmers indicate they have one loan. 14 farmers indicated that they had two loans. The median amount of the first loan is 20000 or 200 Euro the median amount of the second loan is 14500 or 145 Euro.

Table 6.7 Creditor first loan and median amount borrowed

	Count	*Median*	*Mean*
Bingwa TEA SACCO	40	15000	22738
Equity Bank	26	27500	36308
Meru Central Farmers SACCO	12	30000	35042
Meru South farmers SACCO	11	12000	14818
SACCO (unspecified)	10	17500	17800
Wananchi SACCO	7	30000	56429
South Imenti Tea Growers SACCO	7	54000	105857
Greenland Fedha	5	15000	27200

Bureti Tea Growers SACCO	4	25000	22000
Kirinyaga Farmers SACCO	3	15000	26333

The farmers mention 20 different creditors. Annex 6 shows the count, median and mean loan from all these creditors. Table 6.7 shows the creditors which are mentioned more than three times. 40 farmers have a loan at Bingwa Tea Sacco for a median amount of 15000 Ksh (or 150 Euro). The Equity bank provides loans to 26 farmers from the sample. The Meru Central Farmers Sacco and the Meru South farmers Sacco both provide loans to another 12 or 11 farmers. The median tea income is 63500 Ksh, the median of most of these loans is less than half the median income. Only the South Imenti tea Growers SACCO gave a loan to 7 farmers with a median of around the median income. It is however likely that these 7 are bigger farmers with a higher than median tea income.

7. Livelihood

7.1 Experiments

Farmers that know how to experiment with new tools and production methodology will take better informed decisions on which practices to invest in. Farmers that experiment are less dependent of donors passing and offering new technologies. Experimenting is one of the first steps to become an empowered farmer. Only 19% of the farmers indicate they have experimented with new agricultural practices in the last year.

Table 7.1 Experiments per factory

		Kinoro (RA)	*Litein (FFS)*	*Ndima (FFS)*	*Nyankoba (Ra)*
Experimented with any new	no	70,0%	75,9%	86,2%	95,0%
agricultural practices?	yes	30,0%	24,1%	13,8%	5,0%

There is not a significant difference (95% confidence interval) between the FFS, RA-trained and comparison groups. There is however a significant difference however between the factories. Kinoro farmers experiment more often than Ndima and Nyankoba farmers. Litein farmers also experiment more often than Nyankoba farmers. Roughly on third of the farmers experiment in a group, the rest experiments alone.

50 farmers experimented with one new agricultural practice, 10 farmers experimented with 2 new practices, 4 farmers experimented with three or more practices.

Table 7.2 Experiments with new tools and production methodology

	Frequency	*Percent*
New maize variety	10	2,8
Bananas	4	1,1
Avocados	3	,8
New crop varieties (bananas)	2	,6
New crop varieties (fruits)	2	,6
New tea plant	2	,6
Passion fruits	2	,6
Ruiru 11 Coffee	2	,6
Vegetables	2	,6

Table 7.2 shows the practices mentioned by two or more farmers. Annex 7 shows all the experiments mentioned. 10 farmers experimented with a new maize variety, 4 farmers experimented with bananas. Three farmers experimented with avocados.

7.2 Self-assessment of livelihood indicators

Will all the training actually make a measureable difference in people's livelihoods? Questions on these issues are difficult to ask in a questionnaire. However with the indicators below we can measure how the farmers themselves judge their situation on certain aspects. All of the mentioned indicators are relevant for FFS. The relevance to SAN principles is indicated separately in table 7.1. Comparing this baseline with scores given during the final impact assessment will show if the farmers are or becoming more satisfied

with their situation. If the RA certification has an effect on production and better access to markets, this can results in higher income from tea and in positive livelihood effects.

Table 7.1 Self-assessed livelihood of common farmers

	Relevance to SAN	*very unsatisfied*	*unsatisfied*	*neutral*	*satisfied*	*very satisfied*	*Mean*
The relation with your neighbours	X	0%	3%	6%	55%	37%	4,25
The relation with your family members		0%	1%	5%	49%	45%	4,38
The relation with the tea factory	X	2%	11%	26%	45%	17%	3,63
Your ability to help and advice your neighbours	X	1%	22%	25%	42%	9%	3,36
Your ability to talk in front of a group	X	1%	17%	25%	45%	12%	3,48
Access to information on production prices		3%	31%	27%	34%	5%	3,07
Access to self-help activities		2%	10%	18%	48%	21%	3,77
The number of different income sources	X	6%	32%	28%	30%	4%	2,93
Your homestead	X	3%	31%	23%	35%	8%	3,14
Your families health	X	0%	9%	24%	51%	15%	3,72
Possibility to send children to school	X	1%	16%	21%	52%	10%	3,52
Family welfare	X	2%	13%	27%	48%	10%	3,52
Family income	X	16%	26%	22%	32%	5%	2,85

In general most indicators score highest in the satisfied category. Only family income and the number of different income sources score less than 3 (= neutral). Farmers are remarkably often very satisfied with the relation with family members (45%) and neighbours (37%) and access to self-help activities. The indicators that score relatively high in the very *un*satisfied category are family income (16%) and the number of different income sources (6%). Indicators that score high in the unsatisfied category are the number of different income sources (32%), homestead (31%) and access to information on production prices (31%).

RA farmers score significantly (95% confidence interval) lower on neighbours relationships than FFS farmers and the comparison group near. FFS farmers score higher on their ability to talk in front of a group than farmers to undergo RA training and the comparison group near. Farmers to undergo RA training are significantly less satisfied to their access to self-help activities than all other groups.

8. Conclusions and recommendations

The interviewed farmers will either be trained by Rainforest Alliance to obtain the RA certificate or by FFS. Next to these two groups of farmers we have interviewed not-to-be-trained comparison group farmers whom are split in farmers near by the FFS and far away from the FFS. At the moment the data was collected, none but one of the farms were trained for RA-certification. Training only started for Kinoro but was at infancy stage. Consequently, the impact of this limited training will not be visible yet.

8.1 Baseline situation

Former training

59% of the farmers have followed training (other than RA or FFS) in the last year. The trainings most often followed relate tor 'crop production' followed by 'farm management skills' and 'health and safety'. The training is often offered by multiple providers. The factory is the main provider of training for all topics except 'health and safety' which is often offered by NGO's.

Knowledge

The logic model states that farmers first have to know the benefit of a practice before they will apply it. There is a lot of room to improve knowledge which is expected to lead to increased implementation of GAPs and thus a more sustainable production. Farmers from Kinoro score higher than average. Both sharing information with neighbours and receiving data from neighbours is low and can be improved.

Sustainability

Some sustainability practices are already implemented at a broad scale like the best plucking frequency and timing of pruning, access to water and sanitation for workers and the best moment to apply fertilizer to tea. Of the 36 questions on sustainability (GAPS), 19 score more than 0.55 on a scale from 0 to 1. The aggregated scores on the social, environmental and economic indicators are between 4.9 and 6.6 on a scale from 0 to 10. The three different groups (RA-trained, FFS-trained, untrained) score similar averages.

Inputs

Almost all Farmers use the KTDA-recommended fertilizer: 73% indicated that they used NPK 26:5:5 and 25% indicated that they used NPK 25:5:5, which we both consider to be the same product. Farmers use slightly more NPK than recommended. Only 18,5% of the farmers used manure on their tea fields in the last year, it is however recommended to use manure every year after pruning. 22% of the farmers use some kind of chemical, with a remarkable larger use in the Litein factory. The most used chemical by the farmers is glyphosate-based herbicides (generally 'Round-up').

Production

farmers have a median tea area of 0,5 acre (or 3023 m2). The farmers have a median of 1800 tea bushes. Rule of thumb here is 4000 bushes per acre, so this figure is close. The kg per bush that result from the calculation is 1,2. This can possibly be explained by the exceptional good rains in 2009/2010. Farmers produced a median total of 2000 kg of green leaves in 2009/2010. The two RA-trained factories score lower on all the production indicators than the FFS factories.

Tea income

The farmers have a median income of 63530 Ksh or 635 Euro. The median income per group varies from 39571 for farmers to undergo RA training to 80254 for the comparison group far. Both FFS farmers and

the comparison group far score significantly higher than the farmers to undergo RA training. This difference cannot be explained by differences in the bonus paid but may be related with agro-ecological condition in the locations.

Diversification
74 farmers rely only on tea, 111 farmers have one additional source of income, 80 farmers have two additional source of income, 62 have three additional sources of income, 29 have four or more additional source of income. Most mentioned sources of additional income are dairy, coffee, business and vegetables.

Loans
44% of the farmers indicate that they have a loan running at the moment. 133 farmers indicate they have one loan. 14 farmers indicated that they had two loans. The median amount of the first loan is 20000 or 200 Euro the median amount of the second loan is 14500 or 145 Euro.

Livelihood
In general most indicators score highest in the satisfied category. Only family income and the number of different income sources score less than 3 (= neutral). Farmers are remarkably often very satisfied with the relation with family members and neighbours and access to self-help activities. The indicators that score relatively high in the very *un*satisfied category are family income and the number of different income sources.

8.2 Implications of the analysis of baseline differences between groups

There are baseline differences between the groups that need to be taken into account. However, per indicator the differences may originate from different sources, most probably related with the context and history in the area of the factories that differ significantly between the groups. The sections below describe these differences in short.

Training
There are quite some difference between the factories and the trainings that were followed. Farmers in Litein and Kinoro have followed more crop production training and farm management skills training than all other factories. Farmers in Kinoro also followed more safe handling of agrochemicals training than all other factories.

Knowledge
Farmers from Kinoro scores significantly higher on the knowledge indicator than the other factories. They score higher (or the same) than average on knowledge of all practices except the best height for tipping-in and methods to handle weeds in tea. this could be a natural effect of the higher degree of training followed. It is important to disaggregate the groups per factory when comparing the before and after situation.

Sustainability
To calculate the overall sustainability score we use 37 sustainability questions. We present 9 indicators in more closely detail in this report, where impact is most likely to be achieved as a result of training. For the economic perspective towards sustainability, we propose to closely focus on a) frequency of applying composted manure, b) record keeping and c) plucking frequency. For the social perspective we focus on a) the use of PPE and b) reliability of local suppliers. From the environmental impacts we look more

closely to the indicators a) management of household waste, b) main source of water for domestic use, c) distance of spraying from the water source and d) number of eucalyptus trees growing near the river. The significant differences in the baseline situation of the factories make it important to perform the impact assessment separately for the different groups.

Chemicals

Chemical are used hardly by all factories except on Litein. The disaggregation of results per factory is very important for the analyses of impacts on this indicator. Data on chemical use in Nyankoba was not reliably captured.

Production

The exceptional good rains in production year 2009/2010 made this an above average year for tea production. During analyses for the impact assessment this has to be taken into account. Unless rains are as good in 2010/2011 as last year we cannot expect to measure an increase in tea production as a result of training. Preferably time-series data is collected from the factories to get a broader baseline to estimate changes in this indicator that may result from training on good agricultural practices in tea. Data on weather patterns will be collected for different regions through http://www.meteo.go.ke/obsv/agro.html, to include rainfall as a variable to adjust production fugures in the evaluation of the impact of training , if possible disaggregated per factory. Starting tea income levels differ between groups and analyses have to be done accordingly.

Livelihood

RA farmers score significantly (95% confidence interval) lower on neighbour relationships than FFS farmers and the comparison group near. FFS farmers score higher on their ability to talk in front of a group than farmers to undergo RA training and the comparison group near. Farmers to undergo RA training are significantly less satisfied with their access to self-help activities than all other groups.

Annex 1 Sustainable agriculture good agricultural practices (SA GAPs)

SUSTAINABLE TEA FARMING GUIDE FOR SMALL- SCALE TEA FARMERS

ID	
	SOIL FERTILITY
1	Retain prunings in the field
2	Keep ground covered by a crop (beans) or mulch in young tea fields
3	Add composted manure every 3-4 years (after pruning) at the rate of a 'debe' /20 bushes
4	Maintain plant cover on unpaved paths and tractor ways
5	Avoid using heavy machinery on the land especially when it is wet
6	Maintain soil pH at between 4.5 - 5.6
7	Do not apply ash to your tea farm
	SOIL LOSS
8	Practice soil conservation measures (micro-catchments/retention ditches, terraces, cut-off drains etc.)
9	Source nursery soils from areas to be planted
10	Replant gaps in tea
11	Retain prunings in the field
12	Keep ground covered by a crop (beans) or mulch
	NUTRIENTS
13	Use local fertiliser recommendations
14	Broadcast the fertiliser under the tea canopy (or ring application where gaps are high).
15	Avoid applying fertiliser within 3-4 meters of water courses
16	Apply fertiliser during moderate rains
17	Add composted manure every 3 years at the rate of a 'debe' /20 bushes
	DISEASES, PESTS AND WEED MANAGEMENT
18	Use Intergrated Pest Management (IPM)
19	Avoid chemical application within mature tea fields
20	Use recommended herbicides and rates in young tea
21	Do not spray close to water courses/bodies
22	Spot spray with proper targeting, do not spray areas unnecessarily
23	Use correct Personal Protective Equipment (PPE) to protect operator
24	Use manual weed control

	BIODIVERSITY
25	Avoid clonal monocultures, at least two tea clones for less than 1 acre and at least 1 clone for every additional 2 acres
26	Grow other crops and trees especially indigenous
27	Plant woodlots with appropriate firewood
28	Ensure that riparian strips are protected and maintained with native species
	PRODUCT VALUE (THINGS TO DO TO ENHANCE TEA YIELD & INCOME)
29	Pluck 3-4 rounds per month
30	Minimize spillage on the farm and collection centre
31	Maintain a firm plucking table
32	Pluck only 2L+B and soft banjhi
33	For planting and infilling use clones with the following qualities: hardened, high yielding, robust and good quality
34	Nursery plant survival rate: Over 80% is high: Under 80% is low.
35	Ensure a closed tea table
36	Infill at the onset of the long rains, use experienced labour, make large holes and use a table spoonful of TSP/DAP
37	Practice good bringing into bearing (marking, watering, opening up, mulching, decentering, formative pruning etc)
38	Prune at 20 inches and above
39	Prune 2 inches above the previous pruning height
40	Prune every 3-4 years
41	Use the recommended pruning knife or pruning machine
42	Tip in at 4 to 6 inches above the pruning height
43	Keep records of important farm activities and transactions e.g. inputs, yield/production and earnings
44	Maximize productivity of the farm (Yield)
45	Ensure no pesticides in mature tea
46	Ensure no foreign matter in harvested tea
	ENERGY
47	Use renewable energy (solar, hydroelectric, biogas, renewable fuel wood)
	WATER
48	Harvest and store rainwater for domestic use
49	Use rainwater & minimize use of river water
50	Avoid effluent flow into water courses/bodies

51	Use soak pits to dispose wastes
	SOCIAL AND HUMAN CAPITAL
52	Reduce turnover rates among employees to high maintain skill levels
53	Group together with other farmers to obtain bulk discounts and joint transport for inputs
54	Encourage use of KTDA/TRFK/UTK facilities
	LOCAL ECONOMY
55	Reduce use imported goods
56	Use reliable local suppliers
57	Use local employees as much as possible.
58	Encourage employees to send earnings home

Annex 2 Questionnaire

Baseline questionnaire:
KTDA Sustainable Agriculture Project
A: Household identification

02 Date of interview (dd-mm-yyyy):……..

03 Name of enumerator……..

1 KTDA Growers number (2 letters, 3 number of collection centre, 4 number of grower number)

……..

2 Name of the Household head……..

3 Name of the respondent (Interview the person that will be most likely to attend any training offered for tea/ person in charge of tea production):

……..

4 Gender of respondent (person that will attend FFS)? (Circle correct number)
- 0 Female
- 1 Male

5 Respondents position in the household (circle correct answer):
- 1 Household head
- 2 Spouse
- 3 Child older than 18
- 4 Other

6 Did you sell tea in the 2009/2010 financial year?
- 0 No
- 1 Yes

7 Name of Factory: ……..

8 Will you become (or are you) member of a FFS?
- 0 No
- 1 Yes

9 Will you (or are you) trained for Rainforest Alliance certification as a lead farmer by Rainforest Alliance?
- 0 No

1 Yes

10 Will you (or are you) trained for Rainforest Alliance certification by a lead farmer?
0 No
1 Yes

11. Have you participated in any other (not FFS or RA) trainings or workshops over the past 12 months (trainings defined as educational events; for instance, one on one training, group training, workshop, demonstration, training during TESA visit)?
0 No
1 Yes → Skip question 12

12 If **no**, what was the reason?
a) No training offered
b) Offered, but could not get to training, no transportation or resources
c) Offered, but other reasons for not attending (no time, not interested in topic).
→ Go to section B after question 12

13 If **yes**, how much training (trainings defined as educational events; for instance, one on one training, group training, workshop, demonstration, training during TESA visit) have you attended in the past 12 months?
a) 1 training
b) Between 1-5
c) More than 5 trainings

14 Did the farmer follow the following topics in their training (one on one training, group training, workshop, demonstration, training during TESA visit)? Fill in 1 for yes or o for no in column 1. If **yes**, who gave the training? Fill in number 1 to 6.

Topics	Attended training on this topic?	Who gave the training?
Crop production (for instance new crops)	a1……	a2……
Health and safety (for instance HIV/AIDS, housekeeping, food)	b1……	b2……
Farm management skills (for instance record keeping, economic decision making)	c1……	c2……
Chemical application (chemicals used for all farm activities)	d1……	d2……
Other/ combination of topics	e1……	e2……
	0=no 1=yes	1= factory 2= government

		3= NGO 4= input supplier 5= Local individual (e.g. neighbour) 6= other

B: Sustainability

1. Answering options should <u>not</u> be read out to the households, options are for enumerators' convenience only!
2. <u>Select one answer option</u> per question by circling the corresponding letter.
3. Do not give any additional information about the 'right' answers as we will be questioning knowledge alter on.

Profit (questions are all related to tea)

1 How many times do you pluck the same plot of tea per month (this refers to a normal month- when there is no drought and it is not very cold)?
   a) 4 times (every 7-8 days)
   b) 3 times (every 10 days)
   c) 2 times (every 2 weeks)
   d) Less than twice (less than once every 2 weeks)

2 Do you experience leaf spillage at the farm, during transport to buying centre or at the buying centre?
   a) No spillage at all places
   b) Spillage in all three places
   c) Spillage at home only
   d) Spillage at BC only
   e) Spillage during transport

3 Do you use a plucking stick/wand? Is the table firm (Interviewer to observe)
   a) Use stick & table firm
   b) Use stick table not firm
   c) No stick table firm
   d) No stick table not firm

4 If you raise your own planting material what is the success rate in your nursery (Interviewer to observe).
   a) High (More than 80% success rate)
   b) Mediate (Between 80% and 50% success rate)
   c) Low (Less than 50% success rate)
   d) N/A – i.e. no planting or infilling in the last few years, used external source, or farmer does not want to show.

5 What clones have you planted in the nursery?
   a) 6/8
   b) 31/8

c) 303/577
d) SFS 15/10
e) Any other/ do not know which clones
f) N/A, no nursery

6 When do you plant the tea VP plants?
a) During heavy rains.
b) During moderate/light rains.
c) During dry season.
d) None of the above.

7 What is the % crop cover (absence of gaps in the tea) on the farm (Interviewer to observe)?
a) 90-100%
b) 75%- 90%
c) Less than 75%

8 At what height do you prune mature tea?
a) 20 inches and above
b) Below 20 inches
c) N/A; do not know

9 At what period due you prune your tea bushes?
a) Dry season (January – March)
b) Wet season (April – May/ October - December)
c) Cold season (June – August)
d) Warm season (September)

10 How often do you prune the same tea plot/block?
a) Prune ever 6 (or more) years
b) Prune every 3-5 years
c) Prune ever 1 or 2 years

11 What tools are used to prune your tea?
a) Use pruning knife
b) Use pruning machine
c) Other tools

12 Who prunes the tea bushes and have they been trained?
a) Untrained Family member.
b) Trained family member.
c) Untrained non family member.
d) Trained non family member

13 At what height do you tip in?
a) More than 6 inches above pruning height
b) 4 to 6 inches above pruning height
c) Less than 4 inches above pruning height

14 How frequently do you apply composted manure?
   a) Never
   b) Less than once every three years
   c) Every three years
   d) More often than once every three years

15 How frequently do you apply fertilizer?
   a) Once per year
   b) Twice a year
   c) More than twice per year

16 Do you keep records on input use and production?
   a) Only records on production/sales
   b) Only records on inputs
   c) Records on input use and production
   d) No records kept

People *(question 18 about tea, other questions about the whole production system)*

17 Who plucks your tea?
   a) Family members
   b) Regular workers
   c) Irregular workers
   d) Mixture of family and workers

18 Do you have a fixed agreement with hired workers about pay and timing of payment?
   a) Yes
   b) No
   c) N/A (family members)

19 Do your workers have access to potable water and latrines?
   a) Access to potable water
   b) Access to latrines
   c) Both
   d) Neither

20 How often did your family or any of your workers need medical attention after injury on the farm for example fractures or wounds requiring stitches, in the last 12 months?
   a) More than three occasions
   b) On one or two occasions
   c) No occasions

21 Which personal protective equipment (PPE) does your family or your workers use?
   a) All PPE (Mask, gloves, boots, overall, goggles)
   b) Some of the above PPE
   c) No PPE
   d) N/A (don't spray)

22 Do you group together with other farmers to carry out certain activities e.g. sourcing of fertilizer, leaf transport, plucking etc?
a) Yes
b) No

23 Do you turn to KTDA if you experience any problems in your tea production?
a) Yes
b) No

24 Do your children go to school?
a) N/A, no children are too young or too old to go to school
b) No, some children are not going to school although they have the age to attend primary or secondary school
c) Yes, all children in the age to attend primary or secondary school are attending school
d) Yes, all children in the age to attend primary or secondary school are attending school and one or more children are following college or university

25 Do you use locally manufactured farm inputs/ implements?
a) Always
b) Sometimes
c) Never

26 Are your local suppliers of plants, fertilizer and credit reliable?
a) Most suppliers are reliable
b) Half of the suppliers are reliable
c) Few suppliers are reliable

Planet

27 Do you collect prunings from the tea field?
a) No
b) Yes - use as mulch elsewhere on farm
c) Yes - use as fuel

28 Do you infill open areas in your tea (Interviewer to observe)?
a) Yes
b) No
c) N/A (no gaps)

29 When do you apply fertilizer to your tea?
a) Apply fertiliser during moderate rains
b) Apply fertiliser during heavy rains
c) Apply fertiliser during dry periods
d) Other moment
e) Do not use fertilizer

30 In case of chemical control in your tea (pesticides /herbicides /insecticides) how do you apply?
a) Blanket spraying

b) Edges/ spot spraying
c) Other
d) Do not use chemical control

31 Does your farm border a river or water body? If so, do you have a Riparian strip covered by indigenous vegetation and how wide is it (Interviewer to observe)?
a) No; farm does not border a river or water body
b) Yes, farm borders a river/ water body, but no Riparian strip/ strip < than 10 meter.
c) Riparian strip wider than10 meters, but smaller than 30 meters
d) Riparian strip wider than 30 meter

32 Do you have indigenous trees on your farm? If so how many in total on your land?
a) > 10 native trees
b) Between 5 and 10
c) Less than 5
d) No native trees

33 If your farm borders a water stream, how many eucalyptus trees are growing within 10 meters of the water stream?
a) More than 50 trees
b) Between 20 and 50 trees
c) Between 5 and 20 trees
d) zero to 5 trees
e) N/A farm does not border river

34 if your farm borders a water body, what distance do you leave out without applying agrochemicals and fertilizer;
a) No area is left
b) 0 – 5 metres
c) 5 – 15 metres
d) Over 15 metres
e) N/A farm does not border a river

35 How much area of the total farm is conservation area (area under indigenous trees/ vegetation)?
a) More than 10%
b) Between 2 % and 10%
c) Zero to 2 %

36 What is your main source of energy for domestic purposes?
a) Renewable firewood, electricity, solar, biogas (= sustainable sources)
b) A mixture of sustainable and unsustainable sources
c) Use of indigenous trees (= unsustainable)
d) Petroleum products (= unsustainable)

37 What is your main source of water for domestic use?
a) River/ stream or spring
b) Tap
c) Harvested rainwater

38 How do you manage household waste water and effluent from livestock (Interviewer to observe if possible)?

a) Presence of soak pits/ waste pits;
b) Other ways of filtering water
c) Part of the waste in soak pits, part runs directly into farm
d) Discharge direct onto the farm or into waterways

39 How do you manage household solid waste?

a) No waste management in place
b) One pit for all waste
c) One pit for organic waste and one pit for other waste
d) More than two pits in place: non-organic waste is further separated, for instance for plastic or glass

40 Is waste collected and taken elsewhere?

a) Glass, plastic and other waste is collected
b) One of the waste streams is collected
c) No, recycling options known but no transportation available
d) No, collection service is not available
e) N/A no waste pit available

C: Tea production

1. Tea production

Product	**Area in acre**	**Total number of bushes**	**KG production in last 12 months**	**Average Price paid by the factory per KG in the last 12 months**
Tea	1a……..	1b…….	1c……..	1d……..

2. Do you hire labour for plucking your tea?
0 No → Continue to question 4
1 Yes

3 How many ksh do you pay per kg of plucked tea?

……

Inputs used for tea production

1) Please state the inputs used for your total tea area in the 2009/2010 financial year. If the respondent has difficulties answering this question ask him/her how much of these inputs they have bought and if they finished all these inputs.

2) As different people might use different measures this question allows for different units in question 5 and 6: for example quantity 1, unit kg or quantity 0,5, unit litre.
3) Write down the cost for one unit
4) Give respondent time to think about any other inputs used for tea

Input	**Quantity in last 12 months**	**Unit**	**Cost per unit**
4. Fertilizer (chemical) List common/ trade names incl. composition: 1a. ……. 2a……. 3a……. 4a. …….	 1b. …… 2b…….. 3b……..… 4b. ……	 kg kg kg kg	 1d. …… 2d…….. 3d……..… 4d……
5. Organic fertilisers/ manure List types, if any: 1a. ……. 2a……. 3a……. 4a. …….	 1b. …… 2b…….. 3b……..… 4b. ……	Unit: 1c. …… 2c…….. 3c……..… 4c. …….	 1d. …… 2d…….. 3d……..… 4d. ……
6. Other chemicals (pesticides/ herbicides/ insecticides), if any: List common/ trade names: 1a. ……. 2a……. 3a……. 4a. …….	 1b. …… 2b…….. 3b……..… 4b. ……	Unit: 1c. …… 2c…….. 3c……..… 4c. …….	 1d. …… 2d…….. 3d……..… 4d. ……
7. New tea plants, if any	b…….	Number in last year	d……
8. Other: 8a……	b……..	c……	d……..
9. Other: 9a…….	b……	c…….	d……..

10 Do you use bio-pesticides/ organic pesticides?
0 No → skip question 11
1 Yes

11 Do you use bought or home- made bio-pesticides?
1 Bought bio pesticides (include pesticide in question 6)
2 Home-made

Cost for other crop production

Please state the inputs used for your production system (excluding inputs for tea) in the last 12 months. If the respondent has difficulties answering this question ask him/her how much of these inputs they have bought and if they finished all these inputs.

1) *As different people might use different measures this question allows for different units in question 13: for example quantity 1, unit kg or quantity 0,5, unit litre.*
2) *Write down the cost for one unit*

Input	**Quantity**	**Unit**	**Cost per unit**
12. fertilizer (chemicals) List common/ trade names incl. composition: 1a. …… 2a…….. 3a…….. 4a. …….	 1b. …… 2b…….. 3b…… 4b. ……	 kg kg kg kg	 1d. …… 2d…….. 3d…… 4d. ……
13. Other chemicals (pesticides/ herbicides/ insecticides) List common/trade name: 1a. …… 2a…….. 3a…….. 4a. …….. 5a. …… 6a…….. 7a…….. 8a. ……..	Quantity per 12 months 1b. …… 2b…….. 3b…… 4b. …… 5b. …… 6b…….. 7b…… 8b. ……	Unit 1c…… 2c…… 3c…… 4c…… 5c…… 6c…… 7c…… 8c……	Cost per unit 1d. …… 2d…….. 3d…… 4d. …… 5d…… 6d…… 7d…… 8d…… 9d……

9a……	9b……..	9c……..	10d……..
10a……..	10b……..	10c……..	
14. Personal protective equipment, if any:	Answer will often be 1		
1 Overall	1a……..	Piece	1d……..
2 Hat	2a……..	Piece	2d……..
3 Mask/respirator	3a……..	Piece	3d……..
4 Gumboots	4a……..	Piece	4d……..
5 Goggles	5a……..	Piece	5d……..
6 Apron/plucking cape	6a……..	Piece	6d……..
7 Full PPE set	7a……..	Piece	7d……..

15 Do you have any loans at this moment?
0 No→ Skip question 16 and 17
1 Yes

16 Do you want to give us details about the creditor and amount borrowed?
0 No → skip question 17
1 yes → Fill in table below

17 creditor and amount borrowed

1) *Creditor; fill in who provided the loan*
2) *Enter the amount borrowed*

Creditor	**Amount borrowed**
1a……..	1b……..
2a……..	2b……..
3a……..	3b……..
4a……..	4b……..

D: Other sources of income

Can you state your families' most important sources of income, starting with the most important income generation activity (excluding tea)? Can you give an approximation of the yearly income from this activity? Enumerator can use the bottom of the sheet to take notes before filling the table.
Help respondents with possible sources of income: vegetables, fruit, grain, dairy, calves, pigs, rabbit, chicken. Remittances, retirement, business, employment and more.

	Income generating activities *from most to least income generating activity*	Approximation of yearly income from this activity in Ksh
1.	a……	b……
2.	a……	b……
3.	a……	b……
4.	a……	b……
5.	a……	b……
6.	a……	b……
7.	a……	b……
8.	a……	b……
9.	a……	b……
10.	a……	b……

11. How many seasonal or regular workers 9paid monthly) do you have working on your farm for all activities?

……

12. How many casual workers (paid daily) do you have working on your farm for all activities?

……

E: Knowledge and skills learned

1.Answering options should not be read out to the households, options are for enumerators' convenience only!
2. In this part it is encouraged that the enumerators stimulate the farmers to give more options (time to think), but never mention the options!
3. Select the given option by circling the corresponding letter, more answer options can be selected

1 Can you mention some benefits of leaving prunings in the field?
- a) To suppress weeds
- b) To prevent soil erosion
- c) To improve soil structure
- d) Releases nutrients into the top soil at decomposition
- e) Reduces loss of water by evaporation (mulch)
- f) None of the above/ do not know

2 Can you mention the best height to prune mature tea?
- a) Never below 20 inches
- b) 2 inches above the former height
- c) After reaching 28 inches, the bush should be down pruned to 21 inches
- d) None of the above/ do not know

3 Can you mention reasons to prune tea?
- a) To maintain a manageable plucking table
- b) To rejuvenate the bush
- c) To remove diseased, dead and knotted branches
- d) None of the above/ do not know

4 Can you mention some recommended methods to handle weeds in tea?
- a) Slashing using panga
- b) Use of plain jembe
- c) Uprooting using hands
- d) Use of round up for perennial weeds such as couch grass (new fields and young tea only)
- e) None of the above/ do not know

5 Can you mention benefits of fertilizer application to tea?
- a) Get better yields of green leaf.
- b) Get better quality of green leaf
- c) Maintain the tea bush for a long time
- d) Increase nutrients to soil/improve soil fertility.
- e) None of the above.

6 Can you mention any benefits of plucking tea every 7 to 8 days (during normal weather)?
- a) To maintain good quality (older tea is of less quality; more than 2 leaves per bud)
- b) To maintain enough yield (if leaves are plucked to early less yield; less than 2 leaves per bud)
- c) To maintain good plucking table
- d) None of the above/ do not know

7 Can you mention any benefits of maintaining a plucking table?

a) Yields increase when shoots can grow because they are not hindered by shade
b) Shoots are missed during plucking/ plucking goes faster with an even plucking table
c) None of the above/ do not know

8 Can you mention benefits from infilling?

a) Maximises the yield of land in tea production/ increases yield
b) Reduces weeding efforts
c) None of the above/ do not know

9 Can you mention the best height for tipping-in tea?

a) 4-6 inches above pruning height
b) None of the above/ do not know

10 A Riparian strip is a strip of indigenous vegetation between rivers or other water bodies and cultivated field. Can you mention benefits of a Riparian strip?

a) A riparian strip helps protect and conserve wetlands
b) A riparian strip helps prevent soil erosion
c) A riparian strip enriches biodiversity
d) A Riparian strip forms a buffer so that pollution cannot reach the water
e) None of the above/ do not know

11 What are the benefits of personal protective equipment (PPE)?

a) Protects your skin from being touched by chemicals
b) Protects you from inhaling chemicals
c) Protects your feet from chemicals
d) Prevents illness
e) None of the above

12 What are the potential dangers of applying agrochemicals and fertilizer near the natural water bodies like rivers, streams, pools, ponds etc. ?

a) Kill the aquatic life (water plants and animals)
b) Kill the plants growing near the water body
c) Poison the people drinking water downstream
d) None of the above.

13 Why is application of agrochemicals discouraged in tea?

a) High cost of agrochemicals
b) Harmful effect on people
c) Risk of getting into made tea
d) Loss of market of tea
e) Harmful effect on environment
f) None of the above

14 What methods can you use to improve the yield and quality of tea in your farm?

a) Application of the right fertilizer at the right time.
b) Regular plucking rounds
c) Maintaining the plucking table.
d) Training of pluckers
e) None of the above.

15 What are the benefits applying soil conservation measures?

a) Preserve soil fertility
b) Prevent loss of soil
c) Get high production
d) Prevent siltation in water bodies
e) None of the above

F: Experiments

1 Have you experimented (or started) with any <u>new agricultural practices</u> or tools (not tea related) on your land (for example new crops, other fertilizer) in the last year?

0 No → skip question 2 to6, continue from question 7
1 Yes

Experiment

1) *Fill in any practices the farmer has experimented with, for instance new crop varieties, other fertilizer, more/less frequent maintenance, new tools, and new income generating activities).*
2) *Fill in if the farmer experimented alone or in a group.*

Experimented with	0=Alone or 1= in group
2a	2b
3a	3b
4a	4b
5a	5b
6a	6b

7 Did you share information on good agricultural practices you were taught during training or that you have gained during experiments with your neighbours in the last year?

0 No
1 Yes

8 How often do your neighbours share information on good practices with you?

1 Daily
2 Weekly

3 Monthly
4 Yearly
5 Never

G: Social indicators

1 Can you indicate to what extend you are satisfied with the following issues.

How satisfied are you with:	☺☺ Very satisfied	☺ Satisfied	😐 Neutral	☹ unsatisfied	☹☹ Very unsatisfied
a) The relation with your neighbours					
b) The relation with your family members					
c) The relation with the tea factory					
d) Knowledge on good tea management practice					
e) Leadership skills					
f) Access to information on agri commodity prices					
g) Access to self-help activities like Merry-go-rounds					
h) Diversification of income/ number of income sources					
i) Your homestead (house, access to water/electricity etc)					
j) Your families health					
k) Possibility to send children to school					
l) Family welfare					
m) Family income					

That was the last question in this questionnaire. Thank you very much for your time and effort to help us understand more about tea production. Is there anything else you would like to tell us or ask us?

Comments……

……..

……..

……..

Please read through questionnaire to make sure no questions were left unanswered before leaving your farmer!

Annex 3 Knowledge per factory

Table A2 Knowledge questions per factory

	Ndima	*Kinoro*	*Nyankoba*	*Litein*	*Total*
The best height for tipping-in tea	8.2	7.7	9.8	8.0	8.3
What are the main benefits from infilling	6.7	6.8	7.8	6.4	6.8
Benefits of maintaining a plucking table	5.8	7.9	6.5	5.2	6.1
Benefits plucking frequency 7-8 days	5.6	6.7	5.4	4.6	5.4
Benefits fertilizer	5.5	6.4	4.7	4.1	5.1
Dangers agro-chemicals and water	5.0	6.1	3.8	4.8	4.9
Methods to improve yield and quality	5.1	6.0	4.1	4.3	4.8
Reasons not to remove prunings from field	5.3	5.0	5.0	4.2	4.8
Reasons to prune tea	4.7	5.4	4.7	4.5	4.8
Benefits PPE	4.8	6.3	3.8	4.3	4.7
Benefits of soil conservations methods	4.6	5.7	4.2	3.5	4.4
Methods to handle weeds in your tea	4.2	4.0	2.9	4.7	4.1
The benefit of a Riparian strip	3.1	4.1	2.8	3.5	3.3
Best pruning height	3.2	3.2	3.3	3.2	3.2
Reasons to not use agrochemicals in tea	3.6	4.5	2.3	2.6	3.2

Annex 4 Sustainability questions and score

B1_Pluc ('a'=1) ('b'=0.7) ('c'=0.2) ('d'=0)
B2_Spil ('a'=1) ('b'=0) ('c'=0.3) ('d'=0.3) ('e'=0.3)
B3_Stic ('a'=1) ('b'=0.5) ('c'=0.8) ('d'=0).
B4_Rais ('a'=1) ('b'=0.5) ('c'=0) ('d'=0.5)
B6_VP ('a'=0.5) ('b'=1) ('c'=0) ('d'=0)
B7_Cove ('a'=1) ('b'=0.8) ('c'=0.4) ('d'=0)
B8_Pru1 ('a'=1) ('b'=0) ('c'=0)
B9_prun2 ('a'=0) ('b'=0) ('c'=1) ('d'=0)
B10_Pru3 ('a'=0.4) ('b'=1) ('c'=0.6) ('d'=0)
B11_tool ('a'=0.6) ('b'=1) ('c'=0)
b12_trai ('a'=0) ('b'=1) ('c'=0) ('d'=1)
B13_tip ('a'=0.2) ('b'=1) ('c'=0.2) ('d'=0)
B14_manu ('a'=0) ('b'=0.4) ('c'=1) ('d'=0.6)
B15_fert ('a'=1) ('b'=0) ('c'=0)
B16_reco ('a'=0.5) ('b'=0.5) ('c'=1) ('d'=0)
B17_pluck ('a'=0.8) ('b'=1) ('c'=0) ('d'=0.5)
B18_agre ('a'=1) ('b'=0) ('c'=0.5)
B19_sani ('a'=0.5) ('b'=0.5) ('c'=1) ('d'=0)
B20_med ('a'=0) ('b'=0.2) ('c'=1)
B21_ppe ('a'=1) ('b'=0.5) ('c'=0) ('d'=1)
B22_grou ('a'=1) ('b'=0)
B23_ktda ('a'=1) ('b'=0)
B24_edu ('a'=0.5) ('b'=0) ('c'=0.8) ('d'=1)
B25_loca ('a'=1) ('b'=0.5) ('c'=0)
B26_Suppl ('a'=1) ('b'=0.5) ('c'=0)
B27_prun ('a'=1) ('b'=0.5) ('c'=0)
B28_infil ('a'=1) ('b'=0) ('c'=0.5)
B29_When ('a'=1) ('b'=0) ('c'=0) ('d'=0) ('e'=0)
B30_Spr ('a'=0) ('b'=1) ('c'=0.2) ('d'=1)
B31_river ('a'=0.5) ('b'=0) ('c'=0.8) ('d'=1)
B32_indi ('a'=1) ('b'=0.6) ('c'=0.3) ('d'=0)
B33_Euca ('a'=0) ('b'=0.2) ('c'=0.4) ('d'=1) ('e'=0.5)
B34_chem ('a'=0) ('b'=0.2) ('c'=0.8) ('d'=1) ('e'=0.5)
B35_cons ('a'=1) ('b'=0.8) ('c'=0.4)
B36_ener ('a'=1) ('b'=0.5) ('c'=0) ('d'=0.4)
B37_wate ('a'=0.4) ('b'=0.5) ('c'=1)
B38_effl ('a'=1) ('b'=0.8) ('c'=0.5) ('d'=0)
B39_wast ('a'=0) ('b'=0.4) ('c'=0.8) ('d'=1)
B40_coll ('a'=1) ('b'=0.7) ('c'=0.1) ('d'=0.2) ('e'=0)

Annex 5 Other sources of income

Table A4.1 First important source of additional income

	Count	*Mean*	*Median*
Dairy production	88	37080	28800
Coffee	42	15333	10000
Business	31	63375	50000
Vegetables	27	26635	6000
Employment	21	83300	82000
Pineapples	19	50053	25000
Milk sales	13	26692	20000
Grains	11	22429	16000
coffee	10	26000	25000
Calf production and sales	6	18417	12750
Casual labour	5	15216	12480
Maize	4	26500	24000
Chicken	4	2700	2050
Bananas	3	3333	2000
Retirement	2	50500	50500
Pension	2	90000	90000
Horticulture	2	65000	65000
Arrow roots	2	60000	60000
Teacher	1	72000	72000
Self-employment	1	48000	48000
Rent	1	24000	24000
Real estate	1	120000	120000
Quarry/mining operations	1	30000	30000
Potatoes	1	60000	60000
Goats	1	5000	5000
Fruit	1	5000	5000
Driving	1	15000	15000
Canteen operation	1	10000	10000
Building constructor	1	120000	120000
Avocados	1	800	800

Table A4.2 Second most important source of additional income

	Count	*Mean*	*Median*
Dairy production	44	26759	20000
Vegetables	24	18000	10000
Grains	15	10980	9000
Coffee	14	19536	20000
Bananas	14	14979	10000
Fruits	12	18125	10000
Pineapples	10	23880	22000
Business	10	84500	36000
Chicken	8	33817	11750
calf production	6	18400	14000
Goat rearing	5	15200	10000
Milk sales	4	24950	25000
Maize	4	36250	25000
Pension	3	21333	10000
Employment	3	30500	30500
coffee	3	29000	30000
Tree sales	2	4150	4150
Horticulture	2	65000	65000
Beans	2	10000	10000
Avocados	2	950	950
Yams	1	5000	5000
Veterinary services	1	50000	50000
Tomatoes	1	40000	40000
Rabbit rearing	1	6000	6000
Pigs	1	20000	20000
Napier grass sales	1	30000	30000
Mason and carpentry work	1	60000	60000
Fruits and vegetables	1	10000	10000
Canteen	1	20000	20000
Beef rearing	1	20000	20000

Table A4.3 Third most important source of additional income

	Count	*Mean*	*Median*
Dairy production	20	19826	16500
Grains	16	22600	9000
Vegetables	15	12005	4180
Fruits	10	4971	5000
Coffee	9	19111	15000

Bananas	8	7750	5500
Chicken	6	4200	1500
Business	4	20200	20000
Employment	3	150000	150000
Pineapples	2	62500	62500
Goat rearing	2	11500	11500
Calves	2	15000	15000
Yams	1	6300	6300
vegetables	1	6000	6000
Trees sale	1	7000	7000
Tomatoes	1	30000	30000
Sugarcane sale	1	5000	5000
Sheep sale	1	.	.
Remittances	1	2000	2000
Rabbits	1	3000	3000
Pension	1	.	.
Maize	1	5000	5000
Legumes	1	6000	6000
Horticulture	1	16000	16000
Fuel-firewood	1	5000	5000
Finger millet	1	5000	5000
Casual worker	1	30000	30000
Avocados	1	2000	2000
Arrowroots	1	19000	19000

Annex 6 Loans

Table A5.1 Creditor first loan and median amount borrowed

	Count	*Median*	*Mean*
Bingwa TEA SACCO	40	15000	22738
Equity Bank	26	27500	36308
Meru Central Farmers SACCO	12	30000	35042
Meru South farmers SACCO	11	12000	14818
SACCO (unspecified)	10	17500	17800
Wananchi SACCO	7	30000	56429
South Imenti Tea Growers SACCO	7	54000	105857
Greenland Fedha	5	15000	27200
Bureti Tea Growers SACCO	4	25000	22000
Kirinyaga Farmers SACCO	3	15000	26333
Wakenya Pamoja SACCO	2	18750	18750
KWFT (Kenya Women Finance Trust)	2	50000	50000
Merry go round	1	2000	2000
KREP Bank	1	50000	50000
KCB (Kenya Commercial Bank)	1	12000	12000
FAVIN	1	20000	20000
Faulu Kenya	1	30000	30000
Farmers SACCO	1	60000	60000
Barclays and Kirinyaga tea SACCO	1	100000	100000
Baraka SACCO	1	40000	40000

Table A5.2 Creditor second loan and median amount borrowed

	Count	*Median*	*Mean*
Greenland Fedha	6	17500	27500
Kenya Women Finance Trust	2	20000	20000
Bureti Tea SACCO	2	12000	12000
SACCO (unspecified)	1	10000	10000
FAULU	1	50000	50000
Equity Bank	1	25000	25000
ADRA (Adventist Development Relief Agency)	1	8000	8000

Annex 7 Experiments

Table A6.1 New tools and practices experimented with

	Frequency	*Percent*
New maize variety	10	2,8
Bananas	4	1,1
Avocados	3	,8
New crop varieties (bananas)	2	,6
New crop varieties (fruits)	2	,6
New tea plant	2	,6
Passion fruits	2	,6
Ruiru 11 Coffee	2	,6
Vegetables	2	,6
Beans	1	,3
Beekeeping	1	,3
Butternuts	1	,3
CAN	1	,3
Composted manure	1	,3
Cows	1	,3
Cutting pruning to decompose	1	,3
Fertilizer-special	1	,3
Fruits	1	,3
Grafted coffee	1	,3
Grafted MANGOES,AVOCADOS	1	,3
Green house	1	,3
Infilling	1	,3
Macadamia trees	1	,3
Maintenance of plucking table	1	,3
MAVUNO FERTILIZER (10:26:10)	1	,3
Napier grass	1	,3
New chemical application	1	,3
New crop varieties (French beans)	1	,3
New crop varieties (mango trees)	1	,3
New crop varieties (orange trees)	1	,3
New crop varieties (passion fruit, avocado)	1	,3
New varieties of pumpkins and maize	1	,3
NPK17:17:17	1	,3
Peanuts	1	,3
Peas	1	,3

Peppers	1	,3
Pineapple	1	,3
Pineapples planted with phosphates	1	,3
Rabbit rearing	1	,3
Side pruning of tea	1	,3
Spinach	1	,3
Spraying equipment	1	,3
Tea leaf	1	,3
Tomatoes	1	,3
Total	64	18,0