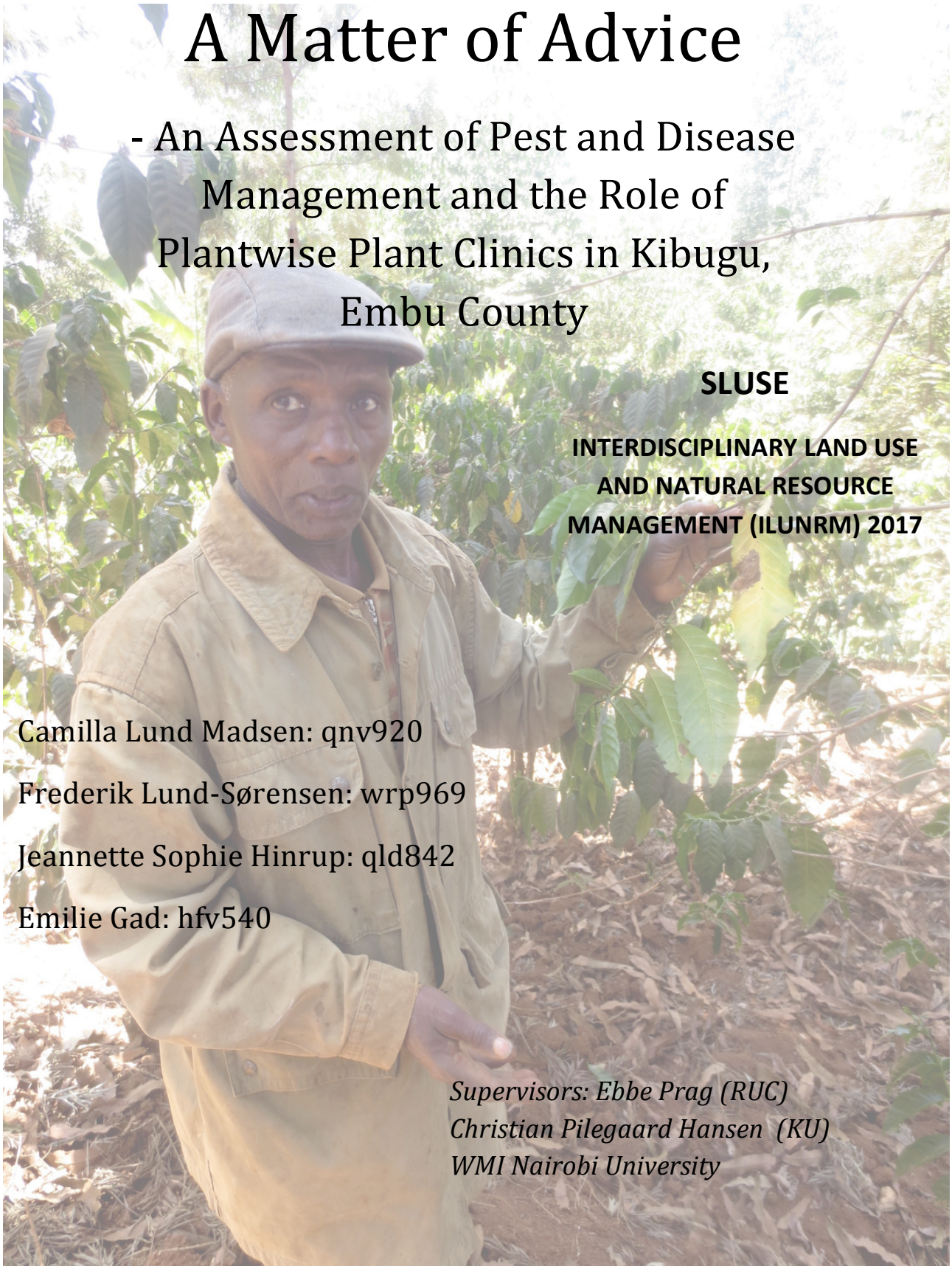
University of Nairobi

A Matter of Advice

- An Assessment of Pest and Disease Management and the Role of Plantwise Plant Clinics in Kibugu, Embu County



SLUSE

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Abstract

Pests and diseases challenge farmers across the globe especially in tropical countries where the conditions are more suitable for pests and where the resources required to manage them properly are not always adequate. To advice farmers on sustainable pest and disease management, and to bridge the knowledge gap between the scientific community and smallholder farmers, plant clinics have been established, a place where farmers can go to get advice on pest and disease management.

By doing a case study in Kibugu, Kenya, this report seeks to investigate the role of the local plant clinic from a farmer's perspective. We have studied how the local plant clinic is organized, how farmers use the plant clinic, the difference between users and non-users of plant clinics, how it can be improved and the future perspectives of the initiative in the area. To gather data 94 farmers have been interviewed through a general questionnaire and 12 through semi structured interviews. Furthermore, 8 semi structured interviews were made with representatives of different agencies and institutions involved with pest and disease management in the area. 3 of these were directly involved with the plant clinic. We found that a large part of the farmers were not aware of the plant clinic. Few farmers use the clinic, but those that do were satisfied with the service. However, they would prefer if the clinic did more field visits.

There was no visible difference between management strategies of users and the non-users. The clinic are generally well equipped to handle the farmers inquiries, but need basic additional resources such as a tent for shading. The funding from CABI is ending next year and the future of the clinic is unclear since it will be up to the local government to fund the project.

Furthermore, there appears to be a disconnection between the intention of the clinic and how the farmers use them, since there was no indication, that the users were less dependent on pesticides. However, this study did not go in depth with this issue, and further studies should be conducted on how farmers using the clinic apply pesticides compared to non-users, and also if farmers benefit economically from using the clinic compared to those that use other advisory services.

Keywords: *Plant clinic, pest and disease management, coffee, smallholder farmer, Kenya.*

Preface

This report was written as a part of the examination for the course ILRUNM – SLUSE on the Faculty of Science at the University of Copenhagen, in collaboration with Roskilde University and the University of Nairobi. The report is directed towards master students with natural and social science background, in addition to anyone with an interest in pest and disease management or plant clinics. This report was handed in at the 31st of March 2017

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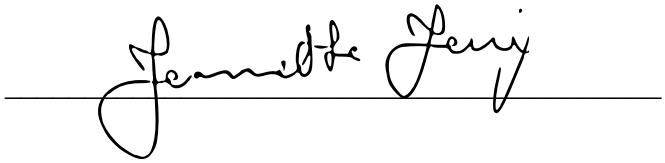

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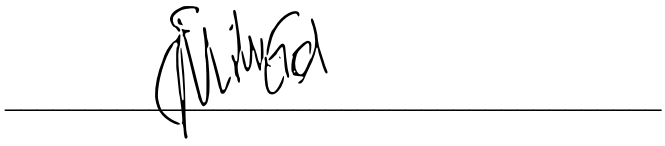

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We are grateful to the chief and the community leaders in Kibugu location for logistical support in the implementation.
We especially thank the villagers of Kibugu - particularly all the farmers setting their valuable time aside to answer our questions; Frederic Ireri, Peter Mbature, John Musangi, Richard Nyaga, Harriet Njeru, Cecilia Kathuri, Samuel Njeru, Charity Manyaga, Catherine Muthori, Linette Chelimo, Jane Wombeti, Nancy Ireri & Samuel Njiru.
Our research are to a large extend based on information obtained by the help of representatives and extension officers of the government of Kenya; Eudesia Ndwiga, David Gitari, William of PCPB & Pauline Muriithi.

Further helping us in conducting our research are our Kenyan colleagues, the Kenyan versions of us, Natasha Nailenya & Peter Kiprop; our guides and interpreters Dennis P. Njeru & Cameline Mukiri and our host families of Selasio, Nthiga & Mureithi.

“The field-based part of the course was a collaboration between the Wangari Maathai Institute for Peace and Environmental Studies at University of Nairobi, Roskilde University and University of Copenhagen. The inputs and efforts of lecturers from the Wangari Maathai Institute, University of Copenhagen and Roskilde University are highly appreciated. This field work and design of the project was collaboratively done by students from University of Nairobi, University of Copenhagen and Roskilde University. Villagers of the Kibugu location, Embu county hosted the students and freely contributed to the information in this report through several interviews and informal communications. Their contribution is acknowledged and much appreciated.

The team. From left to right: Cameline, Emilie, Camilla, Jeannette, Peter, Natasha, Frederik and Dennis.

List of abbreviations

Institutions

CABI	Centre for Agriculture and Biosciences International
FFS	Farmers Field School
KARI	Kenya Agricultural Research Institute (now KALRO)
KALRO	Kenya Agriculture and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Service
MoA	Ministry of Agriculture
PCPB	Pest Control Products Board

Pests and diseases

CBD	Coffee Berry Disease
CBB	Coffee Berry Borer
CLM	Coffee Leaf Miner
CLR	Coffee Leaf Rust
MLN	Maize Lethal Necrosis

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1. Introduction

1.1 Pests and diseases

Pests and diseases in crops are a major source of concern for farmers around the world. Even though management strategies have improved, pests and diseases continue to reduce yields with potential yield losses between 20 % and 40 % on a global level (Savary et al., 2012). Actual losses vary, depending on the crop's susceptibility (Oerke, 2005). In the tropics and subtropics where the climate is warmer and more humid, it is suitable for many groups of pests and diseases, and the potential and actual losses are especially high (Oerke, 2005).

As mentioned above, the consequences of pest and disease attacks are often worse in the tropics and in Kenya up to 40% of crop yields are lost to pests and diseases (KALRO in Sluse, 2017). With the rapidly changing climatic conditions farmers are facing new diseases and pests, which can affect their farming activities and thereby their livelihood options. This can bring further changes to global food and agricultural systems.

In the Kenyan highlands, coffee is widely grown and is a significant contributor to the economy of the country with more than 10% of the population relying on the crop for income (Mugo et al., 2011; Gichuru et al., 2012). However, pests and diseases challenge the stability of the coffee production. Coffee Leaf Rust (CLR) and Coffee Berry Disease (CBD) are the two most influential diseases (Gichuru et al., 2012). Insect pests also challenge the Kenyan coffee farmers. Examples of these are the Coffee Berry Borer, Coffee Leaf Miner, thrips, green scales and aphids (Jaramillo et al., 2011). The pressure of increasing challenges in terms of pests and diseases in Kenya calls for new management approaches and change of existing practices. One of the major challenges and key factors of dealing with these pest and diseases are the agricultural advisory services, - the communication and implementation of scientific research and new knowledge in agricultural practices, through the education of farmers. In that sense, it is also important, that farmers have the ability to keep pace with changing technological advances, which can promote food security and improve income (IFPRI, 2017).

1.2 The Plantwise plant clinics

To provide the farmers with an option to seek advice on pest and disease management, plant clinics are being set up in rural communities in parts of Africa. Plantwise is a project developed by Centre for Agricultural Bioscience International (CABI). CABI has 48 member countries and

work with donors from international agencies, national governments, corporations and regional and local organizations which ensures a "unique, unbiased, inter-governmental structure" (CABI, 2017).

The overall aim of the program Plantwise is to increase food security and improve rural livelihoods by reducing crop losses (Plantwise, 2017). The plant clinics are not operated by Plantwise but Plantwise provides trainings for the plant doctors (local plant health extension officers) at the plant clinics while also connecting them with the Plantwise Knowledge Bank and national research centers in order to provide them with resources and diagnostic support. Today 1800 plant clinics are implemented in 34 countries all over the world (Plantwise, 2017).

The plant clinics provides a meeting place where plant doctors can help farmers who are struggling with pest and diseases by providing management recommendations on how to protect and manage crops (Plantwise, 2017). Farmers bring samples of unhealthy crops to plant clinics thus the plant doctors are able to diagnose pests and/or diseases and advise them accordingly (Plantwise, 2017). The plant clinics further works as a platform for knowledge sharing on farming within local communities. Since 2010, 122 plant clinics have been implemented in Kenya as a community-based approach to overcome some of the challenges in relation to pest and disease management that small-scale farmers are facing (CABI, 2017). Plantwise plant clinics have five key considerations when making recommendations to farmers (Taylor, 2015):

1. Economic efficiency. This is required to ensure that recommendations are meeting the need of the farmers and that they have the ability to afford said recommendation. In some cases, it may even be the best solution not to react to the pest/disease because of the costs and the labor required to save the crops which may in the end fail anyways (Taylor, 2015).
2. Effectiveness. The validity of products used must be considered; the products must be registered and scientifically approved.
3. Protection and safety. This is to secure that farmers are taught how to handle chemicals and stay away from banned products because of the risk of poisoning due to exposure.
4. Practicality. The applicability of the given recommendations is also considered, for example, hand-picking caterpillars from the stem of the crop may be a pest control that is too demanding and not practical for the farmer.
5. Local availability. Plant doctors should consider that some products may not be available at local agro-vets and should therefore not be recommended because of the risk that a

farmer might get a hold of an alternative pesticide which could turn out more harmful than beneficial.

The plant clinics in Kenya are working together with national research institutions such as the Ministry of Agriculture (MoA), Kenya Agriculture and Livestock Research Organization (KALRO, former KARI), Kenya Plant Health Inspectorate Service (KEPHIS), Pest Control Products Board (PCPB) and University of Nairobi (Plantwise, 2017) which is the same case for Embu county.

1.3 Previous studies

Since the first establishment of plant clinics in Bolivia in 2003 a number of reports have been written to evaluate the performance of the plant clinics (Danielsen & Kelly, 2010).

An external evaluation of Plantwise was conducted by Reid and Kiff (2015), to assess the success of plant clinics in China, Pakistan, Vietnam and Sri Lanka. The report stated, that the plant clinics were highly relevant to the farmers and that there is growing demand for their services. Furthermore, it states that the plant clinic's aim to reduce the use of pesticides makes them valid in the eyes of governments that wish to produce crops in a more eco-friendly way. It also finds, that farmers using the service, finds the plant clinics to be trustworthy and reliable especially compared to agro-dealers which the farmers find more likely to be biased. Additionally, it concluded that most farmers were satisfied with the advice given and experienced an increase in yield. However, the governmental institutions responsible for administering the clinics and analyzing the data, was not always working to their full potential and not acknowledging the value of the knowledge and data obtained from the clinics. The report is skeptical about whether clinics in some areas are able to continue functioning if the funding from CABI is stopped. On the contrary, the authors were certain that in other areas the clinics would continue their operations without funding. It also states, that the clinics seem to function best in accessible areas with relatively intensive, irrigated farming, but less in remote rain fed areas with fewer available resources.

Through a study in Uganda which focuses on a quality assessment of diagnoses and advice given at plant clinics in three different districts, it is emphasized that change in farmers' pest and disease management practices only happen, if the advisory services manage to assess the farmers needs, and thus influence their decision making processes while leading to change in local practice (Danielsen et al., 2013). Furthermore, the main performance indicators, in relation

to pest management in developing countries, are identified as respectively technical adoption, cost effectiveness and farmers' perception of pest and diseases (Danielsen et al., 2013).

In the same subject of study, Friis-Hansen & Duveskog (2012) have analyzed the empowerment processes of farmers that have been a part of a Farmers Field School (FFS) initiative that also have field sites located in Kenya. The main focus of FFS is group-based learning processes enhancing the wellbeing of the individual farmer as well as collective community of farmers. Friis-Hansen and Duveskog (2012) emphasizes that a lack in farmers' capacity is evident and that there is a focus on enhancing technology instead.

Bentley et al. (2011) conducted a study in Bolivia investigating the effectiveness of plant clinics from a farmer's perspective. In this study, they used questionnaires to obtain data from more than 300 farmers that had previously consulted the local plant clinics for advice on crop protection. The study found, that "poor" farmers saw the greatest benefits to their economy when consulting plant clinics compared to "medium" and "not poor". Furthermore, it was found, that the clinics helped farmers save money by reducing pesticide use and that the pesticide use in general was reduced. The study also found, that only 11 % of the interviewed farmers did not follow the advice of the plant doctor. Finally it concludes by encouraging more studies of its kind, and suggests future studies of comparing plant clinic users with farmers, that have not used the service.

1.4 Research objective and research questions

The research behind this report is conducted in Kibugu, Kenya. From the information gathered on the Plantwise plant clinics beforehand, we hypothesise that plant clinics in Kibugu are well visited by satisfied farmers, have a positive effect on the management of pests and diseases and that the farmers using the plant clinics are more likely to use cultural control instead of pesticides. However, in the light of the aforementioned literature and the lack of additional literature on plant clinics it becomes clear, that more studies regarding the role and the success of the Plantwise plant clinics from a farmer's perspective should be conducted. Furthermore, it is necessary to investigate what the alternatives to the plant clinics are and how farmers perceive and manage pests and diseases in general. Since that is not the case for plant clinics in Kenya, it have led us to propose the following research objective:

1.5 Research objective

The aim of this project is to investigate in what way farmers in Kibugu are dealing with managing pest and diseases and what role the plant clinics are playing in that specific context. The project takes a starting point in how the farmers are coping with the most prevalent pest and diseases, with specific attention to the crops that may be most important for the farmers. It is furthermore our aim to examine what influences the farmers in Kibugu when seeking external advice on pest and disease management and in that relation, what their perception and/or knowledge about plant clinics are.

We will investigate these objectives by answering the following research questions and sub-questions;

How do farmers in Kibugu, Embu county, manage pests and diseases and what is the role of Plantwise plant clinics?

1. What are the main challenges for farmers in Kibugu in relation to pests and diseases?
    a. Which of the farmers main crops are most significantly affected by pests and diseases?
2. How are the Plantwise plant clinics organized in Kibugu, Embu county and what is their strategy?
3. What is the demand for the Plantwise plant clinics?
4. What other advisory services are present in Kibugu, and how do the farmers use these?
5. What characterizes the farmers that use the Plantwise plant clinics compared to those that do not?
    a. Are there differences in management practises of users and non-users?
    b. What are the farmers' perception of the Plantwise plant clinics' services?
    c. How do farmers use the services provided by the plant clinics?
6. How should the ideal Plant clinic be organized in Kibugu?
7. What are the future prospects of the plant clinics in Kibugu?

Based on our fieldwork in Kibugu, Kenya in March 2017 we will address the above-mentioned questions. We have conducted interviews with farmers, government officials and private companies in Kibugu. Additionally, we have worked towards a review of the research objective with a departure in a study of previous and present literature.

Through an introduction of the area of Kibugu along with an overview of previous studies our theoretical understanding is presented. The structure of the project consists of a review of the concept of plant clinics, an analysis of practices and perceptions of the local farmers, authorities and organizations, a discussion of the role of pest and diseases management and our approach towards the objectives in general (Figure 1).

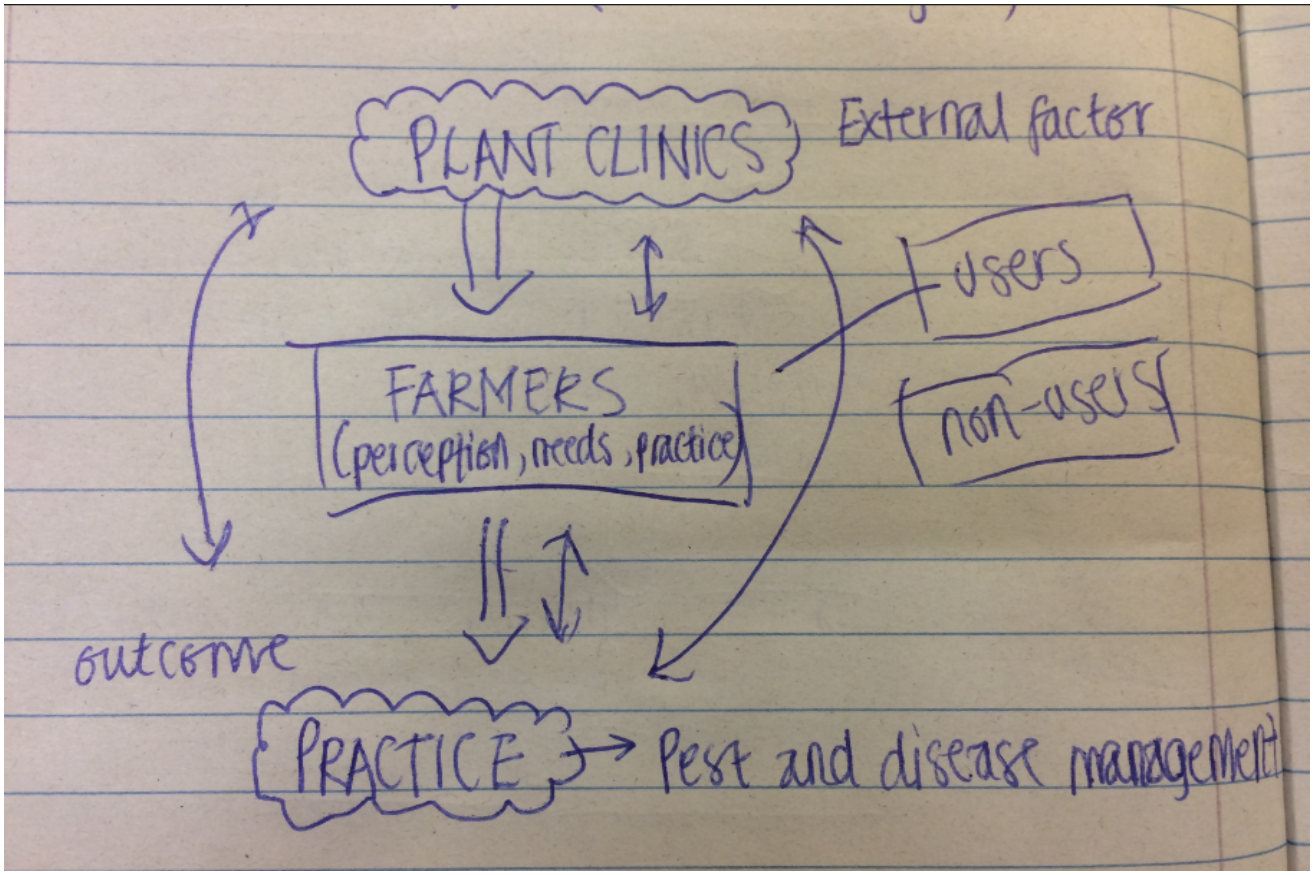

Figure 1. Outline of approach as envisioned before the field work

2. Kibugu location

The fieldwork in Kenya was carried out in Kibugu location, Manyatta sub-county, Embu county, (Figure 2). Northeast of Nairobi, on the foothills south of Mt. Kenya, Kibugu is situated approx. 1600 m.a.s.l. and contains three sub-locations Gicheruri, Kibugi and Ngerwe (Sluse, 2017). The population of Kibugu consists mainly of the Aembu people who share traditional values with Kikuyu and Meru tribes (Embu County, 2015). Agriculture is the main income source with 87.9 % of the households engaged in agricultural activities both small-scale, commercial and subsistence (Sluse, 2017). The soils of the area are of nitisols and andosols that are developed from volcanic materials with low amounts of sands, consisting mostly of clay and clay loams (Gachimbi, 2002). Kibugu is located in an agro-ecological zone where coffee and tea are the biggest cash crops (Gachimbi, 2002) but changes from tea and coffee to horticulture is happening fast (Sluse, 2017). The weather consists of bi-modal rainfall in March - June and between October - December with an average of 1500 mm/a. but this varies with altitude closer to Mt. Kenya (Sluse, 2017).

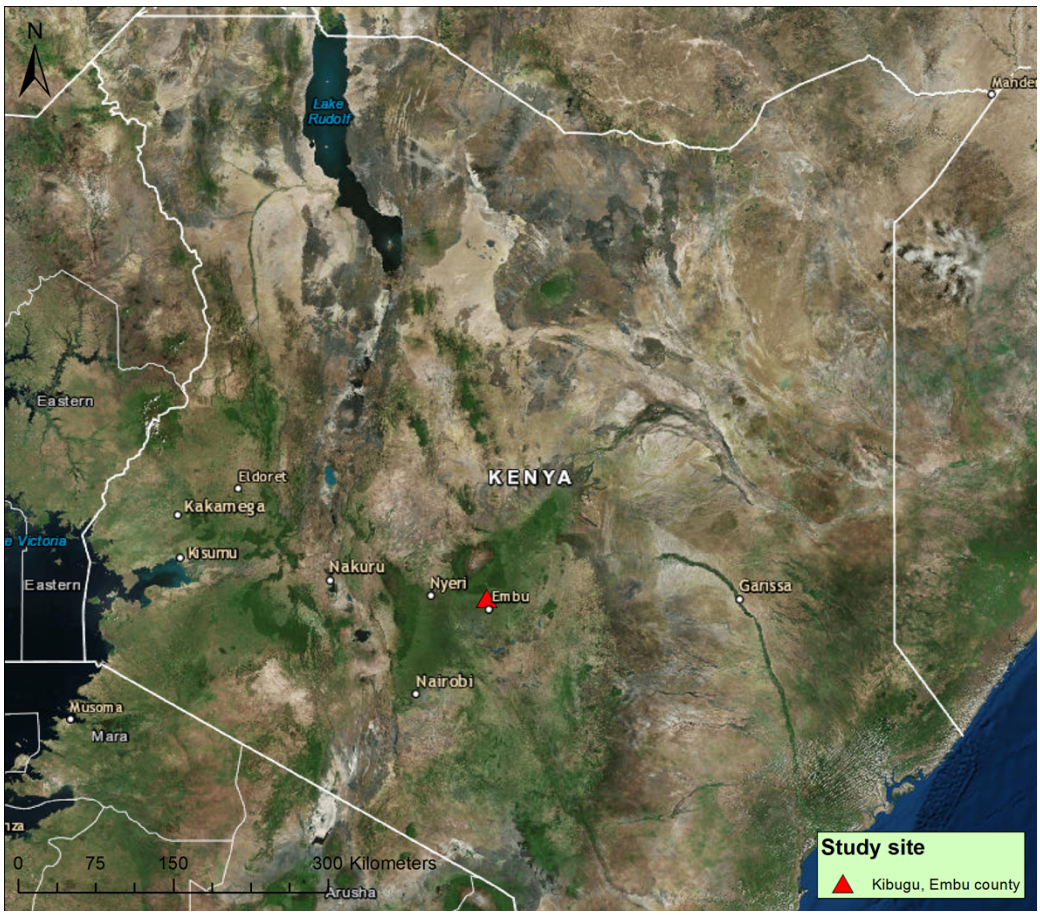

Figure 2. Kibugu location, Embu County, Kenya, Africa

On the basis of a general questionnaire conducted, it is possible to make a general description of the households in Kibugu. The age of the farmers ranges from 23 to 100 years whereof the average age is 51. The average number of people in each household is 4.93, with 1 person as lowest number of household members and 11 as the highest. The smallest farm has an area of 0.04 acres, the largest 20 acres and the average farm area is 2.3 acres.

Of farmers interviewed, 57 % are women, 47 % of the farmers have primary school, 32 % have finished secondary school, 7 % have finished tertiary, 3 % have finished a higher education and 9 % have finished all levels of education.

62 % of the farmers have a monthly income below 10,000 Kenyan Shillings (KES), 25 % earns between 10,000-25,000 KES a month, 7 % earns 25,000-50,000 KES a month and 4% earns more than 50,000 KES every month.

The 10 most commonly grown crops in Kibugu are presented below in Figure 3.

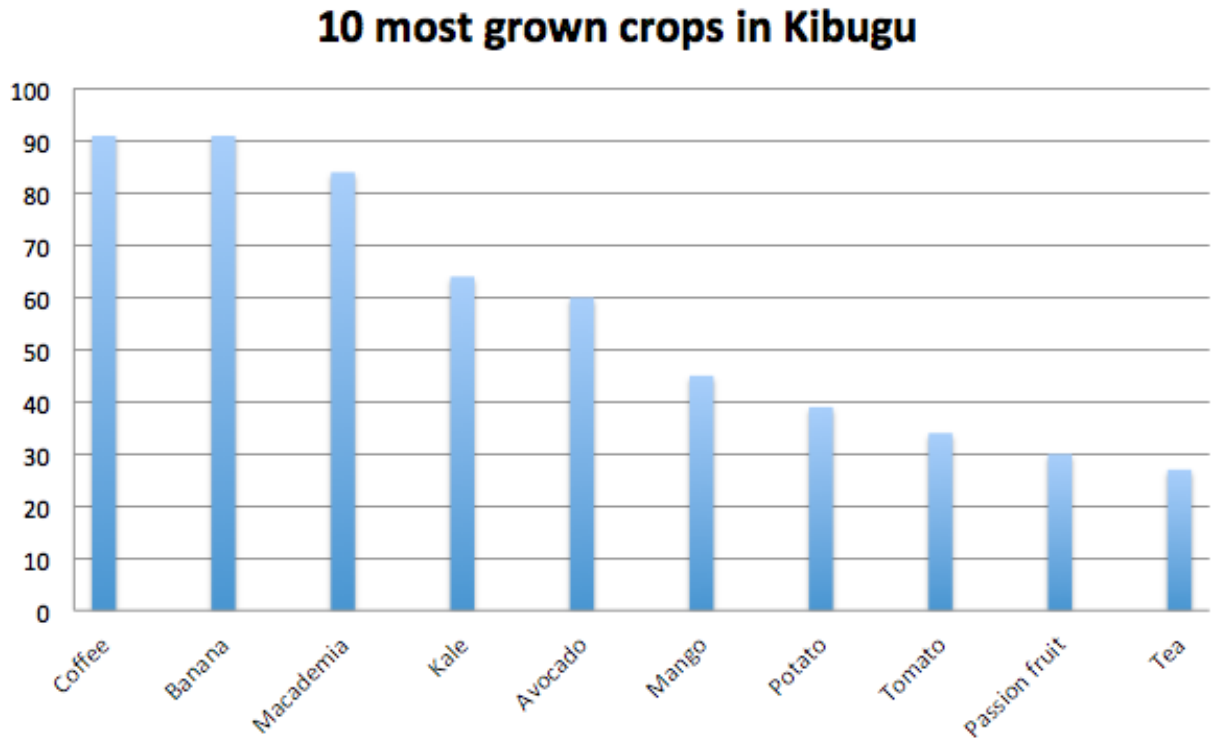

Figure 3. The 10 most commonly grown crops in Kibugu. Data was obtained from 94 farmers using the general questionnaire. The y-axis shows the number of farmers growing the crop.

As seen in Figure 3, the most grown cash crop is coffee while banana is grown mostly for subsistence. Additional crops common in Kibugu are sugarcane, watermelon, sweet potato, beans, butternut, cassava, arrowroot, cabbage, passion fruit, tree tomato, maize, napier grass and carrot.

3. Methodology

In the following section methods used and applied for the conducted research is presented. Furthermore, advantages and shortcomings in the applied methods and a reflection on the methodological choices made during the fieldwork will be discussed. Firstly, the research design is introduced which is followed by a reflection of the positioning in the field and a discussion of the data selection.

3.1 Research design

This research is a single-case study of Kibugu location, Embu county. The research was based on both quantitative and qualitative methods. The aim of the applied methods was to ensure a wide diversity in our data while reflecting potential complexity in the field in order to answer our research questions in the best possible way (Bernard, 2011). Our research was conducted during 11 days of fieldwork while living with three different host families in Kibugu. The research was, apart from participant observations, conducted on the basis of 12 semi-structured interviews with farmers, a general questionnaire targeting 94 farmers in Kibugu and four interviews with informants from governmental institutions and plant clinics. Almost all interviews were conducted in the respondent's private homes or offices.

3.2 Informants

A large part of our data relies on interviews with different actors, each with different interests in our field of study or possessing a specific knowledge on the subject. These actors range from local farmers to government representatives such as desk officers, plant clinic organizers, extension officers and plant doctors. Our informants have provided us with useful background knowledge for our research and they are presented in appendix 7.

3.3 Collection of data

When analyzing data it is very important to reflect upon the aspects of communication and language barriers experienced in the field. Both Swahili, English and Kîembo were used when conducting the interviews, and even though a relatively big part of our interviews was conducted in English, we were sometimes challenged by the process of translation. When the respondents responded in Kîembo, we could not be sure that the local interpreters and the Kenyan

counterparts were translating the words directly, which could have affected the results because of personal interpretation.

3.3.1 General Questionnaire

The quantitative general questionnaire is used to obtain large amounts of data in a short amount of time in order to discover correlations in data. In relation to our specific research objective, the main purpose of the general questionnaire was to get an impression of how many farmers were aware of plant clinics in Kibugu and of those, how many had used/not used them. Furthermore, we wanted to investigate possible correlations between age, gender, crop diversity and size of farm. The general questionnaire relies on data from 94 households in Kibugu based on a random selection of approx. every third household in the area. In order to get as much and diverse data as possible, the general questionnaire have been composed in cooperation with three other SLUSE groups.

It was important for us to conduct the general questionnaire one of the first days of our fieldwork, in that way we were introduced to the community, and at the same time get a general overview of the type of farming systems in the area. On our first day in the field, we tested the general questionnaire on four of the Kenyan interpreters. They were able to give us valuable feedback on the questionnaire and especially on the questions concerning more sensible issues like amount of income or division of labor.

3.3.2 Semi-structured Interviews

The 12 conducted semi-structured interviews were conducted on the basis of the interview-guides (see appendix 6), which were composed in accordance to the specific interview (Bernard, 2011). A semi-structured interview is relatively free and open-minded it its character which allows the informant to make spontaneous contributions to the asked questions (Kvale, 1994). Therefore, the reason for choosing this type of interview was that our research should be done within a relatively short timeframe and therefore we were unsure of the possibilities of conducting follow-up interviews with our informants (ibid.). It was thus important that our interviews touched upon all issues of relevance for our research.

To answer our research question in the best way possible we wanted elaborative perspectives from both small and large scale users and non-users within different categories of size of land, age, gender, educational background and crop diversity. We wanted to discover possible correlations in management strategies in relation to pests and diseases between users and non-users, which could help us determine why some farmers were using/not using the plant clinics.

The conducted farmer interviews were completed with five users of plant clinics and seven non-users collectively representing six large-scale and six small-scale farms. This selection is relevant even though there are more non-users than users, because results from the general questionnaires have shown that this is the general distribution throughout the area. What we perceive as "small" and "large" farms have been decided simply by calculating the mean size of all farms appointed on the basis of the general questionnaire. The interviews with the farmer informants gave us an insight in the farmer's needs in relation to pests and disease management, and we additionally got an idea of how the ideal plant clinic should work. Through the general questionnaire, a relation to the specific farmer was created, and we chose to maintain this relation between interviewer and interviewee, when conducting the semi-structured interviews. We had an assumption that this could give us additional insights, but we are aware that this might also have eliminated gaining new perspectives of the informants.

3.3.3 Observation and participant observation

We have participated in daily activities of our host families, which has given us an opportunity to ask informal questions and thus obtain insights about our area of study and of the everyday life in Kibugu. Because of limited time in the field, participant observations have been valuable for us in gaining in depth knowledge about the local context and social dynamics (DeWalt & DeWalt, 2011).

During the semi-structured interviews we conducted "walk-and-talks" around the specific farms, as well as we performed observation after the interview with the plant clinic, to explore the level of activity and visitors.

3.3.4 GPS Mapping and transect walk

In order to make a spatial analysis and to get an overview of the location of the farmers using/not using the plant clinics we used a GPS to map the locations of the farms. We wanted to explore whether there were any obvious similarities between the household's locations and their management strategies in regards to their status as user/ non-user of plant clinics to detect.

Further, two transect walks in different areas in Kibugu have been conducted to investigate if there existed any correlations between environmental differences, farm size, irrigation and crop diversity and farmers' use/non-use of plant clinics.

3.3.5 Participatory Rural Approach (PRA)

A variant of PRA was used in one case of a farmer interview and in one case during the interview with the plant doctor E. Ndwiga. The informants were asked to draw a map of the plant clinic's relation to other agencies within the context of pest and disease management. Another variant of PRA, ranking, was used in the semi-structured interviews and in the general questionnaires, where informants were asked to rank which pests and diseases they found most challenging (see appendix 6).

It can be argued that both mapping and ranking is a variant of PRA as it is a way of getting the informant to participate more during the interview.

3.4 Data presentation

In the results section of this report, we have used graphs and pie charts to visualize our data. The qualitative data from the informant interviews have been utilized to make analytical generalizations. This is a way in which several generalizations can be shown in the same context which is useful in a process where few descriptions of one phenomena is best explained in complex coherence (Roald & Køppe, 2008).

3.4.1 Analyzing quantitative data

The data from the general questionnaires have been analyzed for significant differences between users and non-users using the statistical analysis program SPSS by IBM. Using the function "Crosstabs" a Chi^2-test have been applied to the data and the significance level interpreted from the output of the analysis.

3.5 Methodical considerations

Whenever research is conducted it is important to be aware of possible biased perceptions and prior understandings one, as a researcher, might bring into the field (Bernard, 2011). It is difficult to be completely objective in the field because the personal views of the researcher will influence what kind of data one will have access to (Bernard, 2011). This was also the case for this research, and we have been reflecting on our positioning and the best possible way of addressing the field of study without affecting the results.

As an example, we decided to split up in mixed groups of one Kenyan and one Danish student when conducting the general questionnaires. The main purpose of this was to ensure that at least one member of the group spoke Swahili, which turned out to have a great effect on the

atmosphere between the farmer and us. In an African rural society like Kibugu being “mzungu” (white) can, from our experience, cause either a case of excessive excitement or aloofness, but most importantly it is very noticeable that we are “strangers”, and even before the conversation begins, there already exists a perception of our differences. Walking in pairs of Kenyan/Danish helped eliminate the strangeness and made the communication easier.

3.6 Positioning and preconceptions

From secondary literature of prior studies of plant clinics in other countries we had preconceptions about the field of study even before we arrived. As an example, we assumed, that there would be a discrepancy between the intention of the Plantwise plant clinic as developing initiative and the context-specific needs and practice in regards to farmers in Kibugu, and the way they manage pests and diseases in their crops. Even though we were influenced by preconceptions, our general aim was to explore the role of the Plantwise plant clinics in the context of Kibugu and to be as open-minded and neutral as possible while letting the data guide our research. It is to be noticed, that having preconceptions of the field prior to a field study not necessarily is a disadvantage as it can ensure awareness and reflectiveness.

4. Results

On the basis of our qualitative and quantitative data, and through both the farmers' and the plant clinic's points of view, our own understanding of how the farmers perceive the plant clinics, how they are organized and how they are related to other advisory services in Kibugu are presented.

4.1 Main challenges for farmers in Kibugu

First and foremost, the main challenge farmers face when dealing with pests and diseases in their crops is the risk of loss in production and in income. According to the general questionnaire, loss of coffee amongst the farmers ranges from 10 - 60 % due to pests and diseases while loss in crops for own consumption such as kale, tomatoes, beans, cabbage, spinach and in few cases banana, ranges from 25 - 50 %. In Figure 4, the crops mostly affected by pests and diseases in Kibugu are presented:

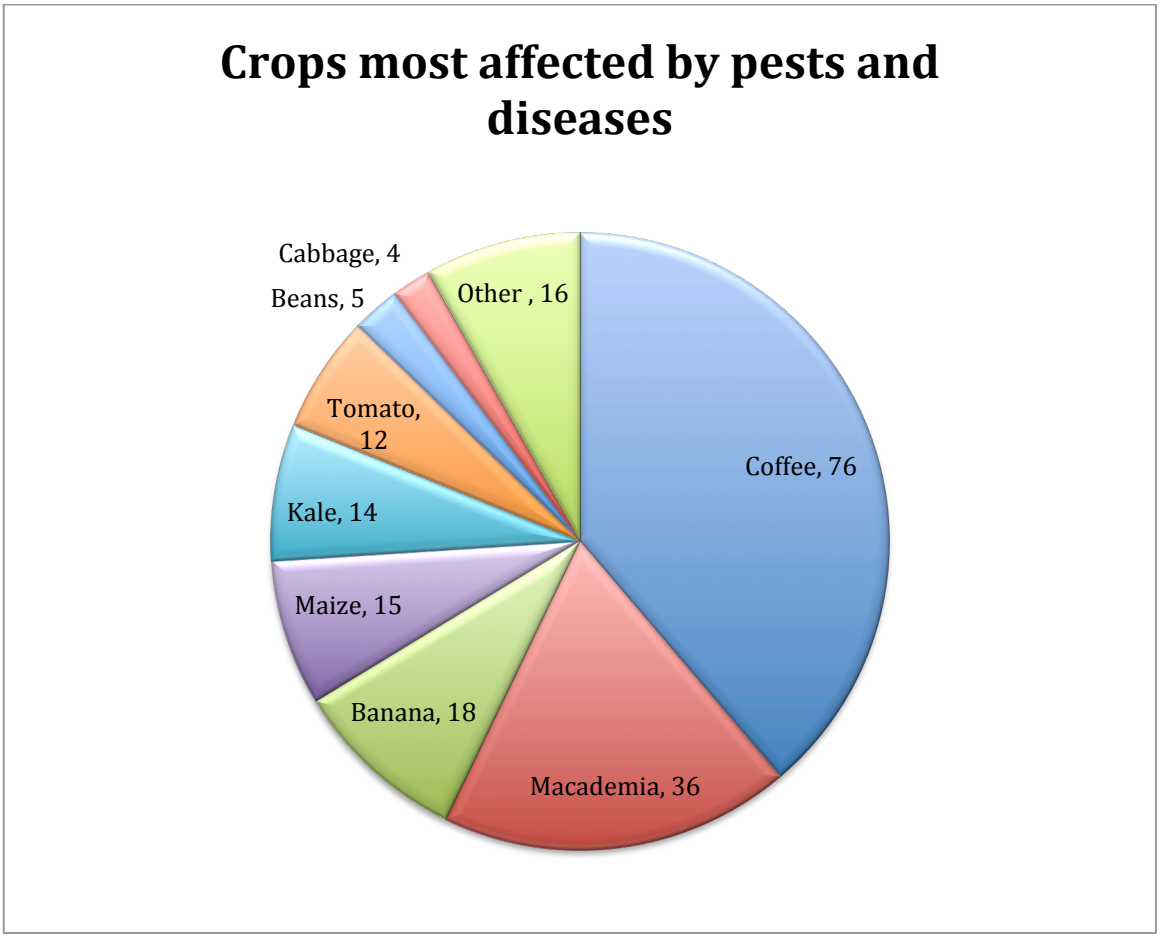

Figure 4. Crops affected by pests and diseases in Kibugu. The data was obtained from 94 farmers interviewed through the general questionnaire. "Other"- category: crops that 3 or less farmers reported as being attacked by pests or diseases. This group includes potatoes, watermelon, sweet potato, arrowroot, spinach, carrot, sugarcane, napier grass, avocado and coriander.

As seen in Figure 4, coffee is the crop most affected by pests and diseases in Kibugu. Of the 91 farmers growing coffee only 15 of them have not reported pest and disease problems. Below, in Figure 5 respondents have listed the most common pest and diseases in coffee.

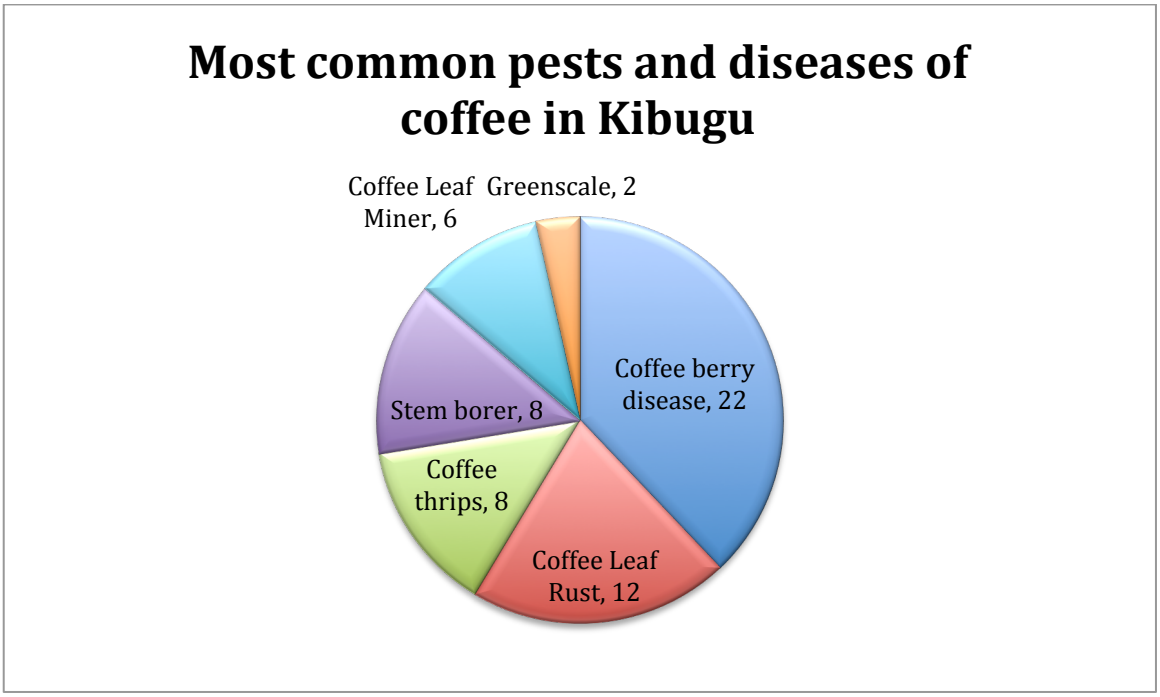

Figure 5. Most common pests and diseases occurring in coffee production in Kibugu. The data is obtained from interviews with the 58 farmers who, in the general questionnaire, specified which pests and diseases they were dealing with.

As seen in Figure 5, the two most common pests in coffee production in Kibugu are CBD and CLR. This is also the two diseases the 12 respondents from the semi-structured interviews mentioned as some of the most problematic diseases (interview farmer 1;4;11;10;2;7). In crops other than coffee, common pests and diseases are worms, thrips, aphids, nematodes and other unidentified insect pests.

4.2 Organisation and strategy of the plant clinics

In Manyatta sub-county there are nine plant clinics out of a total of eleven in Embu county whereof one sub-county does not have a plant clinic. The plant clinic was initiated in Embu county as a pilot project, which explains the many plant clinics in this area (interview P. Muriithi). The Kibugu plant clinic is located in Kibugu Town in the end of the town center on a relatively busy dirt road next to an agro-vet (see Figure 6) and a coffee co-op (appendix 3). The clinic is placed on a plateau that is elevated from the road hidden behind an information town

sign and is therefore not visible from all angles, especially not from the main road (Figure 6 below).

Figure 6. Location of the Kibugu plant health clinic in Kibugu Town center. An information sign is placed in front of the plant clinic and it is not possible to see the clinic when going towards the clinic (from left to right in the image).

The plant clinic is open on Fridays, which is not a market day, and is supposed to only be operating twice a month, every other Friday, but the plant doctor E. Ndwiga wants to attend to her farmers, which means she is there every Friday. She finds that she is helping them and she is very happy about it. "*I love my work*" (interview E. Ndwiga). The clinic is equipped with an umbrella, a portable table, chairs, a tablet and several handbooks on management of crops. A pocket knife and a lens is also provided (interview D. Gitari). Two plant doctors are connected to each plant clinic. The plant doctors have a background in agriculture and extension work, and they go through pest and disease training programs organized by Plantwise in order to be able to give appropriate recommendations and a continuance of small training programs to be kept "up-to-date" (interview D. Gitari; interview E. Ndwiga). It is up to the farmer to come visit the plant

clinics while in the past, extension officers did field visits. This have been stopped due to budget cuts within the government (interview E. Ndwiga).
The communication between plant doctors as well as communication between the plant doctors and the farmers is essential. Through the tablet the plant doctors are able to send information on management and new outbreaks of diseases to the farmer's cellphone. E. Ndwiga says, the tablet battery is not able to last a whole day and that it is problematic (interview E. Ndwiga).
The plant doctors have access to different networks of support and information; if they come across an unknown disease, they are able to search the through diseases through a knowledge forum called Knowledge Bank via the tablet:

"*We have the knowledge bank from Plantwise were we browse by crop or by problem* (…) *it is also translating in Swahili – so they give the prevention and the monitoring and the direct control. And then they also give the chemicals that you can use, although they don't give many. You see, this is universal*" (interview E. Ndwiga).

If the solution is not found in the knowledge bank the plant doctors can turn to different Kenyan research institutions for support:

"when we get challenges of diagnoses, we take it to the KALRO people. If we get problems with the chemicals, we take it to the KEPHIS so we have no problem with that because we are working together" (interview E. Ndwiga).

The plant doctor in Kibugu recommends two types of control strategies; biological/cultural and chemical control. They prioritise the advice on cultural control before the chemical which is in accordance with the principles of Plantwise. They do this because they

"*don't encourage farmers to use so many chemicals because of the stress on the environment. And also,* [for] *economically* [reasons]" (interview E. Ndwiga).

Thus the quote emphasizes that the plant clinics are aware of the environmental and economical challenges related to the use of chemicals.

4.3 Demand of the plant clinic

From the general questionnaire it is seen, that even though 37 out of 94 respondents have heard of plant clinics, only 22 have actually used them. In comparison, 67 of the 94 respondents have used the agro-vets. Of our informants, 5 out of 12 have used the plant clinics. When asked if enough farmers are using the plant clinics P. Muriithi answers:

"No no no, we are trying to look for ways to reach them, to reach more farmers, because our average is around 6-7 per day" (interview P. Muriithi).

It appears that there is not a great demand, but yet it seems to be busy at the Kibugu plant clinic. E. Ndwiga volunteers twice a month and states: *"I chose to be here every week because of the demand"* (interview E. Ndwiga). Our participant observation of the plant clinic (see Methodology) showed, that in 1.5 hours we observed, four clients who visited the clinic with a duration between 15 and 45 minutes.

From these findings, it seems that the general farmer does not requests the plant clinic per se, but this does not mean the farmer does not require its services; our interview with E. Ndwiga reveals that there is a strong demand for extension services in the field:

"I know that when I go to retire, these farmers they are still coming to me, I know that. Even now when I go on leave. I wake up sometimes in the morning, I find them there waiting for me" (interview E. Ndwiga).

It certainly appears that there is a demand for the advices on pest and disease management, which the plant clinics are able to offer, but also there is a gap when it comes to reaching each farmer, and getting them to visit the plant clinic. This might also relates to the availability of other advisory services in Kibugu.

4.4 Other advisory services in Kibugu

Apart from the plant clinic, there are different advisory services present in Kibugu. Of these, the most dominant is the agro-vets. Our interviews with the informants have shown a predominant use of pesticides as a method of controlling pests and diseases. This is because for one, there are visible effects after a relatively short time frame; as farmer 1 says "(...) *I have used it and I have seen the results. They are quite good* (...)" (interview farmer 1). The pesticides are easy to access because of the agro-vets are all located around Kibugu Town center. Here, the farmers can request a specific pesticide and if the chemical is not on stock, the agro-vets can provide a range

of alternatives. There seem to be a dissonance amongst the farmers regarding the perception of whether the agro-vets possess the appropriate knowledge on how to advice farmers on use of pesticides. Farmer 5 claims that:

" The agro-vet has the knowledge of what to spray with and when" (interview farmer 5), which also is the opinion of farmer 1 who states that: *"They also have the knowledge* (...) *normally they take those fellows* [the salesman] *for training, so they are trained"* (interview farmer 1). While farmer 6 says: *"the people who sell the pesticides, they are just selling for business* (...)" (interview farmer 6).

This is supported by farmer 9 who states that she also goes to the agro-vet "*but it depends on the person in Agro-Vet, if the person has experience"* (interview farmer 9), which gives us a differentiated picture of the capabilities of the personnel in agro-vets, and that the users of these are aware of their skills. Another company enabling easy access to pest and disease control methods is the chemical company Greenlife (appendix 3);

"*Greenlife produces chemicals as well in Kenya. So he is available* [and] *that company sends representatives all over, so* (...) *I call and he come*s (...) *he comes on a weekly basis*" (interview farmer 1).
This led farmer 1 to stop using the services provided by the plant clinics, due to the fact that she does not have to go and search for recommendations.

The ability to share knowledge with neighbors is also a source of advice for the farmers. Farmer 7 tells us that he use the inspiration from other farmers and neighbors, who he feels are much better at farming than himself, while farmer 6 says that:

"Farmer to farmer are nice, because they have the experience", "*I ask people here in this area and the few you know from other places, who are doing the same kinds of farming"*

This also has something to do with trust - the farmers trust each other more, than they trust the agro-vets. Farmer 7 explains, that from his friends he can directly see what they are doing, and how they can give him guidelines; *"*(...) *the agro-vets you cannot trust them, compare*[d] *to how you trust the friend".*

Furthermore, it can be the case that farmers' different tools for coping with pest and diseases are derived either from inheritance or from indigenous knowledge; farmer 3 scatters ash on arrowroots and sweet potatoes, and spreads soil on young plants, to keep the insects away, which she calls "indigenous knowledge" (interview farmer 3).

A few of the farmers have mentioned being in contact with MoA as one of their sources of advice. They visit the office in Manyatta, to get advice on management, and to gain knowledge on possible new management strategies. Farmer 8, who is a large-scale non-user is one of them. But the MoA office is far away and it might be because of the fact, that farmer 8 has hired labor at his farm, that he has the time and money to leave his farm for a day to collect information.

Several of our non-users got their information from the coffee cooperative they are affiliated with and based on collected data, 62 out of the 93 farmers growing coffee is connected to a coffee co-op.

The secretary at the coffee co-op explained (interview J. Njoki) that different chemical companies, NGO's, as well as agro-vets, provide seminars on management and growing of coffee at the co-op.

One farmer visits the coffee co-op to get information and advice on pest and disease management, and to borrow pesticides. He has the possibility of repaying the coffee co-op later, which gives him an opportunity to act in time to pests and diseases (interview farmer 7).

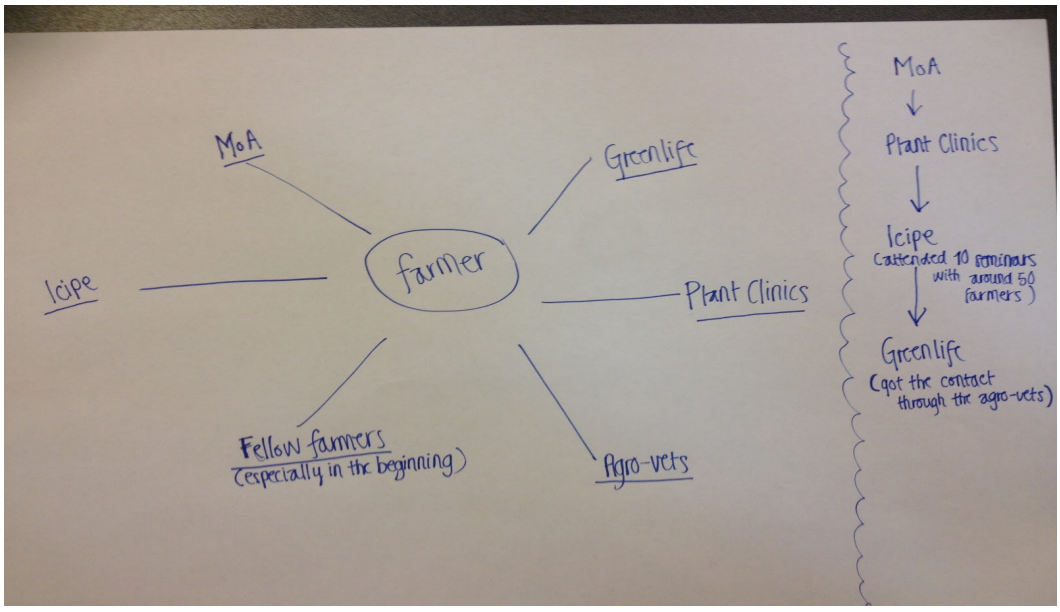

Figure 7. PRA mapping by farmer 1 The sources of advices and knowledge in Kibugu. To the right: the informant's way to the private agro-chemical company Greenlife is outlined - this emphasizes that all the services in some way are connected.

As shown in Figure 7, the farmer has several options of advisory services in Kibugu. The accessibility of the services are the most important parameter for the farmers but also the economically advantages are emphasized - this being either the price of recommendations, logistic advantages or awareness of services. Below, in Figure 8, E. Ndwiga has shown how the different agencies in Kibugu are linked to the plant clinic.

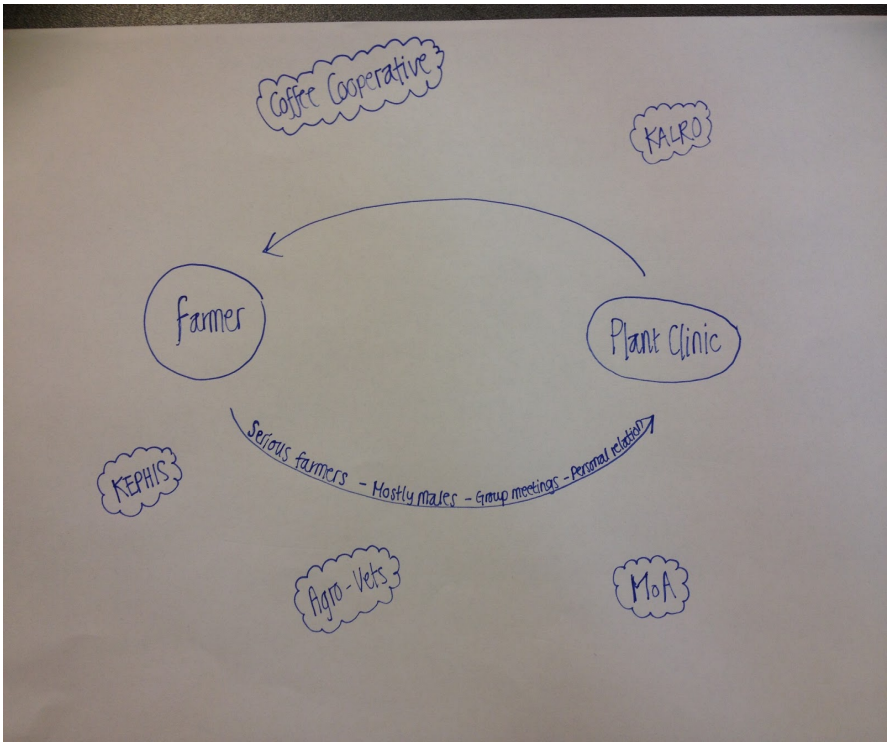

Figure 8. PRA-Mapping by E. Ndwiga - the context in which Plant clinics are working and what characterize the farmers who use the plant clinics service.

The PRA-mapping shows that the farmer and the plant doctor apart from few differences share the same perception of the context of pest and disease management and the options of advisory services in Kibugu. On the other hand we have identified some contradictions in the perception of the level of cooperation between the different advisory services and specifically between the plant clinics and the coffee-cooperative in Kibugu.

According to E. Ndwiga, D. Gitari and P. Muriithi the plant clinics cooperate with the coffee cooperative in training of farmers on pest and disease management;

(...) Yes, we work together with these ones [coffee cooperative]. *And also* [they] *ask me what kind of advice is good for this season or what chemical should we order for the farmers (...) They also request us to go and train their farmers. There are training days* [which we attend] *once a year"* (interview E. Ndwiga).

But after talking to the secretary of the coffee cooperative, an essential contradiction is visible; *"*[We have] *no cooperation with the plant clinics, but* [we are] *aware of them"* (interview J. Njoki).

The statements make it uncertain whether there is cooperation between the plant clinics and the coffee cooperative or not. We are aware that this cannot solely be based on one statement from one coffee cooperative, and if we had conducted interviews with several coffee co-ops, the result might have been different.

4.5 Comparing users and non-users

In relation to gender, it was found that there was no significant difference (p=0.859) in gender when comparing users and non-users of the plant clinic. However, there was a larger proportion of women among the users (59.1%). A bar chart of the gender data can be seen in Figure 9. According to P. Muriithi women are the most common visitors of plant clinics, men will visit plant clinics when it comes to management of cash crops. This differs from E. Ndwiga's statement about men being more frequent visitors to the plant clinics. She also states that the farmers visiting the plant clinics are the more serious farmers.

Figure 9. Distribution of gender between users and non-users of plant clinics.

Income do not seem to have an effect on the use of clinics either as no significant difference between levels of income and the use of plant clinics was found (p=0.147). The data is visualized in Figure 10.

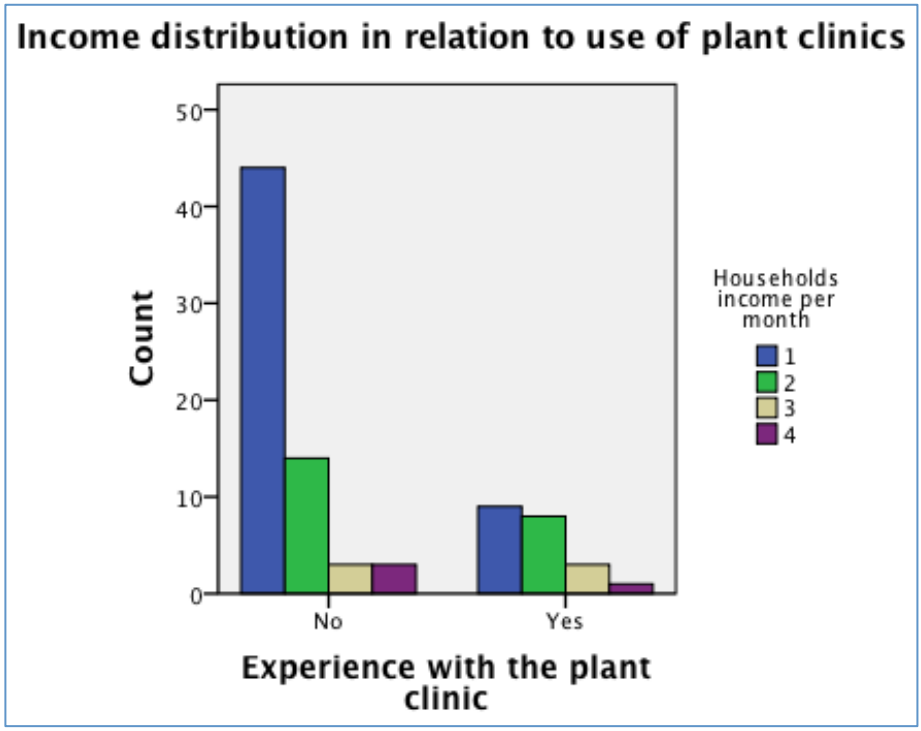

Figure 10. Distribution of income levels within the "user group" and the "non-user group". Income category 1: Below 10.000 KES. Income category 2: 10-25.000 KES. Income category 3: 25.000-50.000. Income category 4: Above 50.000 KES.

The users of the clinics were not characterized as having significantly different farm sizes from those farmers with no plant clinic experience (p=0.873). The distribution of large and small farms within the users and non-users can be seen in Figure 11.

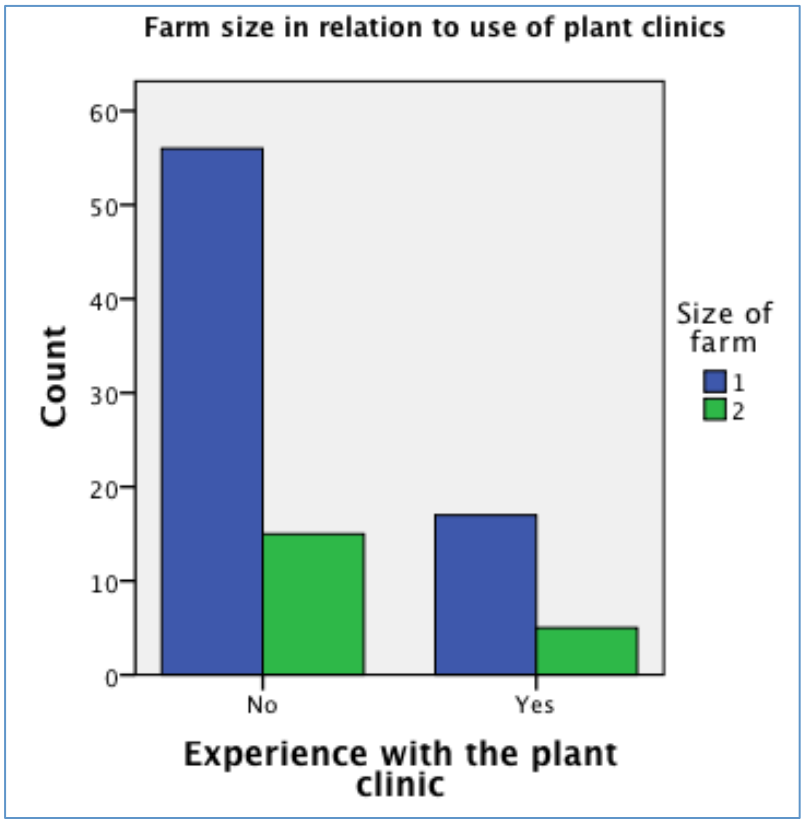

Figure 11. Distribution of farm size within the two categories of farmers. Farm size category 1 is farms smaller than 2.31 (the mean), and farm size category 2 is farms larger than 2.31.

No significant difference was found between the users and non-users in relation to education level (p=0.289) or number of people in household (p=0.414).

Geographical visualization

In Figure 12 below, the GPS coordinates from each interview with general questionnaire respondents have been visualized to illustrate the geographical location of all interviewed.

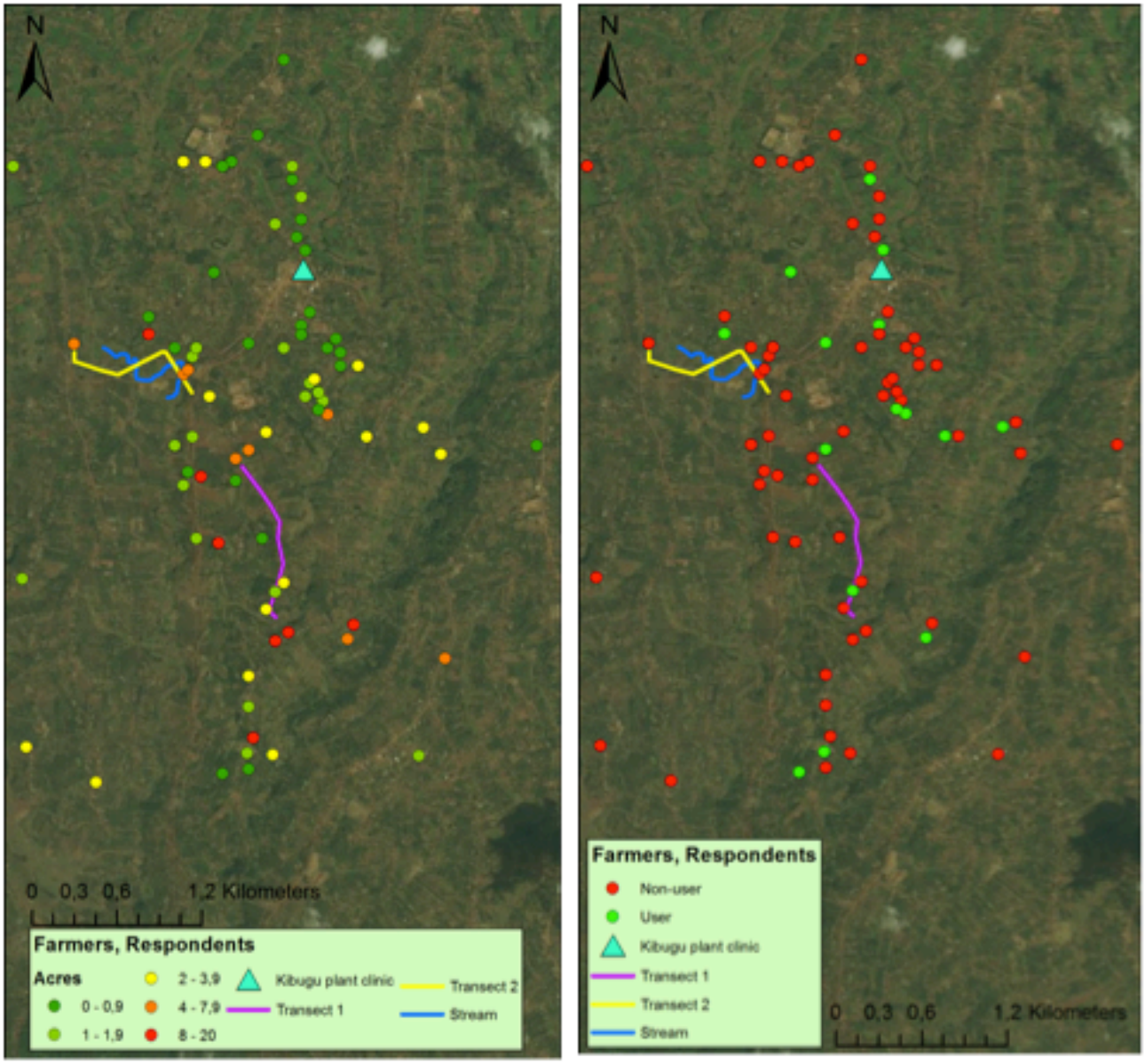

Figure 12. Geographical distribution of users and non-users of plant clinics and of farm size in relation to plant clinic in Kibugu based on the general questionnaire, along with conducted transect walks.

Based on the general questionnaire respondents, there is no visible pattern in the distribution of users and non-users in relation to where the plant clinic is located. In Figure 13, farms have been grouped by size, showing where small and large farms are located in relation to the plant clinic. There is a slight tendency of smaller farms located close to the plant clinic, but if we keep in mind that the average size of farms in Kibugu is 2.31 acres, there is no visible pattern in farm size and distance to the plant clinic. It is not the case that users are located closer to the plant clinic neither are larger farms located close to the plant clinic and those that are generally not users.

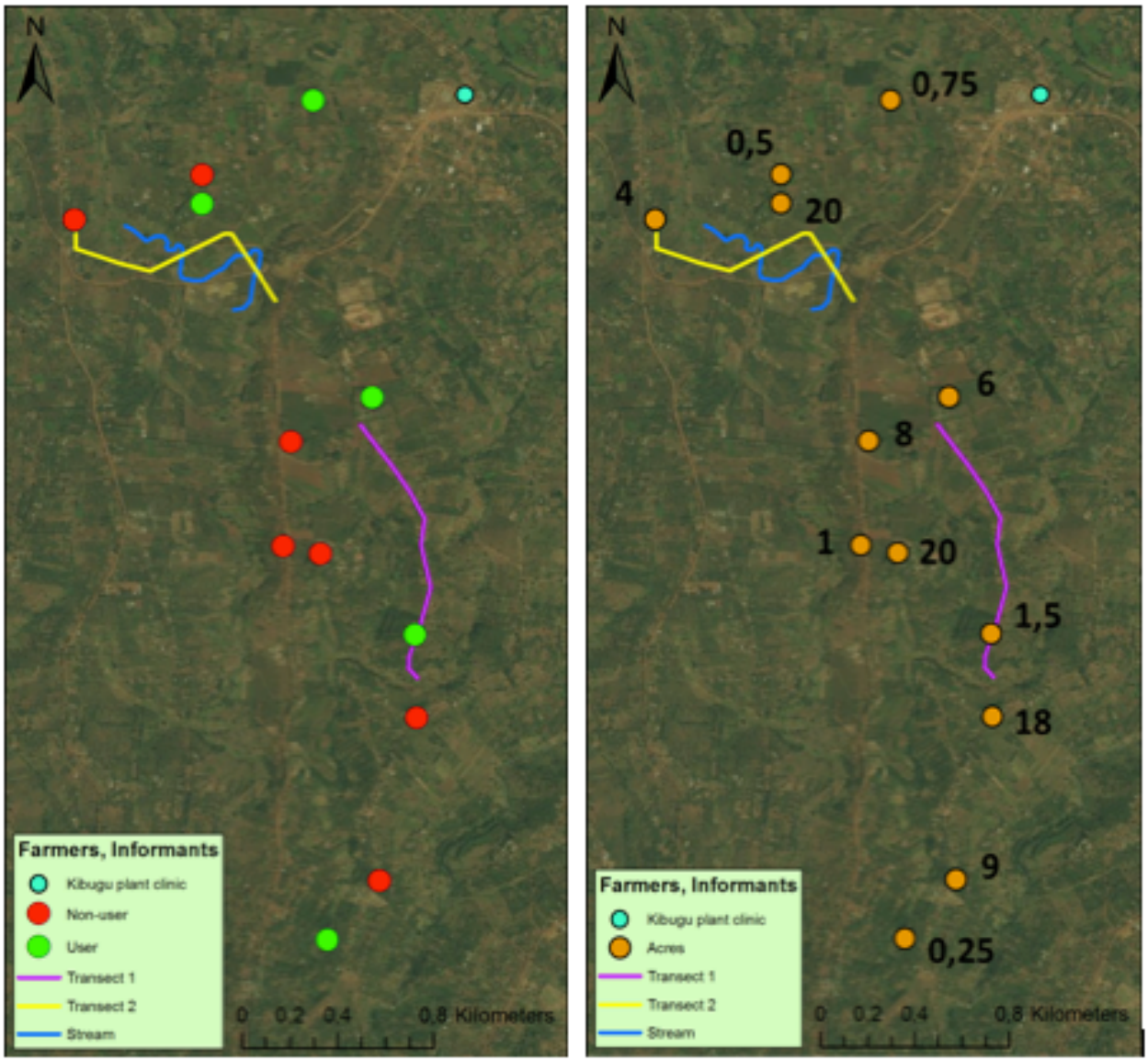

Figure 13. Geographical distribution of users and non-users of plant clinics and of farm size in relation to plant clinic in Kibugu based on semi-structured interviews, along with conducted transect walks.

The geographical distribution of user and non-users found through semi-structured interviews shows no pattern. The farm located furthest away from the plant clinic is a user, which is also the case for the farm located closest to the plant clinic. If this is compared to the size of the farms, it is seen that size in user-farms range between 0.75, 20.6 and 1.5 acres, resembling no correlation between size of farms and use of plant clinics. The variation in farms size of non-users is the same.

Transect walks

In the figures above, two transect walks are shown. The walks were intended to reveal any differences or similarities between fields located close to the water and those located far away,

and further if it should be the case that the farms with water-access would also be plant clinic users.

Transect 1 was conducted in an elevated area, where also some of the general questionnaires were conducted. The general tendency in this area was small-scale crop production of mainly coffee and tea with subsistence crops consisting of bananas, avocados, mangos.

Transect 2 was conducted in a valley, where access to irrigation was possible. This was also visible in the produce in the area, where the majority of the fields were irrigated, and the cultivation mainly was horticulture produce consisting of tomato, kale, cabbage etc.

Except from the cultivation differences and that the fields were a lot bigger close to the water there is no coherence in access to irrigation and users of plant clinics.

4.5.1 Differences in management practises of users and non-users

The results show, that the use of chemicals was the most common control strategy applied in regards to pest and disease management, and that there were no difference between strategies of users and non-users.

A reason for this might relate to the fact that some of the farmers, take action too late, in order to implement the biological and cultural control strategies in relation to the stage of the pest or disease infection in their crops. This is emphasised by the plant doctor D. Gitari:

"Sometimes the farmers give samples where it is too late to treat. So it depends on what stage the farmers comes to the plant clinic". (interview D. Gitari)

4.5.2 Farmers' perceptions of the plant clinics' services

The general opinion amongst the farmers regarding the services provided by the plant clinics is that they are satisfactory and that the advices received are efficient in dealing with pest and diseases. Of the 22 plant clinic users, 21 of them were "satisfied" or "very satisfied".

4.5.3 How farmers use the services provided by the plant clinics

It is our impression that users to a large extend adopt and use the advices provided by the plant doctors. They may get a second opinion from the agro-vet or in this case - the other way around: *"The plant clinics recommended the same chemical as the agrovet."* (interview farmer 5).

It is P. Muriithi's impression that those farmers who keep returning to the service are satisfied:

"if it works, we realize that farmers keep on coming to the clinic. So in other words it shows us that whatever we recommended it was good" (interview P. Muriithi).

When E. Ndwiga advice farmers on pest and disease control methods, she always recommend a cultural control method as the first one before recommending on spraying of pesticides:

"We always start with the cultural", "(..) for coffee, we give the cultural [recommendation] *and then a resistance variety alternative". "So, you give all the alternatives for the farmers to choose, for the farmer to make a choice"* (interview E. Ndwiga).

However, it appears the farmers choose to control pest and diseases with chemicals. All of the 12 informants have stated, that they use chemicals as a method of controlling pest and diseases, and only one of them have expressed, that he would be willing to accept the use of biological/cultural control methods even though it takes longer time to implement, as he would save costs in the long run (interview farmer 4).

4.6 Farmers perception of the ideal plant clinic

The ideal plant clinic service for the farmers would be farm visits. In that way, the plant doctor would be able to notice and to react to pest and disease outbreaks in time; *"They should bring back those field officers (...) and visit somebody's home once a week or even once while. That would be good"* (interview farmer 1).

Farmer 1 mentions "funding" as something that would support the recommendations given by the plant doctors, as it can be expensive for the farmers to control pests and diseases; when asked, 6 out of the 12 informants says that the government should reduce taxes or provide subsidies on chemicals. However, there is a chance that this would lead to an increase in the use of pesticides which is not in accordance with the Plantwise principle of reducing pesticide use.

Farmer 3 states, that the plant clinic should be open everyday, and farmer 4 says, that the plant clinic geographically should be located closer to the farmers (interview farmer 3; farmer 4). Farmer 1 requests that the plant clinics advertise their whereabouts better in order to reach out to individual farmers because "*actually there are people who don't know. They should hold a seminar once in a while to make people know about it and to encourage people to keep visit them*" (interview farmer 1).

4.6.1 The plant clinics perception

The way to be an ideal plant clinic, according to the plant clinic officials; D. Gitari, P. Muriithi and E. Ndwiga, is to optimize the existing features of the plant clinic. D. Gitari suggests an office where they are able to get away from the rain, the sun and the dust, and E. Ndwiga suggests a tent where she will be able to consult farmers one-on-one (interview D. Gitari; interview E. Ndwiga).

"*when it is very dusty, it is not very comfortable here (...). When it is too hot, when it is 2 pm,* [...] *the sun will start coming here and it will be very direct and it is also very uncomfortable. When it is raining, that is the worst, because then it also very chilly, that is also very uncomfortable*" (interview E. Ndwiga).

The tablet is a great asset to the plant doctors, making them able to access the knowledge bank, to create detailed prescriptions to the farmers, and to consult with plant doctor colleagues. But as E. Ndwiga explains, the tablet's battery does not last for long. She suggests a power bank or alternative battery for the tablet so she is able to access information all day (interview E. Ndwiga).

4.7 Future prospects of the plant clinics in Kibugu

The future of the plant clinics is uncertain. There have been contradictory statements from different institutions (interview D. Gitari; interview P. Muriithi) as to whether or not, the plant clinics will survive after CABI stops funding. D. Gitari states that the program and the support of CABI, will end next year, E. Ndwiga mentions her worries about the future, but says that she is not sure the plant clinics will shut down per se, and according to P. Muriithi CABI will continue to support the training of plant doctors. Both E. Ndwiga and P. Muriithi concurs that the counties will take take over the program of plant clinics:

"*we hope that even as the county takes over* [the program] *it will also consider teaching the plant doctors, but CABI is still with us. It is facilitating in the training of doctors as well as the materials for training*" (interview P. Muriithi).

"As much as CABI may not be able to fund like they are funding [now]*, but still they are funding because (...) CABI is important with their trainers* [trainings] *and their training materials"* (interview P. Muriithi),

"(...) the only thing that can take up [overtake] *the clinics is the counties. But even the counties will not be able to take them, it will not work very well. You need some funding. I don't know what will happen (...)"* (interview D. Ghitari).

In the worst case the plant clinics will fall under the administration of the government, and the farmers will have to pay for the advisory service. Farmer 5 says that she will not be willing to because she does not have the money for it (interview farmer 5), and also on the practical level the plant doctor believes it will cause problems;

"once they [plant clinics] *are related to the government , with the crisis we had with the devolution, I'm not sure they will get involved in the facilitation"*, *"I think they will not be willing* [to pay]. *For me, I would not*." (interview E. Ndwiga).

5. Discussion

The following section aims to discuss the discrepancies identified in the results from the research in Kibugu. It is furthermore a discussion and a reflection on our findings in relation to the literature presented in the introduction and to our research questions. By discussing our results in the light of the literature, both in regards to the general reflections on development programs represented by Friis-Hansen and Duveskog (2012) as well as the literature of results from earlier studies of plant clinics represented by Reid and Kiff (2015), Danielsen et al. (2013) and Bentley et al. (2011), we will argue, that our results from our research in Kibugu contribute to a more nuanced perspective of the plant clinics as a development initiative in general. Thus the discussion will touch upon the general operation and demand of the plant clinics, the characteristics of a user and a non-user and the future aspects of the initiative.

5.1 Awareness and use of the plant clinics

As emphasized in the results, one of the main findings from our research was that the differences in practice between users and non-users of the plant clinics, was not notable and that the use of chemicals is the predominating control strategy in Kibugu. This result differs from the results obtained by Bentley et al. (2011) in Bolivia, where the use of pesticides was reduced among the farmers using plant clinics. However, our study in Kibugu can not determine, whether or not the use of pesticides among plant clinic users was reduced. It is possible that, even though still using pesticides as the main control strategy, the plant clinic users were in fact using less pesticides, because they used more appropriate ones in different application rates. However, this was not a parameter from which we collected data.

Since the intention of the plant clinics is to reduce pesticide use, we did expect our results to reflect this, but it was not the case. The lack in difference between users and non-users on this topic might relate to the fact, that most farmers visit the plant clinics too late, in order to implement biological or cultural control strategies that often result in the use of chemicals. Furthermore, cultural and biological control can be too time and money consuming to implement. For example, the plant clinic advises farmers to plant resistant cultivars as a cultural control strategy but this is costly and time consuming. Additionally, if the farmers have to change the cultivars already planted, there will be a long period with less production while the new resistant cultivars mature.

The external evaluation conducted by Reid and Kiff (2015) showed, that the plant clinics in Asia were of big relevance to the farmer, which is also emphasised in our results. Even though the plant clinics were not prevalent, our results show that 21 out of 22 users of the service were satisfied which is also emphasised in the following quote:

"(...)so she [E. Ndwiga] *will go and identify, so this is aphids or this is a root problem or whatever it is, then now she will advise what apply or how to go about it. Soo, they are helpful, the plant clinics are really helpful"* (Interview farmer 1).

This level of satisfaction matches well with the external evaluation report from Asia, which reported 95 % of the farmers using a plant clinic were satisfied with the service.
The fact that only ⅓ of the 94 respondents in Kibugu have heard of the plant clinics, and only 22 have used the service, resembles that there is a lack of prevalence of the clinics in Kibugu. The need for the plant clinics to do more advertising in order to reach out to more farmers is also problematized by some of the farmers which is emphasised in the following quote:

"(..)yeah they should hold some kind of a meeting and invite people, so that everybody can know about these plant clinics, because actually there are people who don't know. They should hold a seminar once in a while to make people know about it and to encourage people to keep visit them.(...)They should do some awareness program or something to advertise themselves" (interview farmer 1).

As the quote emphasizes, the plant clinics need to make an effort in order to make the community aware of their existence. The fact that the plant clinic in Kibugu is located behind a big town sign also emphasizes the issues of invisibility. The physical location of the clinic could also explain the lack of awareness since it is placed on the outskirt of the town instead of in the center of a market such as mentioned in Bentley et al. (2011). The same study also mentions plant clinics that are open on market days, where many farmers gather in the area around the clinic, which was not the case in Kibugu.

The fact that the plant clinics exist in a context of a lot of other institutions advising on pests and disease control like the coffee cooperative, agro-vets and private companies also influence the use of plant clinics and the perception of the demand for their existence in Kibugu.

5.2 Perceptions of agro-vets and plant clinics

Reid and Kiff (2015) emphasizes that there is a distinction in farmers perception between agro-vets and plant clinics in accordance to trustworthiness and reliability, where the plant clinics from the farmers perspective seemed to be more trustworthy and reliable. Although the results show that the perceptions of agro-vets and plant clinics are different from the individual farmer, it can be argued that some perceptions occur more than others. Overall the perception of plant clinics is positive among the users and a large part of the farmers perceive the agro-vets as businessmen who are not trained to advice on pests and diseases, which is emphasised in the following quote.

> *"(...)but the people who sell in the agro-vets, they are just selling for business, not just for any other thing. It is for business, so you just go and ask for this thing and he is giving you that, but no advice on that. So you have to know what you are going for"* (interview farmer 6).

Bentley et al. (2011) showed that small-scale farmers benefit the most from using the clinics, and Kibugu consists mainly of small-scale farmers. Thus when looking more into the context-specific needs of the farmers it becomes clear that there is a demand for the existence of plant clinics and the service they offer in Kibugu. This is both emphasized through the economic aspects that are connected to the reduction of chemicals and the increase of eco-friendly production strategies, which is of great benefit, both on the governmental level and the farmers.

5.3 The structure of implementation

When looking at our results in the light of the development theoretical aspects presented in the introduction through Friis-Hansen & Duveskog (2012), the literature emphasizes the need of bringing supporter and beneficiaries into account when implementing development programs. Our results also show a need for the farmers to be a part of decision making especially when discussing the case of plant clinics in Kibugu;

Many farmers express that they wish to go back to "the old days", where the extension officers came and visited the farms. The following quote emphasizes this:

"Yes, that is good. The government should go back to how they used to do it" (interview farmer 7).

The request from the farmers together with the challenge plant clinics face in regards to make the farmers use the service, reflects that the governmental organization functioned better, when the extension work was more prioritized, because it met the farmer's needs to a higher extend. CABI collaborate with existing structures; extension departments, county governments, research centers, producer organizations, NGOs and regulatory agencies when implementing the Plantwise plant clinics which is sensible as a project needs to be implemented through the local structure, in order to reach the target groups in the very best way (CABI, 2017). But in the case of Kibugu where plant clinic are organized through MoA, it appeared that challenges faced in the government are reproduced in the plant clinic initiative. Thus, it can be argued that a weak government goes against implementations of such beneficial program initiatives.

Because more farmers seek advice, attend seminars, often through the coffee-cooperative, it is possible to argue that it would have been an advantage to implement the plant clinics through for example the coffee co-op, which to a higher extent seems to meet the needs of the farmers.

5.4 Reflections on methodology

5.4.1 A questionnaire across thematic areas of studies

When four different groups with four different thematic issues are conducting a questionnaire it is impossible to do the interview in the exact same way. Even though we had agreed on a specific way to address and inform the farmers when conducting the questionnaire, we might each have been giving some different explanation and information to the respondents.

Some of the respondents in the general questionnaire that was characterized as users of plant clinics, turned out not to have any knowledge of the initiative, when we then went to interview them. This was a shortcoming that might relate to a lack of knowledge sharing between the groups, before the questionnaire was conducted and of the fact that each group might not have placed equal value on each thematic issue. This has resulted in a differentiation in data, and clear guidelines from the beginning could have helped in avoiding this. Even though we had made agreements it is impossible to avoid differentiation when many people are conducting a questionnaires independently.

Furthermore there is a chance that our presence might have influenced whether the respondents answered honestly, both because they do not know us and because some of the themes might be sensitive (Bernard, 2011).

5.4.2 Semi-structured interviews

Although we tried to select the farmers for semi-structured interviews across different characteristics and neighborhoods in Kibugu, we did not get enough informants from other neighborhoods. Due to practicalities, limited time and some delays in some of the other groups data collection is was a challenge to identify more informants from other areas.

The fact that we decided only to do an interview with the plant clinic in Kibugu, can be seen as a shortcoming that have narrowed down our research. Perspectives from other plant clinics in the area would have contributed to a more nuanced understanding of the plant clinics and their practice.

In relation to the result from Reid and Kiff (2015) which shows that the users experienced increased yield, we did not manage to ask enough detailed questions on this specific issue of increasing yields when interviewing the users, although it could have been interesting to look further into this aspect.

Furthermore, we should have asked the farmers if they were aware of the biological and cultural control strategies and what influences their choice of control strategies.

5.4.3 Access to data from the Plant clinic

Client data from the plant clinic in Kibugu could have given some different perspectives and additional data. However, we were not able to obtain this data from the clinic. We then tried contacting CABI's office in Kenya, but with no success.

6. Conclusion

Pest and disease management is very important due to the dependency of income from the crops grown in Kibugu. The most dominant crops grown in Kibugu are coffee and tea, and farmers experience most challenges related to coffee.

Of 94 respondents, 37 have heard of plant clinics and of these, 22 are users. Users of plant clinics are very satisfied with the advice given at the plant clinic, and have been visiting multiple times.
The farmers face many options when it comes to advise pest control; agro-vets, coffee co-ops and other private companies are providing more accessible services and therefore the plant clinic are not the first choice amongst farmers.

There is no visible correlation to detect between location of users/non-users, location of the plant clinic, access to water and farm size, neither does level of income influence who use or not use the plant clinics.
No differences in pest and disease control methods between users and non-users are found. Even though plant clinics recommend on both cultural, biological and chemical control, farmers favors chemicals because of the almost instant, visible result. A cultural or biological control method may have a greater positive effect on both income, quality of yield and environment in the long run, but if not instant effective, the farmer may face reduced yields and thereby a lower income.

The plant clinic are not efficient in reaching the farmers; the farmers do often not have the resources to visit the plant clinic and the farmers are requesting that the extension officers in the plant clinic make farm visits instead like they did before the devolution

The sustainability of the Plantwise plant clinic is debatable. From next year CABI will end its funding and the future for the plant clinic are uncertain.

7. Perspectives

During the interview with D. Ghitari, he mentioned that a plant clinic experiment was being conducted in one of the neighboring sub-counties. Here, trained plant doctors were members of community and not extension officers as in the case with the Kibugu plant clinic.
It could have been rather relevant for our research to look into that experiment and to compare its operations and functions with the case of Kibugu. This could have been an example of a case where the villagers and farmers was more included in the plant clinics as a development initiative, which could contribute to a better operation or success of the plant clinics.

While conducting our research, we became aware that the economic aspects played a big role in regards to farmers management practices in relation to pests and diseases. This was an aspect, which we, after finishing the fieldwork, wished we had investigated more thoroughly. The high expenses of buying chemicals for pest and disease control were a big challenges for the majority of our informants. It would have been of relevance to ask our informants specific questions related to the possible economic benefits farmers got from using the plant clinics, as we assume that the plant clinics are better at advising the farmers on the right amount of chemicals to apply on infected crops than for example agro-vets and coffee cooperatives.

Furthermore, we are aware that if we had been in Kibugu during growing season, we would have gained different results, as not many pests and diseases are present in the fields in the end of the dry season. This might had allowed us to perform an assessment of the specific level of pest and disease infection, the management strategies the farmers applied and furthermore compare these results across users and non-users of plant clinics.
Further studies should look into how users apply pesticides compared to non-users, to investigate if users apply more appropriate types and rates pesticides, and how the economy and yield is affected by using a plant clinic.

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Interview D. Gitari, 6th March 2017, Agriculture Office in Manyatta

Interview E. Ndwiga, 10th March 2017, Kibugu Plant Health Clinic, Kibugu Town centre, Ngerwe

Interview P. Muriithi, 6th March 2017, Ministry of Agriculture, Embu Town

Interview William PCPB, 8th March 2017, Selasio house

Interview J. Njoki, 8th March 2017, Coffee co-op office Kibugu Town

Interview farmer 1, Linette Chelimo, large-scale user, 9th March 2017
Location: GPS record: 0 26´46¨S 37 25´37¨ E

Interview farmer 2, Jane Wombeti, small-scale user, 7th March 2017
Location: GPS record: 0 28´25”S 37 25´54”E

Interview farmer 3, Catherine Muthori, small-scale user, 8th March 2017
Location: GPS record: 0 26´32¨S 37 25´52” E

Interview farmer 4, Samuel Njiru, small-scale user, 7th March 2017
Location: GPS record: 0 27´44¨S 37 26´6¨ E

Interview farmer 5, Charity Manyaga, large-scale user, 7th March 2017
Location: GPS record: 0 27´12¨S 37 26´0¨E

Interview farmer 6, Cecilia Kathuri, small-scale, non-user, 8th March 2017
Location: GPS record 0 26´42¨S 37 25´37E

Interview farmer 7, Frederick Ireri, small-scale, non-user, 7th March 2017
Location: GPS record 0 27´32¨S 37 25´48¨E

Interview farmer 8, Samuel Njero, large non-user, 7th March 2017
Location: GPS record: 0 28'17" S 37 26' 1" E

Interview farmer 9, Harriet Njeru, small-scale non-user, 8th March 2017
Location: unknown

Interview farmer 10, Richard Nyaga, large non-user, 7th March 2017
Location: GPS record: 0 27´55¨S 37 26´6¨ E

Interview farmer 11, John Musangi, large non-user, 7th March 2017
Location: GPS record: 0 27´18¨S 37 25´49¨ E

Interview farmer 12, John Peter Mbature, large non-user, 7th March 2017
Location: GPS record: 0 27´33¨S 37 25´53¨E

Interview Agro-vet 1, 10th March, Kibugu town centre

Interview Agro-vet 2, 10th March, Kibugu town centre

Interview Agro-vet 3, 10th March, Kibugu town centre

Observation 1, 10th March 2017, Kibugu town centre

Questionnaire, 4th March 2017, Ngerwe

Transect Walk (2), 12th March 2017, Ngerwe

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Appendix 1 - Final synopsis

Perspectives on Pest and Disease Management in Kibugu, Embu County, Kenya

A case study on the influence of Plantwise plant clinics in regards to pest and disease management in Kibugu, Embu County in Kenya

Interdisciplinary Land Use and Natural Resource Management SLUSE 2017
Synopsis for the field study

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Synopsis February 24th 2017
University of Copenhagen

A case study on the influence of Plantwise plant clinics in regards to pest and disease management in Kibugu, Embu County in Kenya

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1. Introduction

1.1 Pests and diseases

Pests and diseases in crops are a major source of concern for farmers around the world. For many subsistence farmers a healthy crop can mean the difference between a plentiful food supply and the possibility of going without any harvest. Even though management strategies have improved, pests and diseases continue to reduce yields, with potential yield losses of up between 20 and 40 percent on a global level (Savary et al., 2012). Actual losses vary, depending on the crop's susceptibility (Oerke, 2005). In the tropics and subtropics where the climate is warmer and more humid, and thereby very well suited for many groups of pests and diseases, the potential and actual losses are especially high (Oerke, 2005). The increased use of pesticides have not been able to lessen the extent and severity of attacks, which seems to have increased during the last decades, and in some cases, when overused or used wrongly, even worsened the situation due to increased resistance of the pests and disease-causing pathogens and destruction of natural enemies.

As mentioned above, the consequences of pest and disease attacks are often worse in the tropics, and in Kenya up to 40% of crop yields are lost to pests and diseases (KALRO, 2017). With the rapidly changing climatic conditions, farmers are facing new diseases and pests which can affect their farming activities and thereby their livelihood options. This can further bring changes to global food and agricultural system. Some of the pests and diseases can be extremely devastating, such as the Maize Lethal Necrosis (MLN), a disease caused by the co-infection of the virus *Maize chlorotic mottle virus* with a virus from the *Potyviridae* family. *Maize chlorotic mottle virus* can cause MLN alone, if the plants are exposed to to abiotic stresses (Mahuku et al., 2015). The disease was first detected in Bomet County in 2011, and in 2012 it was reported to have infected 77.000 ha of maize in Kenya, causing yield losses of up to 90% and estimated economic losses of around 52 million US dollars. (Mahuku et al., 2015). Animal pests also poses a threat to the maize production in Kenya. Stem borers attacks almost all parts of the maize plant, and the two species *Chilo partellus* and *Busseola fusca* are among the most important, causing yield losses of up to 13% (Tefera et al., 2011). To manage stem borers as these, Napier grass (*Pennisetum purpureum*) can be used as a trap crop. Furthermore it is useful for livestock feed, soil improvement and water conservation (Asudi et al., 2015). However, the Napier grass is threatened by the Napier grass stunt disease, which is caused by a bacteria transmitted by a leafhopper (*Maiestas banda*) or when using infected cuttings (Asudi et al., 2015).

In mango production, fruit flies pose a problem to a stable production. Depending on the mango variety, the climate of the locality and the season, species such as *Bactrocera dorsalis, Ceratitis cosyra* and *Cetratitis cosyra* among other can causes yield losses between 40-80% (Korir et al., 2015). In Kenyan coffee production, the coffee berry borer (*Hypothenemus hampei*) can become an increasing problem as temperatures rises due to climate change, creating more favourable conditions for the pests (Jaramillo et al., 2011). The coffee production also has to deal with diseases such as coffee leaf rust caused by the fungi *Hemileia vastatrix* and the coffee berry disease caused by *Colletotrichum kahawae* (Plantwise, 2017).

The pressure of pests and diseases in Kenya calls for new approaches and change of existing practices. One of the major challenges and key factors of dealing with these emerging pest and diseases are the agriculture advisory services - the communication and implementation of scientific research and new knowledge in agricultural practices - through the education of farmers. In that sense, it is also important that farmers have the ability to keep pace with changing technological advances which can promote food security and improve income (IFPRI, 2017).

1.2 Plantwise Plant clinics

To give the farmers advice on pest and disease management plant clinics are being set up in rural communities in some parts of Africa. Plant clinics are an initiative developed by Centre for Agricultural Bioscience International (CABI) and are a part of the global program Plantwise. The overall aim of the program Plantwise is to increase food security and improve rural livelihoods by reducing crop losses (Plantwise, 2017).
The plant clinics provides meeting places where plant doctors can help farmers struggling with pest and diseases by providing management advice on how to protect and manage crops (Plantwise, 2017). The plant clinics further works as platforms of sharing of knowledge on farming within local communities and since 2010, 122 plant clinics have been implemented in Kenya as a community-based approach to overcome some of the challenges in relation to pest and disease management small-scale farmers are facing (CABI, 2017). The plant clinics in Kenya are being established in cooperation between the Ministry of Agriculture, Livestock and Fisheries, (KARI), Kenya Plant Health Inspectorate Service (KEPHIS), Pest Control Products Board (PCPB) and University of Nairobi (Plantwise, 2017).

The plant clinics are not operated by Plantwise, but Plantwise provide trainings for the plant doctors (local plant health extension officers) at the plant clinics while also connecting them with the Plantwise Knowledge Bank and national research centers in order to provide them with resources and diagnostic support. Today 1800 plant clinics are implemented in 34 countries all over the world (Plantwise, 2017).

Since the first establishment of plant clinics in Bolivia in 2003, several reports and assessment of the initiative has been conducted and thus plant clinics have been a popular study for both natural and social scientists. Especially the importance of taken the farmer's perspectives into account in order to ensure successful implementation are being emphasized in several different reports (Danielsen et al., 2013, Friis-Hansen & Duveskog, 2012).

For the case of Embu, plant clinics have been established and are run by the Ministry of Agriculture, Livestock and Fisheries, with technical support from the Kenya Plant Health Inspectorate Service, the Kenya Agricultural and Livestock Research Organisation, University of Nairobi and the Pest Control Products Board. Farmers take their infected, infested and affected crops to plant clinics in designated areas where experts (plant doctors) diagnose pests and diseases and advise them accordingly (Plantwise, 2017). This supplements the low extension staff numbers and low networks and help in managing crops pests and diseases.

1.3 Results from previous studies

Plantwise established a 1 year pilot project e-plant clinics in Kenya, where the use of information and communication technologies (ICT), tablets and short message service (SMS) was tested with 60 kenyan extension workers (Wright, 2016). This was a way to enhance already established plant clinics by eliminating “paper work” as many complications have occurred when trying to keep documents updated and in good condition. As an example, farmers may not live close to the clinic, which is leading to loss of treatment documents from the plant clinics. Further, the plant clinics experience many obstacles when updating prescriptions and factsheets in paper form (Wright, 2016), and by using electronic tablets that gives access to data (also available offline) makes it possible to eliminate these obstacles. An app have been created which offers free to download of a Plantwise Factsheet that will update when an internet connection is available. The project was implemented in 2014 with 10 plant doctors involved and subsequent expanded to 50 plant doctors (30 clinics in total due to plant doctors work in pairs). SMS services make it possible for farmers to receive invitations to clinics and recommendations from the plant doctors, these recommendations are fulfilling for the farmer and always accessible because the farmer

always bring the phone with them (Wright, 2016). Having the tablet available also make it possible for the plant doctor to upload photos and prescription forms of farmers' samples to validate the diagnosis the plant doctor have made and also to be able to confirm a diagnosis when in doubt. In conclusion this approach has been successful with beneficial elements such as quick response to threats, higher quality recommendations and a uniform data collection and resource delivery process (Wright, 2016).

Through a study in Uganda focusing on a quality assessment of diagnoses and advice given at plant clinics in three different districts it is emphasized, that change in farmers' pest and disease management practices only happen if the advisory services manage to assess the farmers needs and thus influence their decision making processes while leading to change in local practice (Danielsen et al., 2012). Furthermore, the main performance indicators in relation to pest management in developing countries are identified as respectively technical adoption, cost effectiveness and farmers' perception of pest and diseases (Danielsen et al., 2012). These indicators are reflected upon in the research questions that have been put forward in the synopsis (see below). The Uganda research also showed that plant doctors need more training in symptoms recognition, pest management and record keeping as well as better resources to solve unknown issues (ibid.:).

In the same subject of study, Friis-Hansen and Duveskog (2012) have analysed the empowerment processes of farmers that have been a part of the Farmers Field School (FFS) initiative with field sites located in East Africa, including Kenya. The main focus of FFS is collective/group-based learning processes, to enhance the wellbeing of the individual farmer as well as collective community of farmers. Friis-Hansen and Duveskog (2012) emphasizes that a lack of enhancing farmers' capacity building is evident and that there instead is a focus on enhancing technology in the investigated areas. Friis-Hansen and Duveskog acknowledge the importance of empowerment of the farmers, "facilitating empowerment means supporting people in becoming *agents* in their own development" (Friis-Hansen & Duveskog, 2012: 418).

2. Research Objective

On the basis of the factors outlined above, and in order to understand how the plant clinics are functioning, it is our plan to investigate the Plantwise plant clinics in Kibugu and whether they succeed in bringing the farmers an applicable set of tools and knowledge in terms of pest and disease management. Thus our main objective is to analyze the Plantwise plant clinics through the lenses of the farmers. Furthermore, we wish to investigate what influences a farmer in Kibugu when seeking external advice on pest and disease management.

We will examine the prevalent crop species existing in Kibugu while giving particular attention to whatever crops that may be most important for the farmers in relation to pests and diseases. Additionally, we wish to identify pests and diseases affecting these crops and specific management strategies used by the farmers in order to determine if they reflect the Plant clinic's advice.

Our overarching research question will guide us in the analytical process concerning pest and disease management in Kibugu, and is as follows;

How do farmers in Kibugu, Embu County, manage pests and diseases and what is the role of Plantwise Plant Clinics?

2.1 Sub research questions

1. What are the main challenges for farmers in Kibugu in relation to pests and diseases?
→ Which of the farmers main crops are most significantly affected by pests and diseases?

2. How are the Plantwise plant clinics organized in Kibugu, Embu County?

3. What is the demand for the Plantwise plant clinics and how has it developed since the initiative was implemented in Kenya?

4. What motivates some farmers to use the Plantwise' plant clinics and what other advisory services are present in Kibugu?
→ Do management practices differ from those using the Plantwise plant clinics to those that don't, and how are these practices different?

5. What are the farmers' perception of the Plantwise plant clinics' services?

6. What is the scope or diversity of crop protection management (crop pests, diseases, weeds, nutritional disorders) provided by the Plantwise plant clinics?

7. What is the impacts of Plantwise plant clinics on crop pest and disease management?
→ How do farmers use the services provided by the plant clinics?

8. How are the farmers perception of pest and disease management?

3. Methodology

The following section describes the different kinds of methods we expect to use in our research in Kibugu. The aim of this methodology design is to collect different kinds of data and thus ensure that our research will reflect the different nuances in the field (Bernard 2011:266).

3.1 Questionnaires

Questionnaires make it possible to make a **random systematic sampling** for questionnaires (grid over village and chose the house in the center of the square)
→ To specify our project
→ To obtain general insights on how popular/known the plant clinics are in the area
→ To identify informants for semi-structured interviews
→ To observe potential correlations between age/gender (etc.) and if farmers are using/not using the plant clinics

We do not have much time and we work with small communities, so the questionnaires should not contain more than 5 questions. We must be aware that we (and the indigenous) come from different cultures and that it might give few misunderstandings. Our questionnaires should therefore be an exploratory study, it should be short and it should be simple sampled.

We will conduct our questionnaire on our first working day, also in order to meet a lot of people and to present ourselves. This will give us a quick overview of data and informants along with research leads.

3.2 Semi-structured interviews

Key-informant interviews with user of plant clinic vs. non-user of plant clinic (5-6 pers.)
→ To see why farmers are using/not using the plant clinics
→ To get insights in the farmers needs in regards to pests and disease management

3.3 Participant observation

→ By participating in everyday practice and activities in our host-family we will hopefully get some insights and knowledge about the local context and social dynamics in relation to our area of research.
→ Spending a day in the field with Plant clinic-staff/plant doctors and local farmer

3.4 Focus group Interview

→ With farmers to create opportunities for discussion about pest and disease management and catch insights about social dynamics and different interest in the field of research.

3.5 Participatory Rural Approach (PRA)

→ *Mapping* with the farmers and staff at the plant clinics - in regards to get an overview of the different agencies and their interest in the field.
→ *Ranking* which pests and diseases are the most challenging for the farmers in Kibugu.
→ *Transect walk*
Going with a field-guide and translators across the community/village from one boundary to another while making a transect line. This is to map what we see along the walk, to discuss it with our guide while taking notes and drawing sketches. In other words; obtaining most possible information.

3.6 Fieldnotes

During the fieldwork we will be taking individual field notes, which will contribute to our final analysis. Fieldnotes is an essential part of out data collection because we will be taking notes when using the different kinds of methods. In the field we will spend some time on organising our notes, which is also emphasized by Bernard (Bernard 2011).

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Appendix 2 - Pests and diseases in coffee

CLR is caused by the fungus *Hemileia vastatrix*. The fungus causes orange blotches on the underside of the leaves while the upper side turns chlorotic and the chlorotic tissue will turn necrotic as the lesion develop further. The leaves are shed which then reduces the tree's photosynthetic activity, while also limiting the growth of new stems which negatively affects next year's production. The berries of the current year can be affected as well, as the disease can cause premature ripening (Plantwise, 2017). CBD, caused by the fungus *Colletotrichum kahawae* causes berries to rot, and the symptoms appears as dark, sunken lesions. The berries will often be shed before maturity.

Various insect pests also challenge the Kenyan coffee farmers. The Coffee Berry Borer (CBB), *Hypothenemus hampei*, infests the berry feeding on the fruit and possibly causing the seeds to rot (Plantwise, 2017). CBB can become an increasing problem in Kenya as temperatures rises due to climate change creating more favourable conditions for the pest (Jaramillo et al., 2011). Coffee Leaf Miner (CLM), *Leucotera* spp., is another insect pest on coffee. The larva feeds on the leaves causing shedding of the leaves which reduces the photosynthetic activity of the tree. Other common insect pests in Kenyan coffee production include thrips, *Diarthrothrips coffeae*; green scales, *Coccus alpinus*, and aphids, *Aphis coffeae* (Mugo et al., 2011).

Appendix 3 - List of other advisory services

A range of advisory services besides the plant clinics who has a direct contact to farmers regarding pest and disease management exist in Kibugu and they are put forward below

Agro-vet: a shop that services farmers in both agriculture and veterinary subjects. The agro-vet personnel has certifications from the PCPB, the Kenya Veterinary Board and KEPHIS. The shop carries input products, certified and approved (by law) chemicals for pest and disease management in crops. Also products for livestock management are present in an agro-vet (Kimanthi, 2016). The agro-vets are able to diagnose and recommend uses to manage of i.e. a pest in coffee crops.

Coffee co-op: is a platform for small-scale coffee farmers where processing, milling, marketing and auctioning of final product is handled and the farmer is paid accordingly to the auctioned price. The cooperative is either run by farmers or consumers. The coffee co-op can establish workshops and seminars to train the membered farmers to manage pests and diseases in crops.

MoA: The Ministry of Agriculture is a place where the farmer also has access to information on management of crops in regards to pests and diseases. Where they advisory services consists in pest and disease management, development of crop technologies, policies and strategies within industrial crop development and changes in demand and supply etc. (MoA, 2016).

Greenlife: Greenlife Crop Protection Ltd is a privately held company with services covering all agricultural management, from pest control chemicals to post harvesting strategies (Greenlife Africa, 2017). They produce their own pesticides and fertilizers for crops with delivering services to farmers household.

Bayer: German privately held chemical company established in 1863 and founded in East Africa in 1968, in Kenya 1934. They are in the fields of pharmaceuticals, consumer health, crop science and animal health. In crop science is world leading within the crop protection, innovative pest management solutions and "providing extensive customer service for for sustainable agriculture" (Bayer, 2017).

Appendix 4 - Overview of applied methods

Overview of applied methods
4 Expert interviews
12 Farmers interviews
3 Agro-vets interviews
1 Coffee cooperative interview
25 Questionnaires (In total 94)
1 Observation
2 Transect Walks
1 Pilot test of questionnaire (In total 4)
3 PRA's

Appendix 5 - General Questionnaire for Kibugu

GPS-point: x:_____ y:_____ z:_____	**Interviewer:**
Sub-location:	**Group Number:**
Note taker:	**Translator:**
Picture:	**Date and time: / / : :**

Personal information

1. Name: _____

2. What is your gender? Male ____ Female____

3. How old are you? _____

4. Marital status:
a) Single_____ b) Married_____ c) Widowed_____d)Divorced_____

5. Which levels of education did you finish?
None educational background
Primary school
Secondary School
Tertiary level
Bachelor degree
Master degree

Other: specify _____

6. Are you a part of any of the following networks? (place an "X" in all choices that apply)
- Church
- NGO
- Cooperative
- Political party (you don't have to specify which party)
- Social club
- Others _____

Household information

7. How many people are part of your household (including workers, children and relatives contributing)?

_____

8. Name the 3 main income sources for your household?

_____
_____

_____

9. What is your household's income pr. month?
- Below 10.000
- 10.000-25.000
- 25.000-50.000
- Above 50.000

Farm characteristics

10. How many acres are your farm?

_____

I don't know ____

11. How big is your farm compared to the rest of the village?

a) Small _____ b) Medium_____ c) Large_____

12. How did you obtain the land of your farm?
- Inheritance
- Purchasing
- Renting
- Other:_____

Pests and disease Management

13. Have you heard of the Plantwise Plant Clinics organized by Centre for Agricultural Bioscience International (CABI)?

Yes
No

If no

- Have you visited any other agro-vet?

Yes
No

14. Have you any experience with using the plant clinics?

Yes
No

If yes
- How many times have you visited the Plant Clinics?

_____

- How will you characterize your experience with the Plant clinics?

Not satisfied
Satisfied
Very Satisfied

15. What are your most important crops? Add the disease/pest if any are present (list most important first - please state crop followed by pest/disease)

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____

16. What are the most important crops infected with pests and diseases? (list most important first - please state crop followed by the pest/disease)

1. _____

2. _____

Gender

17.

Activity / Crops	Which crops do you produce in your household?	Of the crops you produce in your household, which do you sell?	Of the crops you produce in your household, which are consumed in your household?
Mango			
Banana			
Passion fruit			
Avocado			
Kale			
Tomato			
Carrot			
Butternut			
Watermelon			
Potato			
Coffee			

Tea			
Cotton			
Macadamia			
Other			

Livestock

18. How many of the following animals do you have in your household?

Livestock group	Number of heads	Types/Breeds
Cattle		
Goats		
Sheep		
Poultry		
Rabbits		
Donkeys		
Pigs		
Others		

19. Which household member has the right or responsibility to which areas of livestock husbandry? *(Place an "X" in the boxes that applies)*

	Daily care				**Income from milk sales**				**Income from animal sale (meat or alive)**			
Type of livestock	**Husband**	**Wife**	**youth**	**Hired labour**	**Husband**	**Wife**	**Youth**	**Hired labour**	**Husband**	**Wife**	**Youth**	**Hired labour**

20. What do you think is the main livestock change you did in the last 5 years?

_____

21. Are you **member in a breeding association** or **milk cooperative**?
If yes, please specify:

	Goat breeding/husbandry	Cattle breeding/husbandry	Milk cooperative	other, please specify
Put X if yes				

Post-Harvest Management

22. What are the storage technologies that you use?

List here _____

23. Have you adopted new storage technologies in the last 3 years?

- Yes
- If yes, what are they? _____
- No

24. Over the last 5 years, how many new crops did you begin growing? What are they?

_____

25. After harvest, what is the main cause/factor of crop losses?

- Pests, rodents,
- Rainfall
- Temperature
- Other: _____

26. Per harvest season, how much of harvest crops do you lose on average? And for which crop?

_____

Crop:

_____

27. Who do you sell your crops to?
    - Retail, i.e. Supermarkets
    - Middleman
    - Direct sale to consumers, i.e. Local market
    - Wholesale markets
    - Auto-consumption

28. Do you process your crops on the farm to add value?

    Yes
    No

If yes, state here:

_____

Appendix 6 - Interviewguides

Interview questions for farmers (plant clinic-users)

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu
- Short about SLUSE
- Interview; relaxed conversation with questions, will take some notes, 30-60 min.
- Anonymous, right to regret, stop if you have questions, our assignment will not be published (just for internal), okay to record?

General informations

- Name, Age, sex, family, education
- For how long have you been a farmer?
- Why did you choose to be a farmer?
- How much land do you have?
- Which crops do you grow most?
- Why did you choose to grow these specific crops?

Pests and disease management

- Which challenges do you (farmer) in Kibugu meet in your everyday life?
- Will you try to explain these challenges - how are they different from each other?
- Have you experienced any challenges with any specific pests and diseases in your own crops?
- ---> if yes: what do you think is the reason? (climate change?)

→ if yes, what do you see as the most challenging pest/disease that farmers are struggling with?

- What kind of methods do you use to overcome challenges?
- How do you manage pests and diseases in your crops?
- Who is having the responsibility in the household for managing plant diseases and why?
- How/where do you get knowledge about how to manage pests in your crops?
- Why/why not did you choose these methods?
- What do you see as the main challenge in relation to pest and disease management in general for farmers in Kibugu?
- What do you like most about being a farmer?
- About the future; How could, for example, local authorities and/or government in the best way help farmers to overcome the challenges in relation to pest and diseases management?

Interview questions for other advisory services

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu
- Short about SLUSE
- Interview; relaxed conversation with questions, will take some notes, 30-60 min.

- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published (just for internal), okay to record?

General informations

- Name, Age, sex, family, education(?)
- How did you become a part of this service?
- For how long have you been working/volunteering here?
- Why did you choose to be involved with this advisory service ?
- Did you receive any special training before starting work here?
- Do you sometimes go to fields to identify pests/diseases?

The work at the advisory service

- How long have you been working with this
- How many come on a weekly basis? WHO come (male/female)
- What is the most common problem? (nutrient depletion / fungi / irrigation / ...)
- Are you most likely to help on the spot/looking at the crop or do you have to seek outside help?
- Do you have necessary resources in clinic?
- Have there been any changes in diseases over the past xx years?
- Has there been a development in crops → from subsistence to cash crops (and the type of crops)
- Are there any organic farming in the area ?
- Which solutions do you (the doctor) prescribe? Biological solutions /chemical solutions
    - What is in mind when prescribing solutions? Quick / crop / biological / cash /donor influents (eg. specific products)

If soils are so fertile in west africa, foot of mt kenya, what are the obstacles to overcome poverty and be able to increase economy / livelihood. Go from subsistence to cash crops.

Observations:

- What does it contain/ consist of
- which tools do they have, how many working
- status of clinic (worn down / new equipment / simple tools)
- communications from advisor to farmer (do they express themselves on "simple" level to farmer)

Interview questions for Plant Clinic employee

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu
- Short about SLUSE
- Interview; relaxed conversation with questions, will take some notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published (just for internal), okay to record?

General informations

- Name, Age, sex, family, education(?)
- How did you become a part of this plant clinic?
- For how long have you been working/volunteering here at the plant clinics?
- Why did you choose to be involved with the plant clinics?
- Did you receive any special training before starting work at the plant clinic?
- Do you sometimes go to fields to identify pests/diseases?

About the plant clinic

- What is the background for this plant clinics? (when was it established and why?)
- What is the aim of the plant clinics?
- Why do you think people are using the plant clinics?
- What is the advantages of the plant clinics in your opinion? (what is the advantage of the plant clinic compared to other advisory services)

The work at the plant clinics

- Do donors come a visit / do they come and check up on status of clinic?
- Have there been resistance against the clinic from farmers?
- How many come on a weekly basis? WHO come (male/female)
- What is the most common problem? (nutrient depletion / fungi / irrigation / ...)Which crops do people most often ask you help them with?
- Are you most likely to help on the spot/looking at the crop or do you have to seek outside help?
- Do you have necessary resources in clinic?
- Have there been any changes in diseases over the past xx years?
- Has there been a development in crops → from subsistence to cash crops (and the type of crops)
- Are there any organic farming in the area?
- Which solutions do you (the doctor) prescribe? Biological solutions /chemical solutions
    - What is in mind when prescribing solutions? Quick / crop / biological / cash /donor influents (eg. specific products)

The future for the plant clinics

- If you could improve the plant clinic (with money not being a problem), what would you suggest?
- How could you reach more clients if that's a goal?

If soils are so fertile in west africa, foot of mt kenya, what are the obstacles to overcome poverty and be able to increase economy / livelihood. Go from subsistence to cash crops.

Observations (be aware of the following..)

- How is the clinic
- which tools do they have, how many working
- status of clinic (worn down / new equipment / simple tools)
- communications from plant doctor to farmer (do they express themselves on "simple" level to farmer)

Interview questions for other institutions/agencies

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu
- Short about SLUSE
- Interview; relaxed conversation with questions, will take some notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published (just for internal), okay to record?

General informations

- Name, Age, sex, family, education(?)
- How did you become a part of this service?
- For how long have you been working/volunteering here?

- Why did you choose to be involved with this advisory service/institution?
- Did you receive any special training before starting work here?

Interview questions for farmers (non-user of plant clinics)

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu
- Short about SLUSE
- Interview; relaxed conversation with questions, will take some notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published (just for internal), okay to record?

General informations

- Name, Age, sex, family, education(?)
- For how long have you been a farmer?
- Why did you choose to be a farmer?
- How much land do you have?
- Which crops do you grow most?
- Why did you choose to grow these specific crops?

Pests and disease management

- Which challenges do you (farmer) in Kibugu meet in your everyday life?
- Will you try to explain these challenges - how are they different from each other?
- Have you experienced any challenges with any specific pests and diseases in your own crops?
- ---> if yes: what do you think is the reason? (climate change?)

→ if yes, what do you see as the most challenging pest/disease that farmers are struggling with?

- What kinds of methods do you use to overcome challenges?
- How do you manage pests and diseases in your crops?
- Who is having the responsibility in the household for managing plant diseases and why?
- How/where do you get knowledge about how to manage pests in your crops?
- Why/why not did you choose these methods/sources of knowledge?
- What do you see as the main challenge in relation to pest and disease management in general for farmers in Kibugu?
- What do you like most about being a farmer?
- About the future; How could example local authorities and/or government in the best way help farmers to overcome the challenges in relation to pest and diseases management?

<u>Section A: Questions for Plant doctors</u>

Location
Name of the plant clinic
Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu?
- Short about SLUSE
- Interview; relaxed conversation with questions, notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published,ok to record?

Background of plant doctor

1. Name, age, sex, education
2. Why did you become a part of this plant clinic?
3. For how long have you been working/volunteering at this plant clinic?
4. Why did you choose to be involved with the plant clinic?
5. Did you receive any special training?

a. If yes, what kind?
b. Do you have the necessary resources/access to knowledge?
c. If not, what do you recommend could be done to improve this?

About the plant clinic

1. How long has the plant clinic been in operation
2. Main economic activity of the area (rank in terms of importance)
3. List the main crops and rank in order of importance in terms of diseases/most common problem that people seek advice about (we want five) - Peter
4. What are the most common cases of plant health presented at the clinics (rank in importance). The researcher is also going to use records kept at the plant clinics
5. Do you go to the field to identify pest/diseases?
6. What are the challenges faced in making diagnosis and recommendations (separate and rank in order of importance)
7. Is the information generated from the plant clinics utilized fully?
8. If no to the above, indicate which information is not fully utilized
9. What do you think can be done to improve the operations of plant clinics?

Section B: Questions for Farmers

- GPS record

a. Longitude……
b. Latitude……
Altitude……..

- Crop health status (using the scale developed)……

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu?
- Short about SLUSE
- Interview; relaxed conversation with questions, notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published,ok to record?

Background

1. Name of the farmer……Farm No……..Date……
2. Sex, age, education
3. County……Sub-county……Village……...…
4. For how long have you been a farmer?
5. Why did you become af farmer?

6. Which crops do you grow?

a.
b.
c.
d.
e.

7. Size of the whole farm……Acres

About the farmer

1. Which pests and diseases do you meet in your everyday life?
2. Which one do you see as the most challenging pest/disease?
3. Do you know about the plant clinics organised by Plantwise?

YES

a. How far away is the plant clinic from you
b. Have you ever visited plant clinics
c. What were the reasons for the visit (which pest/disease did you seek advice on?)
4. Did you get advice on diagnosis and recommendations?
5. What advice did you get, and did it help you?
6. What do you think can be done to improve the plant clinic?

NO

1. **Where do you then get information/advice on disease management?**
2. **Has the advice you have been given been efficient?**

FOR BOTH AGAIN

1. **What kind of methods do you use to overcome pest and disease challenges**
2. **Responsibility for managing plant diseases and why?**
3. **How could for example local authorities/government help you to overcome the pest and disease challenges?**

<u>Section C: Regulators/ministry/policy makers/other players</u>

Introduction

- Thanks
- Who we are, our project: Pest and disease management in Kibugu?
- Short about SLUSE
- Interview; relaxed conversation with questions, notes, 30-60 min.
- Anonymous?, right to regret, stop me if you have questions, our assignment will not be published,ok to record?

Background

1. Name, sex, age, education/background……
2. How did you become a part of this service/organization?
3. For how long have you been working here?
4. Do you sometimes go to the field to identify pest and diseases?

5. Nature of the organization……
6. Nature of collaboration or involvement with the plant clinics……
7. What can be done to improve the operations of plant clinics

8. How can other stakeholders be brought on board to improve the management of crop health issues among the farmers

9. Source of funds ……..

The work at the advisory service

- How long have you been working with this
- How many come on a weekly basis? WHO come (male/female)
- What is the most common problem? (nutrient depletion / fungi / irrigation / ...)
- Are you most likely to help on the spot/looking at the crop or do you have to seek outside help?
- Do you have necessary resources in clinic?
- Have there been any changes in diseases over the past xx years?
- Has there been a development in crops → from subsistence to cash crops (and the type of crops)
- Are there any organic farming in the area ?
- Which solutions do you (the doctor) prescribe? Biological solutions /chemical solutions
    - What is in mind when prescribing solutions? Quick / crop / biological / cash /donor influents (eg. specific products)

If soils are so fertile in west africa, foot of mt kenya, what are the obstacles to overcome poverty and be able to increase economy / livelihood. Go from subsistence to cash crops.

Observations:

- What does it contain/ consist of
- which tools do they have, how many working
- status of clinic (worn down / new equipment / simple tools)
- communications from advisor to farmer (do they express themselves on “simple” level to farmer)

Appendix 7 - List of semi-structured interviews

Interview D. Gitari
David Gitari, plant doctor and plant clinic officer; Ministry of Agriculture
Semi-structured interview, 6th March 2017
Location: Agriculture Office in Manyatta, Kenya
Length: 1 hour, 37 minutes
Interviewer: Peter
Observator and supplementing questions: Emilie
Notes and supplementing questions: Natasha, Frederik, Camilla, Jeannette, Jane, Dr. Kunyanga

Working for MoA since 2010
Manager of one plant clinic in Manyatta and one in Tharaka Nithi
Involved with plant clinics since 2013

Interview E. Ndwiga
Eudesia Ndwiga, plant doctor, extension officer
Semi-structured interview 10th March 2017,
Location: Kibugu Plant Health Clinic, Kibugu Town centre, Ngerwe, Kenya
Length: 1 hour, 24 minutes
Interviewer: Emilie
Notes and supplementing questions: Natasha, Peter, Frederik, Camilla & Jeannette

- Plant doctor in the plant clinic in Kibugu Town
- Extension officer since 1980 for MoA

Interview P. Muriithi
Pauline Muriithi, plant clinic organizer
Semi-structured interview 6th March 2017,
Location: Ministry of Agriculture, Embu Town, Kenya
Length: 40 minutes
Interviewer: Frederik
Observator and supplementing questions: Jeannette
Notes and supplementing questions: Natasha, Peter, Camilla, Emilie, Jane

- Plant clinic organizer in Manyatta sub-county through the MoA in Embu
- Worked with Plantwise since 2013

Interview William
From Pest Control Products Board, government of Kenya
Semi-structured interview 9th March 2017
Location: Selasio house
Interviewer: Frederik
Notes and supplementing questions: Camilla, Natasha, Peter, Emilie, Jeannette

- Regulatory agency in Kenya established in 1982
- Regulates manufacture, distribution, sale, import, export and use of Pest Control Products

- The PCPB works to ensure pesticides are of good quality, that they are safe and efficient in managing crop husbandry

Interview J. Njoki
Jane Njoki, coffee co-op secretary
semi-structured interview 8th March 2017
Location: Coffee co-op office Kibugu Town
Interviewers: Frederik & Natasha

Interview farmer 1
Linette Chelimo, large-scale user
Semi-structured interview 9th March 2017
Location: GPS record: 0 26´46¨S 37 25´37¨ E
Interviewer: Emilie & Denis

Interview farmer 2
Jane Wombeti, small-scale user
Semi-structured interview 7th March 2017
Location: GPS record: 0 28´25”S 37 25´54”E
Interviewer: Camilla & Cameline

Interview farmer 3
Catherine Muthori, small-scale user
Semi-structured interview 8th March 2017
Location: GPS record: 0 26´32¨S 37 25´52” E
Interviewer Frederik & Natasha

Interview farmer 4
Samuel Njiru, small-scale user
Semi-structured interview 7th March 2017
Location: GPS record: 0 27´44¨S 37 26´6¨ E
Interviewer: Peter & Jeannette

Interview farmer 5
Charity Manyaga, large-scale user
Semi-structured interview 07th March 2017
Location: GPS record: 0 27´12¨S 37 26´0¨E
Interviewer: Frederik & Natasha

Interview farmer 6
Cecilia Kathuri, small-scale, non-user
Semi-structured interview 8th March 2017
Location: GPS record 0 26´42¨S 37 25´37E
Interviewer: Emilie & Dennis

Interview farmer 7
Frederick Ireri, small-scale, non-user
Semi-structured interview 7th March 2017

Location: GPS record 0 27´32¨S 37 25´48¨E
Interviewer: Emilie & Dennis

Interview farmer 8
Samuel Njero, large non-user
Semi-structured interview 7th March 2017
Location: GPS record: 0 28'17" S 37 26' 1" E
Interviewer: Camilla & Cameline

Interview farmer 9
Harriet Njeru, small-scale non-user
Semi-structured interview 8th March 2017
Location: unknown
Interviewer: Camilla & Dennis

Interview farmer 10
Richard Nyaga, large non-user
Semi-structured interview 7th March 2017
Location: GPS record: 0 27´55¨S 37 26´6¨ E
Interviewer: Frederik & Natasha

Interview farmer 11
John Musangi, large non-user
Semi-structured interview 7th March 2017
Location: GPS record: 0 27´18¨S 37 25´49¨ E
Interviewer: Peter & Jeannette

Interview farmer 12
John Peter Mbature, large non-user
Semi-structured interview 7th March 2017
Location: GPS record: 0 27´33¨S 37 25´53¨E

Appendix 8 - The Devolution of Kenya and agriculture and climate change

The Devolution of Kenya

The new constitution of Kenya was enacted in 2010. It's goal is to involve the population of Kenya with improved supervision and implementation of policies at grassroot level (Kenya information guide, 2015). Kenya was divided into 47 counties with the intention of ensuring, that each county would have the qualities of transparency, accountability and decision-making at the lowest level of the government (Collins, 2016). An additional goal was to minimize the gap between social inequalities by decentralizing state organs to open the access for the public (Collins, 2016).

Several strategies, implemented by the MoA since Kenya's independence in 1963, have benefited small-scale farmers; for example training and visit (T&V), FFS and implementation of cooperatives to improve crop yield and management (Muyanga & Jayne, 2006). By the 1980's the Kenyan government was forced to minimize their role in national economies, which meant budget cuts from extension officers. Prior to the devolution in 2013 the Ministry of Agriculture and Rural Development was criticized for governing the rural agricultural development with a top-down approach which led to poor development, and therefore a wish was made for decentralization in order to strengthen the county governments and facilitate local farmers (Muyanga & Jayne, 2006).

Agriculture and Climate Change

Climate change will have an enormous effect on Africa and especially in East Africa. The dependency of diurnal precipitation is paramount for survival. It is seen in multiple areas of the continent, that droughts are ruining crops and forcing the population to migrate. Lack in precipitation are stressing crops and leading to failed yield. When the precipitation comes, the rains can be so strong and heavy, that they wash away the crops and leaves nothing left to the farmer to harvest. Adaptation and mitigation through irrigation systems, drought and heat tolerant crops, insurance and other social protection programs are just simple tools but necessary strategies to minimize loss of livelihood and lives (Bryan et al., 2012). Keeping in mind, political and economic changes can force the farmer away from traditional coping methods onto strategies that undermine long-term security through intensification of crop and livestock, which can cause maladaptation (Niang et al., 2014).

Appendix 9 - Time Schedule of Fieldwork

Date	Task	Method
Day 1 Thu. 02.02.2017	- Arrival at our host-families - Grand-tour in Kibugu - get an impression of the location and the farming systems. 18.00 - Evaluation meeting + prepare for the following day's tasks.	
Day 2 Fri. 03.02.2017	- Meeting at the school - Print Questionnaire - Make visual time schedule for fieldwork - Establish ourselves in the group room available - Test general questionnaire (possible change questionnaire) - Agrucultural Faire in Embu - Try to establish contact to plant clinics or people involved with them + other advisory services in the area etc. 18.00 - Evaluation meeting + prepare for the following day's tasks.	Questionnaire
Day 3 Sat. 04.02.2017	- Questionnaire samplings (all) - Use GPS for mapping the households of the respondents - Create contacts to possible informants (users/non-users of Plant Clinics) 18.00 - Evaluation meeting + prepare for the following day's tasks.	- Participant Observation - Questionnaire
Day 4 Sun. 05.02.2017	Church (all) - Identify informants for semi-structured interviews + prepare interview (check interview-guide) - Type-in results from Questionnaires 18.00 - Evaluation meeting + prepare for the following day's tasks.	- Participant Observation
Day 5 Mon. 06.02.2017	- Semi-structured interview with David Gitari, MoA, Embu - Semi-structured interview with Pauline Muriithi, Plant clinics organizer, Embu - Type-in results from questionnaires 18.00 - Evaluation meeting + prepare for the following day's tasks.	- Semi-structured interview
Day 6 Tue. 07.02.2017	- 8 Semi-structured interview with farmers (3 users and 5 non-users) 18.00 - Evaluation meeting + prepare for the following day's tasks.	- Semi-structured interview
Day 7 Wed. 08.02.2017	- 3 Semi-structured interview with farmers (1 user and 2 non-users) - Semi-structured interview with Willian (PCPB) - Semi-structured interview with Jane Njoki, representative, Coffee-cooperative, Kibugu Town - Status meeting - In which direction is our data taken us?	- Semi-structured interview - PRA
Day 8 Thu. 09.02.2017	- 1 Semi-structured interview with a farmer (user) - Data work	-Semi-structured interview

	18.00 - Evaluation meeting + prepare for the following day's tasks.	
Day 9 Fri. 10.02.2017	- Semi-structured interview with plant doctor Eudesia Ndwiga, Kibugu Plant Health Clinic, Kibugu Town centre, Ngerwe - Observation+ Participant observation at the plant clinic - Semi-structured interview with 3 agro-vets in Kibugu Town centre - Prepare presentation for saturday-meeting 18.00 - Evaluation meeting + prepare for the following day's tasks.	- Semi-structured interview
Day 10 Sat. 11.02.2017	- Evaluation meeting/presentation of results - Dinner in Embu 18.00 - Evaluation meeting + prepare for the following day's tasks.	
Day 11 Sun. 12.02.2017	- Transect walk (all) - Observation - Social activity: visit coffee farmer Peter	- Transect walk
Day 12 Mon. 13.02.2017	- Departure from host families Going back to Langata	