PROMOTION OF OIL PALMS: A CASE OF TENERA OIL PALMS IN ISUBILO, MWENSE-LUAPULA ZAMBIA

A Research Project Submitted to Van Hall Larenstein, University of Applied Sciences in Partial Fulfilment of the Requirement for the Award of the Master Degree in Management of Development with Specialisation in Food Security

By

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Wageningen

The Netherlands

DEDICATION

This thesis is dedicated to my children: Choolwe, Beenzu that missed the affection care of their father and Mazuba who was two months old when I left for studies.

ACKNOWLEDGEMENTS

This report is not complete without thanking everyone that was behind its success.

I therefore would like to express my sincere heartfelt indebtedness to the Netherlands Government for according me this rare opportunity to study in the Netherlands. The Zambian Government through the Directorate of Human Resource Development for awarding me a paid study leave deserves my heartfelt gratitude.

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My heartfelt gratitude are also extended to all the students and Dutch corridor mates that made my stay pleasant and memorable in Holland.

With gratitude
Osbert Hamweete
September, 2012
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ABBREVIATIONS AND ACRONYMS

ASD…….. Agricultural Services Development

CEEC……Citizen Economic Empowerment Commission

CSO…….. Central Statistics Office

DoA…….. Department of Agriculture

FAO…….. Food and Agriculture Organisation

FFB…….. Fresh Fruit Bunch

FISP……..Farmer Input Support Programme

GPS…….. Geographical Positioning System

IHFSAN …….. Improved Household Food Security and Nutrition

LFSNAC…….. Luapula Food Security Nutrition and Communication

MAL……. Ministry of Agriculture and Livestock

MFNP…….. Ministry of Finance and National Planning

NAP…….. National Agriculture Policy

NISIR…….National Institute for Scientific and Industrial Research

PAViDIA……... Participatory Village Development in Isolated Areas

PLARD……. Programme for Luapula Agriculture and Rural Development

PPU…….. Provincial Planning Unit

SNDP……Sixth National Development Plan

WHO……. World Health Organisation

ZMK……. Zambian Kwacha

ABSTRACT

This research focusses on adoption of oil palm among the farmers of Isubilo, Mwense Luapula as recommended by the Department of Agriculture (DoA). The DoA is a government department in the Ministry of Agriculture and Livestock working with other government departments with a goal to increase food security, income, employment creation and poverty reduction. It inherited the Isubilo palm project after FAO in 2005/6 to promote hybrid oil palm cultivation. After six to seven years, 30% of input beneficiaries-targeted farmers (29) adopted. However, 22% of the adopters fully adopted oil palm cultivation as recommended by the DoA.

The objective of the research therefore was to investigate reasons why the targeted farmers adopted and/or did not adopt hybrid oil palm farming recommendations.

To achieve this, the research questions were formulated as follows: 1.How is the knowledge of the farmers in the management practices of Tenera oil palm. 2 What are the claims and benefits of the cultivation of Tenera oil palms to the farmers?
To answer these questions, eight individual interviews were conducted among the adopters and two focused group discussions were conducted with the adopters and non-adopters. The focus groups comprised eight oil palm adopters and nine non- adopters.

Eight adopted farmers were all interviewed as the number was small and convenient to allow all to be interviewed. Nine non-adopters were selected as they were the only ones available in the village at the time of interviews out of 21 non-adopters.

The outcomes of the interviews and focus group discussions yielded the following results: husbandry practices like land preparation, weeding, irrigation, fertilizer application, and plant protection were hardly done by non-adopters compared to full adopters.

Reasons most frequently for non-adoption are: high labour demands, lack of finances, costly inputs, fire outbreaks and lack of labour saving technologies.

The fully and partly adopted farmers mentioned the following as the most important reasons for adopting: oil palm was more profitable than the commonly grown cassava and maize, oil palm offered them many benefits they did not have or hardly had before like cooking oil, manure from sludge, fibre and empty fruit bunches and easier access to heat energy from oil palm products.

Based on these results/findings, the study concludes: Wider knowledge gap exhibited among the part-adopters; weak institutional linkages affecting farmers' access to inputs; weak group dynamics making them over-dependent on government support and lacking labour saving technologies adversely affecting oil palm cultivation.

With the given conclusions, the study recommends the following: Timely trainings by the department to the farmers are needed to fill the knowledge gap; Oil palm farmers should also be subsidised with inputs to ease the costly input constraints; enhancing linkages with actors that include government departments and Non-Governmental Organisations to facilitate access to microfinances, labour saving technologies among other empowerment initiatives is needed. The manual farmers are using should be simplified to a level easily understood.

1. INTRODUCTION

This research is about the adoption of oil palm among the farmers of Isubilo in Mwense - Luapula as recommended by the Department of Agriculture (DoA).The DoA has been promoting oil palm packages in this area since 2005/6 after FAO.

The aim of the research described in this report is to investigate reasons why the targeted farmers adopted and/or did not adopt hybrid oil palm farming. The research questions are: 1.How is the knowledge of the farmers in the management practices of Tenera oil palm. 2 What are the claims and benefits of the cultivation of Tenera oil palms to the farmers?

To answer these questions, eight individual interviews were conducted among the adopters and two focused group discussions were conducted with the adopters and non-adopters. The focus groups comprised eight oil palm adopters and nine non- adopters.

The structure of this research is as follows: Chapter 2 shows a short background information description on oil palm, the study area (Isubilo in Mwense), the Department of Agriculture (DoA) as the promoting organisation and introduces the adoption concept; Chapter 3 describes the problem statement, the research problem, the research objective, main and sub research questions leading to interview questions and checklist for semi structured interviews; Chapter 4 describes the adoption conceptual framework and operationalisation of willingness and knowledge ; Chapter 5 describes the research strategy and research methods for data collection and processing; Chapter 6 summarises findings from the interviews. Chapter 7 discusses the findings leading to results as solutions to the sub-research questions. Chapter 8 portrays conclusions from the results and recommendations to the conclusions. To complete the report, references and appendices are attached.

2. BACKGROUND INFORMATION

2.1 Introduction

This chapter portrays facts on oil palm, facts on the study area (Isubilo) that include location, climate, background about Isubilo, facts on the Department of Agriculture with regard to oil palm promotion and finally the concept of adoption is introduced.

2.2 Oil palm overview

Palm oil production has recorded history of 5000 years (MPOC, 2006). The oil palm (*Elaeis guineensis*) is one of the largest of the palm species and produces more oil per hectare than any other oil crop (4-6 tonnes oil/ha/ year) (Arulraj and Suresh 2009) and (Fairhurst and Hardter 2003).

African oil palm originated in Africa, along the coastal strip (200–300 km wide) between Liberia and Angola, from whence it spread North, South and East to Senegal, the Indian Ocean, Zanzibar (Tanzania) and Madagascar (New CROP, 1996 cited in Douglas, S. et al, .2009).

In Africa, the expansion of industrial plantations has changed its focus from edible palm oil to the production of agro fuels, mostly led by a broad array of foreign corporations eager to invest in the region (Carrere, 2010). This has led to prioritisation of early and high yielding hybrid palms to meet industrial demands. FAO has pioneered development of cold-tolerant oil palm in poor rural communities of central Africa with Agricultural Services and Development (ASD de Costa Rica). FAO Tenera technology transfer promotion began in Ethiopia and continued in Cameroon (the Village Women's Organization, Bamenda), Malawi (Kaporo) and Zambia (Luapula) before being extended to west Kenya (Griffee, Diemer and Chinchilla, 2003).

Tenera oil palm being promoted resulted from the controlled crossing of Pisifera and Dura (AAR, 2010). Dura, a local variety has a thick husk, thin mesocarp and small kennel with less oil yield as compared to Tenera.

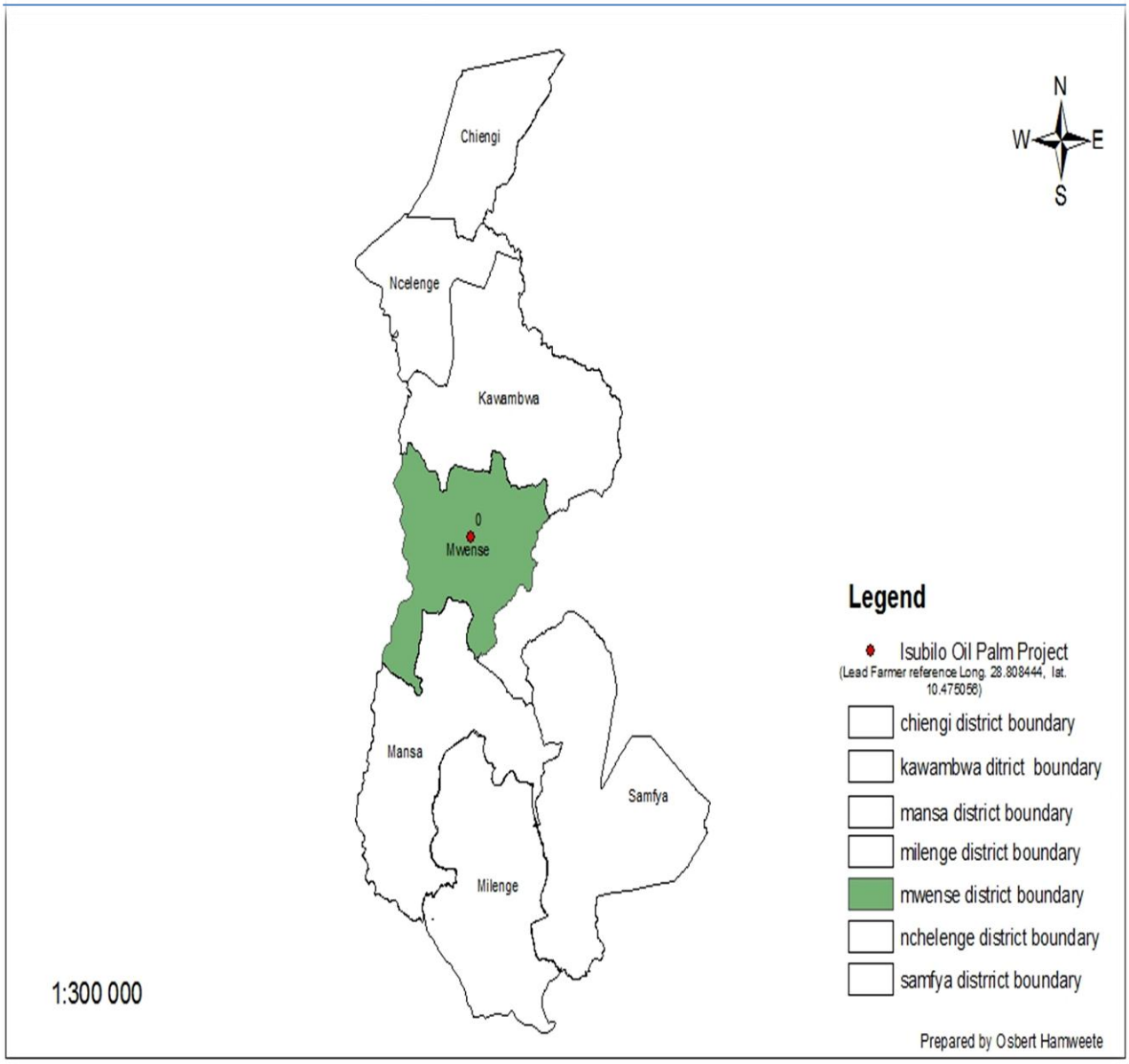
Pisifera is noted for its importance for cross breeding palms although it is of little commercial value owing to its high ratio of abortion. In the fertile fruits, it has small pea like kernels (Corley and Tinker, 2003; Verheye, 2011).

Tenera according to Verheye (2010) has the following characteristics: "shell 0.5-3mm thick; comprising 1-32% of weight of fruit; medium to high mesocarp content of 60-95%, but occasionally as low as 55%". It has a 26% oil to bunch ratio as compared to 16% in Dura (Mohan and Priyadarshan, 2009). "One tree yields 24 fruit bunches/year weighing 30Kg each under good management. Each bunch has a potential of 10 litres of oil. Ten trees can give 2400 litres of oil per year and yields can be 4- 5ton oil /ha/year", (Rachier, 2008).

According to the DoA (2011) farmer register, Luapula, Zambia has about 4500 oil palm farmers out of which about 1000 famers (350 females and 650males) are in Mwense. The oil palm tree population in Mwense by the end of 2011 was about 16700 out which about 11800 were Tenera hybrids.

2.3 The study area

The map below in accordance with the stated scale shows seven districts of Luapula province and Isubilo in Mwense district.



Map 2.1 Location of Isubilo in Mwense district of Luapula province

a. Location and population

Isubilo oil palm is in Mwense district of Luapula province. The central district is located at 10.383S and 28.63E, about 115km from the Mansa the headquarters of Luapula. The district has about 107,000 inhabitants (DoA, 2011). Isubilo is located at 10^{o}24'27.02"S and 28^{o} 43'33.04" with the elevation of about 1000m as depicted from Google earth.

b. Physical and relief features

Mwense falls in agro ecological zone III. Much of its topography in the East is a valley. Mwense River from Muchinga Escarpment in the East passes through Isubilo oil palm scheme before flowing into Luapula River in the West.

c. Climate and Weather

The geographical characteristics of Isubilo that determine its suitability in oil palm production are shown in table 2.1 below:

Table 2.1.Soils, Humidity and Day length in Isubilo, Mwense

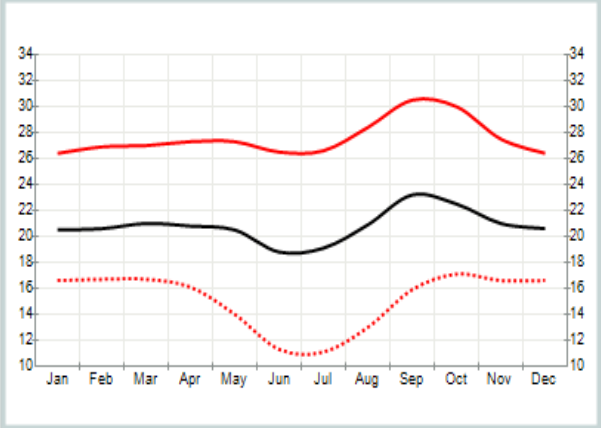
Soils	pH around 5; sandy loamy soils, land slightly sloping towards the river
Humidity	Ranges from around 30 to 85%
Day length	11hours 40 minutes on average

Source: Meteoroidal Department, Department of Agriculture and own GPS measurements

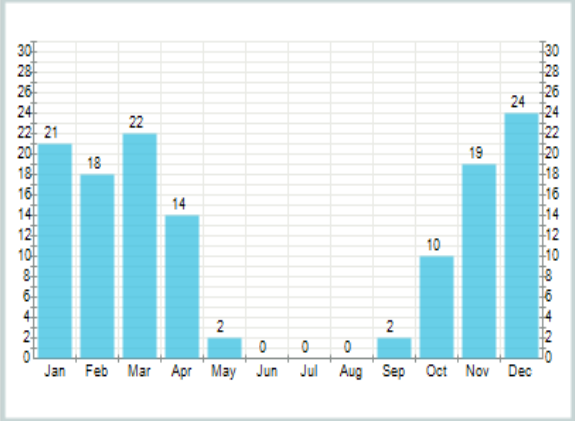
Table 2.2: Temperature and number of days per month with precipitation in Mwense

Months Days	Temperature			Precipitation days
	Normal	Warmest	Coldest	Normal
January	20.5°C	26.4°C	16.6°C	21
February	20.6°C	26.9°C	16.7°C	18
March	21.0°C	27.0°C	16.7°C	22
April	20.8°C	27.3°C	16.1°C	14
May	20.5°C	27.3°C	14.0°C	2
June	18.8°C	26.5°C	11.3°C	0
July	19.1°C	26.6°C	11.1°C	0
August	20.9°C	28.4°C	13.0°C	0
September	23.2°C	30.5°C	15.9°C	2
October	22.5°C	30.0°C	17.1°C	10
November	21.0°C	27.5°C	16.6°C	19
December	20.6°C	26.4°C	16.6°C	24

Graph 2.1 Average monthly temp/per year.



Graph 2.2. Avg. days per month with rains



Source: Kawambwa Meteorological Department

d. Background of the oil palm in Isubilo

Isubilo oil palm project cooperative formed in 1998, is situated in Chebele village of Mwense district under the chiefdom of Senor Chief Kashiba and is located about 3km from Mwense District Farmers' Training Centre. The village has about 500 households out of which only nine were involved in oil palm production out of the 150 targeted farmers at the time of the research. The land earmarked for oil palm had a total hectarate of about 300 expandable to 500. Out of this, about 72ha was under oil palms, while much of the rest of the land was virtually unutilised. Tenera hybrid oil palm production in Isubilo began in 1993, Alex Chibiliti, being the first farmer. Before then, the farmers in Chebele were involved mainly in cassava production. All farmers in Isubilo Oil Palm Project were not farming the local Dura type of oil palm even though they were aware of it growing in other areas of Mwense Valley and the entire northern valley region as a whole. Project members however planted their oil palms in 2005/6 season.

The area was earmarked for Tenera palm pilot project by the Food and Agriculture Organisation (FAO) sponsored Luapula Food Security and Nutrition and Communications (LUFSNAC) and Belgium sponsored Improved Household Food Security and Nutrition (IHFSAN) Projects.
The value chain of palm oil in Isubilo is shown in appendix 5.

e. Administration

The District Commissioner is in charge of all government administrative issues in the district. However the chiefs and headmen are in charge of villages. Traditional land allocation is done by chiefs.

2.4 The Department of Agriculture and stakeholders

The Department of Agriculture (DoA) is one of the nine departments of the Ministry of Agriculture and Livestock (MAL). It inherited the oil palm project after (IHFSAN) and LUFSNAC, FAO initiatives in 2006/7. Extension messages are delivered to the farmers through the Camp Extension Officer who links the department with the farmers. The department's interest in the project is to increase income, food security, create employment opportunities and reduce poverty among the rural people in line with the Sixth National Development Plan (SNDP) and National Agriculture Policy (MFNP, 2011). The department works closely with the Provincial Planning Unit (PPU) of the Ministry of Finance and National Planning (MFNP) that remits funds and ensures prudent use of resources. These supporters to the oil palm chain are shown in appendix 5.

In April 1997, FAO in collaboration with the Ministry of Agriculture began implementation of an integrated five-year project focusing on household food security and nutrition. Promotion of high oil content hybrid Tenera oil palm with Luapula Food Security Nutrition Action and Communication Project (LFSNAC) began in 1998 with the aim of mitigating the nutrition and prevalent blindness problem due to its vitamin A content (Griffee, Diemer and Chinchilla, 2003). The first Project, IHFSAN, GCP/ZAM/052/BEL) was implemented between January1997 and February 2002 (FAO, 2006). Statistical surveys showed 50% of the under five children and 60% of adults having mild to moderate serum retinol deficiencies (Sherman, 2003).

The project's target area included Kawambwa, Mwense, Nchelenge and Chienge valley districts due to their suitability for commercial hybrid oil palm production (Ngoliya et al, 2000). By end of 2011, the province had about 55,000 hybrid palm trees being grown by about 4500 small scale farmers. The following farmers are taking the lead – Chibiliti at Isubilo farms in Mwense, Kelos and Chinyanta in Kawambwa and Manchene in Nchelenge (see list of prospective oil palm areas in the province in Appendix 3). The DoA together with FAO has since the project inception, distributed about 11000 hybrid oil palms (DoA 2011) in Mwense. Currently, oil palms are imported from Costa Rica as pre-germinated seedlings after which the DoA nurses them for about 18 months before being distributed to farmers.

2.5 Introducing the concept of adoption

With reference to (Leeuwis, 2004, p.90), adoption can be defined as "acceptance of predefined innovations". According to Leeuwis model (2004), adoption goes along with four dimensions: knowledge, wanting to do it (aspiration), ability to do it and being allowed to do it. From these dimensions, it would be helpful to understand farmers' preferences at a particular time. This according to Leeuwis, (2004) provides an entry point to contributing to change and innovation. The dimensions of adoption are further elaborated in theories of adoption sections in Chapter 4.

3. PROBLEM STATEMENT, RESEARCH PROBLEM, OBJECTIVE AND RESEARCH QUESTIONS

3.1 Introduction

In this chapter, the problem statement, the research problem stressing the need for the research, the research objective, the adoption concept framework linking the research objective and questions is shown followed by questions seeking solutions to the objective.

3.2 Problem Statement

Low oil yields resulting from poor utilisation of Tenera oil management practices lead to low income among the small scale farmers depended on palm oil for their survival. Inadequate knowledge, resource inabilities, low willingness, lack of enabling customs and social status negatively influence adoption of oil palm production recommendations, hence resulting into low yields. These dimensions are reflected in the conceptual framework. Therefore it is within a farmer's domain to choose whether to or not adopt an innovation. Availability and accessibility of inputs, poor access and control of resources within the household also lead to poor adoption of oil palm production practices. In addition, the physical environment in form of climate contributes to low oil palm production and poor demotivating infrastructure demotivate the farmers. Low oil yields and low incomes contribute to farmers' low purchasing power of food items thus access to food becomes a challenge. Reduced oil palm production also leads to reduced vitamin A and E and protein utilization as these are main constituents in red oil palm (Griffee, Diemer and Chinchilla, 2003).

3.3 The Research Problem

The DoA has since 2007distributed more than 34,000 seedlings of Tenera oil palm to small scale farmers. Out of this, about 16, 000 were distributed in February 2011 at no cost. From this, about 4000 were distributed to Mwense famers. However, field monitoring visits by the ministry staff have reviewed poor growing and uncared for growing palm trees (DoA, 2011).

The number of oil palm input beneficiaries in Isubilo, Mwense was 29. Out of this about 30% adopted Tenera oil palm farming while the rest did not (DoA, 2011). In some cases, it has been reported in the district that differences in yields between Tenera and Dura are negligible, being around 3ltrs per palm per season in Mwense valley. This is a source of concern by the Department of Agriculture as it results in low palm oil yield as it is either difficult or impossible to compensate for incorrect practices applied from seed quality through to early field management (Griffee, Diemer and Chinchilla, 2003). The situation is appalling as Tenera hybrids are known to start yielding at three and half years but for seven years in Mwense, Isubilo project, about 80% of the farmers oil palms have not yet started yielding (DoA, 2011). It is interesting to note that the demand for oil palm seedlings is so creating an impression that farmers are very eager to venture into hybrid oil palm production.

Therefore this research sought to understand why the farmers are not following the recommended oil palm production practices leading to poor adoption of the Tenera oil palm. Promotion of Tenera is the main interest of the Department of Agriculture due to its high yielding and early maturity that would enable quicker income generation. Added to this, the department sees the crop as a high commercial crop that would create confidence to would-be oil palm investors in the province. It is the Department of Agriculture's intention that the oil palm sector in the province expands to a meaningful commercial oil palm level.

3.4 Objective of the study

To investigate reasons why the targeted farmers adopted and/or did not adopt hybrid oil palm farming.

3.5 Research Questions

From the adoption theory, the researcher focussed on the knowledge farmers have and do not have and investigating reasons behind the farmers' willingness to cultivate Tenera oil palms. It might have been necessary to know the skills but due to perceived limitations on finding standard procedures in this aspect, the researcher could not concentrate on this dimension. Whether the farmer is allowed customary and socially to adopt Tenera hybrid oil palm production was not considered in this research. This was mainly due to time limitation of the study. The abilities dimension was captured under claims as lack of resources was taken as a claim in the production of Tenera oil palm.

a. Main research question

What are the reasons for adopting/and or not adopting recommended production practices of hybrid Tenera oil palm in Mwense, Luapula Zambia?.

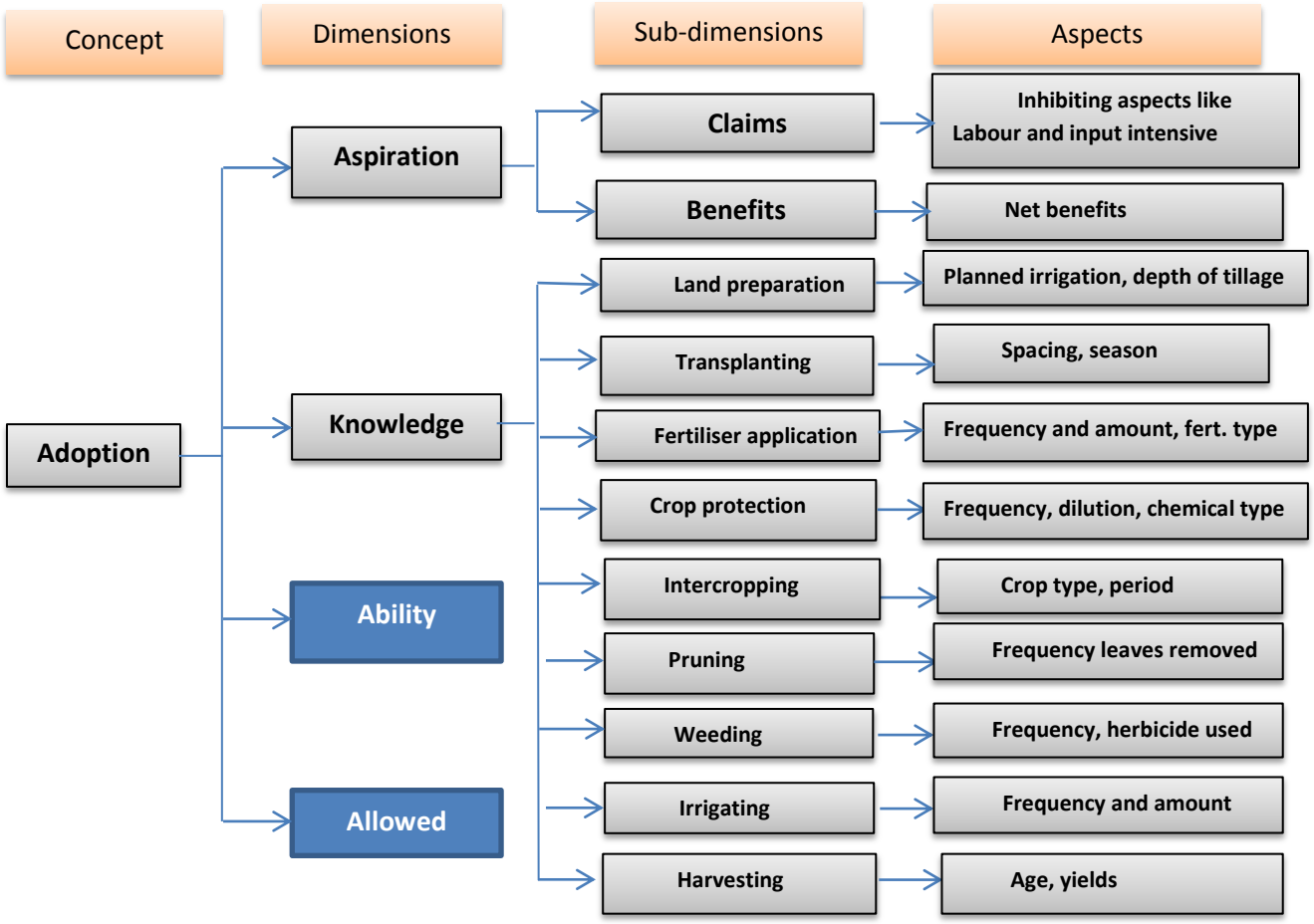
b. Sub research questions

1. What are the claims and benefits of the cultivation of Tenera oil palms among the farmers?
2. How is the knowledge of the farmers in the management practices of Tenera oil palm?

4. THE ADOPTION CONCEPTUAL FRAMEWORK AND CONCEPTUALISATION

4.1 Introduction

The following section explains and defines the concept of Adoption and its dimensions. The dimensions are Aspiration or willingness, Knowledge, Abilities and Allowance. Figure 4.1 shows the adoption conceptual framework and its operationalisation.



Note: Details of the indicators on knowledge are shown in table 4.1.and benefits in fig 4.2

Fig.4.1 Adoption Conceptual Framework as adapted from Leeuwis (2004)

4.2 Adoption

In continuation of this adoption concept defined in 2.5, according RUSH,2009, it is a critical element in increasing the effective reach of research outcomes and is most likely to occur when potential users determine that they have a need for particular information. In farming, a farmer must be in position to relate research findings to practical applications.

The following terms used in the report categorising farmers can be defined as follows:

Full adopters: Those that to a large extent follow the oil palm recommendations (indicators) as outlined in table 4.1 and are able to start harvesting Fresh Fruit Bunches (FFB) at four years.

Part or poor adopters: Those that largely do not follow the recommendations (indicators) as shown in table 4.1 and are unable to harvest FFB at five years.

Non- adopters: Farmers that benefited seedlings and initial fertilizer but did not plant or gave up as their plants completely died.

4.3 Willingness (Aspiration)

Farmers do what they do and do not do because they want or do not want. They look at associated benefits and claims. For instance a farmer may not give the palm trees adequate management attention due to the perceived long maturity period and its high labour requirements. He or she may focus the attention on short maturing crops requiring less labour attention hence compromising the growth of the oil palm. This is summed up in Leeuwis (2004,pp.69) where it was stated that “in processes of reasoning about pros and cons of particular farming practices, perceptions about consequences, likelihoods and risks are linked to subjective preferences and aspirations”. From the utilization continuum information can be either received but not internalised or received but not internalised or rejected, internalised and partially applied/rejected, internalised and fully replicated or internalised and adapted/tailored for application (RUSH, 2009).

4.3.1 Claims of Tenera and Dura

Farmers may not decide to adopt oil palms like Tenera owing to the following claims: risky of very low yields if not well provided with water, not well adapted to the local environment as compared to the indigenous Dura variety and requires better management in its growing. According to Gawanker et al, (2003), water stress reduces Fresh Fruit Bunch yield by 88.4%.

According to Poku (2002), traditional African farmers have not embraced Tenera because consumers complained that the palm oil produced from the variety was too fatty, solidifying at ambient temperature instead of remaining fluid and red. Besides, the oil did not have the right taste as oil or as a soup base. Also, the extension officers failed to position Tenera as high-yielding industrial purpose oil, as opposed to oil for home cooking. The negative perception of Tenera led to its slow adoption and the failure of Africa to maintain its lead in palm oil production.

Dura claims include: Difficulties experienced in extraction of oil due to thick husk, it takes longer to mature, starting producing fruits at 7 to 8 years after transplanting. In Zambia, local Dura start yielding at 8yrs compared to 3yrs in Tenera (Poku, 2002).

The delay in yielding coupled with less oil yield contributes to low income realised among the palm oil small scale farmers. It is also taller than the Tenera giving extra labour when harvesting. Fungal diseases according to Ekwenye and Okpokwasili (2006) are more prevalent

in Dura. The fungal infections include Aspergillus, Sacchormyces, and Candida while Aspegillus and Sacchomyces were also detected in Tenera.

4.3.2 Benefits of Tenera and Dura

On the other hand a farmer may aspire to cultivate Tenera for the following reasons: Fruits can be harvested from three-year-old palms, and the palms reach maturity at about six years. It produces 20 tonnes of fresh fruit bunches per hectare/year equivalent to 25% bunch oil palm content or 5 tonnes of oil, four times more than the local variety (Griffee, Diemer and Chinchilla,2003) and Poku (2002). For example, it was found that the FAO projects in Malawi and Zambia, oil per palm reached 9-12 litres when palms were 4½ years of age, and increased to 20-30 litres at six years. The best on farm experiments bunch yields were 60 and 150 kg/palm Alvarado and Sterling (2005).

It has a 26% oil to bunch ratio as compared to 16% in Dura (Mohan. and Priyadarshan, 2009). It has a thin husk easier to extract oil, produces larger bunches of fruit than Dura and is a cold tolerant variety adapted to high altitude. Besides, it is stabilised, environmentally friendly providing a complete ground cover hence enriching the soil with its decomposing falling leaves. (Griffee, Diemer and Chinchilla, 2003) and (Chapman, Escobar and Peter Griffee, 2003),

Citing Alvarado and Sterling (2005), 'Tenera has shown great precocity and better adaptability than local and other commercial varieties in Ethiopia, Kenya, Malawi, Zambia and Ecuador'. According to Chapman et al. (2003) and Poku (2002) in Alvarado and Sterling (2005), cold tolerant Tenera oil yield per palm was observed to be high in stress conditions. It was found to be more stable to bacterial and fungal deterioration, Ekwenye and Okpokwasili, (2006). Hence it has a better storability or shelf life as it readily solidifies at room temperature.

Dura has the following benefits: It has a unique flavour, although less productive, it is a hardy variety and well adapted to village gardens. From Ekwenye and Okpokwasili (2006), it has more unsaturated fatty acids that help in reducing cholesterol levels in the blood stream, Its rich in vitamin A and high in iodine value. It therefore may be more preferred nutritionally.

4.3.3 Benefits of Oil palm for Food Security

Food Security can be defined as existing when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life (Andersen, 2008).

Palm oil, palm kernel oil and palm cake are the main products of oil palm. Palm oil and palm are used for home consumption as cooking oil, shortenings, baking fats and ice creams (MPOC, 2011).
Today, oil palm feeds people in 150 countries, boosting global food security and curbing nutrition deficiency as well as heart disease. Under the codex alimenterius commission, the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) have endorsed palm oil as reaching food standards (MPOC, 2006).

Red palm oil according to Griffee, Diemer and Chinchilla, (2003) has the following uses; cooking oil for spicy food, such as curry, sauce, or other dishes which it gives a reddish colour. It can also be used as a portion in margarine blend to provide a natural source of colouring and a desired level of vitamin A, E proteins and as a nutritional ingredient for instant noodles, salad dressing and peanut butter. It is ideal for stir-fried dishes but is not recommended for repeated

use, since the carotenes will be degraded. It can also be consumed in a variety of flavours varying from sweet unfermented to sour fermented and vinegary alcoholic drinks. The fresh sap is sweet, as it contains sucrose and glucose and nutritious, clear, and colourless and with a neutral reaction.

Palm cabbage, the sweet, delicate central stem and bud (heart-of-palm) cut from the young palm, is, like the cabbage from other palms, eaten as a salad vegetable.

Red oil palm has high Density lipoproteins (HDL) and less in trans-fat acids (MPOC, 2011; Ekwenye and Okpokwasili 2006). This means that it can prevent cardiovascular high cholesterol intake related infections.

In addition, it is an important source of income to farmers. In Luapula, the demand for oil palm is far from being met. The neighbouring Congo offers a very lucrative price for oil palm. Income realised from these sales is injected into household food purchases and invested into farming of food crops.

Schematically, the *benefits* of oil palm are shown in fig 4.2 below;

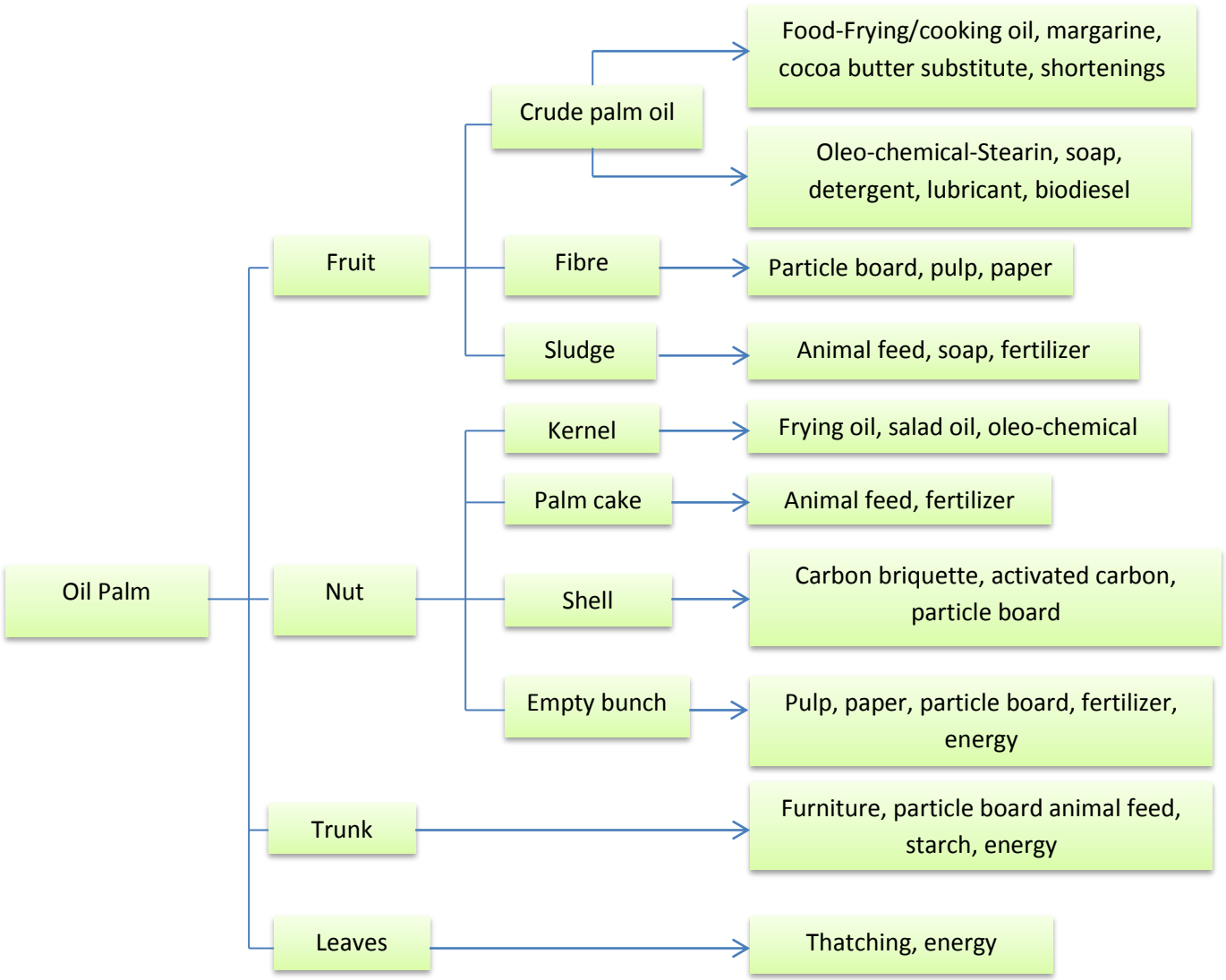


Fig. 4.2 Oil palm benefits (adapted from Fairhurst and Mufurt (1999); Griffee, Diemer and Chinchilla (2003) and Poku (2002))

4.4 Knowledge

This is what farmers believe to be true. What they do or do not do in the oil palm production process, lays in what they believe to be true. Farmers are very rich in indigenous knowledge. They often have basic ways of going along with farming problems that confront them. For example they have own ways of managing their local Dura palm with their own knowledge. This knowledge grows from own experiences and experimentations. Citing Leeuwis (2004, pp.68), "to understand what farmers do and do not do, it is irrelevant whether their beliefs about consequences are – in the eyes of, for example scientists-valid, correct or complete". Farmers indeed are not absurd as they have basic knowledge about their farming system. This is reflected in Leeuwis (2004) posit where it was alluded that Farmers not only consider possible technical consequences like yield expectations, required inputs and impact on quality, but also socio-economic effects like required labour organisation, income effect and impact on social relations. In this research therefore as seen from the conceptual framework, knowledge of farmers in Tenera oil palm husbandry was being explored.

Management/husbandry practices: these are practices carried out in the production of oil palm from land preparation to harvesting. Poor management as a result of knowledge gap causes low yields. Low yields according to Carson, 2000 in Douglas, et al., (2009), is attributable to labour shortages, limited mechanisation, low-grade planting material, palms that are too old or too tall, poor crop production practices, changes in oil prices, inadequate fertiliser use, economic instability, increased production costs, pests and serious droughts.

According to Lobell, Cassman, and Field (2009), factors that affect growth and yields include factors related to management, soil properties and interactions among these factors. These factors are biophysical and social economical factors of the farming system. Nandanjain, (2011) and Gawanker, et al (2003), indicate that oil palm yield potential is reduced when trees are exposed to stressful conditions. The most critical periods for oil palm are 24 months, 18 months, and 6 months prior to maturation of the fruit bunches. If oil palm trees are subjected to stress at this critical time, a higher proportion of the flowers become male flowers, which do not become fruit. Oil palm husbandry practices are shown in table 4.1 to portray indicators of good husbandry practices.

Table 4.1 Oil Palm husbandry practices

Smallholder Oil Palm Manual as adapted from FAO Oil Palm Manual and as referred to the Plantation Crops Practices from Andhra Pradesh Horticultural University

Climate: Oil palm needs tropical and semi-tropical climates High rainfall (minimum 1 600 mm/yr.) in tropical climates within 15°N and 15°S of the equator. For the maximum growth it needs average daily temperatures between 20 and 35°C during any month of year. The optimum growing temperatures are 25°C to 35°C. At 15°C its growth stops, but the tree is not damaged and the same is the case with temperatures over 40°C. It also needs long hours of sun-shine. Humidity should be above 80% and sunshine of not less than 5hrs/day.

Terrain of the planting site can be *flat if well drained,* but best sites are *gently sloping* <4% (1-2°) to provide adequate drainage. If only sloping land >4% (>2°) is available, construction of platforms may be necessary.

Soils: It can be grown on a variety of soils. But *moist, deep, loamy and alluvial soils rich in inorganic matter with good water permeability* are best suited, for its cultivation. Highly alkaline, saline, waterlogged and coastal sandy soils should be avoided. At least 1m depth of soil is necessary. The *soil pH of around 5.5 to 7.5* is convenient. Oil palm is sensitive to high pH soils and hence alkaline soils are not suitable.

Land preparation: The cleared areas should be at least *2m wide along the planned drainage canals, internal paths* and *palm alignment and 5-8 m along the access ways*. *Removal of the dead grass* or if this is not possible, burning if legal.

Planting: Planting should be in the *beginning of the rainy season*. In this way the young palms will have as much time as possible to develop their root system in order to withstand the following dry season. In order to ensure proper moisture conservation, *mulching is recommended*. Oil palm is planted in the main field in triangular system at *spacing of 9 x 9 m accommodating about 143 palms/ha in hexagonal system* of planting. *The hole should be 10cm wider and 5cm deeper*.

Manures and Fertilizers

Age	g/palm/year		
	N	P2O5	K2O
First year	400	200	400
Second Year	800	400	800
Third Year	1200	600	1200

Fertilizers should be applied in *two equal split doses at planting and three months after within 2m diameter* around the palm and forked in. *50-100g of Borax application* per tree/ year is needed. Application of potassium fertilizer may be enhanced depending on the requirement of the palm.

Weed Control: *Circle weeding* must be done around each palm. *Always keep 4.8metre wide circles* around the base of the palms free of weeds and any other plants. A good way of reducing weed growth is to use *organic mulch*. Mulch can improve the soils chemical and physical conditions, preserve soil water and at the same time reduce weed growth. *Selective weeding* should be done for weeds that cannot otherwise be controlled (e.g. vines and creepers that invade the palm trunks and leaves). Target weeds can either *be dug out or pulled up and removed or slashed at ground level* and if possible be sprayed with *herbicide after a 2-3 weeks re-growth*.

Legume cover crops (*beans, cowpeas, groundnuts*) have the potential to supply 200-300 kg N/ha of which about 80% is derived from biological N_2 fixation. Do not apply N fertilizers in very wet or dry weather and do not over fertilize young recently planted palms that have not yet established a proper root system. Maintain proper ground cover conditions to minimize fertilizer losses.

Pest and disease control: Ensure *no presence of these* in the field. It is important to detect outbreaks of pests and diseases as early as possible, so that control measures need only be implemented over a small area, and damage to the palms can be minimized. *Use appropriate chemicals for pests*. Once a pest or disease problem has been identified control measures must be implemented. The presence of natural pest predators should be assessed and if possible the habitats should be improved to encourage a larger population of these.

Pruning: *Maximum number of green leaves should be retained* on the palm. As a regular practice, *all dead and diseased leaves should be pruned*. Severe pruning adversely affects both growth and yield of palm. Pruning should be done by giving clear cut to the petiole as close to the stem as possible with the help of a sharp chisel.

Irrigation: For grown-up yielding palms of *3 years age* and *above*, a *minimum of 200-250 litres water/day* is a must. However, in older plantations *during hot summer*, this amount may be increased up to *300litres*. When water is not a constraint, basin irrigation can be taken up. Required *quantity of water can be given at weekly intervals or once in 5 days* depending on soil condition. Irrigation channels must be prepared in such a way that the individual palms are connected separately by sub-channels.

Intercropping: If properly done, young oil palms can be safely intercropped for *up to two years and if necessary also up to three years*. *Annual crops like chillies, gourds and other vegetables can be profitably grown* as intercrops leaving an area of *2 m around the palm* for the first two years only. After the onset of flowering there should not be any competition from other intercrops for the early stabilization of yields.

Harvesting: First harvest *3 ½ -4 years after planting*. A chisel is used for harvesting bunches from young palms. When the palms become taller, a harvesting hook has to be used. Under very good maintenance especially with irrigation the yield could be *4-6 tonnes* of oil per hectare per year.

4.5 Abilities

This portrays the *means* and *skills* needed by farmers in the production of oil palm. It portrays *resources* a farmer has at hand or does not have to manage his or her farming venture. In this research, aspects of resources have been looked into from the claims point of view. This is vital especially in determining gender participation in cash crop and food crop farming. Often women are not favoured in accessing of farming resources like land, labour and cash for inputs. As such cash crops like oil palm production are often regarded as a man's crop due to men's superior advantage in resource access.

4.6 Allowance

Culture and social status influence decisions farmers make whether to adopt or not adopt a particular farming system. For example if the crop is a staple food in a particular community, it receives all the support deserved from the community. Customary land laws inhibit equality in gender participation in farming. In Zambia for example most customs do not allow women to own or inherit land after the death of their husbands. Women may have access but not control over land. This has impelled women to concentrate on small plots for farming. As such they are more active in food crops like vegetables and legumes on small plots.

Socially, farmers choose to learn or not to learn from other farmers and then decide to adopt or ignore the innovation. For example in Mwense district some farmers adopted oil palm farming because of learning of how better oil palm farmers in the neighbouring Congo region were doing. This is posited in Leeuwis (2004) where it is stated that, "farmers' practices are shaped also by pressures that farmers experience from other people with whom they relate".

5. RESEARCH STRATEGY AND RESEARCH METHODS

5.1 Introduction

This chapter portrays the design of the research, the selection of the study area, selection of the respondents and sampling procedures, primary and secondary data collection, interview flow, how the findings were analysed, limitations and constraints of the research and consequence for the reliability of the research outcomes.

5.2 Design of the research

This research was carried out in two phases. The first being the desk study and the second being the collection of data from primary and secondary sources as explained later in 5.5.
The research took a qualitative approach of semi-structured interviews as it involved exploring farmers' knowledge opinions on oil palm production as the main question entails. The researcher therefore was trying to understand the farmers' opinions on why they manage their Tenera hybrid oil palms in the way they do. Such a selection of the qualitative interview was supported by Blumberg et al., (2005) in Saunders, Lewis and Thornhill (2007) where they noted that where the study involved an exploratory element, non-standardised (qualitative) research interviews would be included in the design. Further, Saunders, Lewis and Thornhill (2007) postulate that "where it is necessary for you to understand the reasons for decisions that your research participants have taken, or to understand the reasons for their attitudes and opinions, it will be necessary for you to conduct a *qualitative interview"*.

Semi-structured interviews with a list of themes and questions covered were used as attached in appendix 1. This approach was considered because semi-structured interviews provide an opportunity to probe answers, as the researcher builds on farmers' responses in questioning and hence learns more from explanations. This approach is an interpretivist epistemology where the researcher is concerned to understand the meanings that that farmers ascribe to certain phenomena resulting in collection of rich and detailed set of data (Saunders, Lewis and Thornhill 2007).

This type of interview offered an opportunity to the researcher to cross check the responses from the farmers. This was done by observing the prevailing scenario in the oil palm fields as most interviews were done in the fields. The observation was limited to the farmers farming system as shown in appendix 4.

5.3 Selection of the study area

Mwense amongst the four districts in the valley part of Luapula province with farmers involved in oil palm had the first oil palm pilot project by FAO in Isubilo, Chebele village. It was surveyed and recommended to be suitable for oil palm production. A lot of financial and material resources have been spent on this project in this area. The researcher saw it befitting together with the Luapula DoA, to choose this site to understand farmers' reasons for the slow and poor adoption of Tenera oil palm cultivation. Findings from this research in this area should contribute to helping out in coming up with an appropriate approach to this intervention to ensure good standing oil palms.

Map 5.1 Isubilo oil palms aerial view (Source: Google earth 2008)

5.4 Selection of the respondents and sampling procedures

A non-probability sampling was chosen as it provides a range of alternative techniques to select samples based on one's subjective judgement. Limited time and resources dictate the use of one or more of the non-probability sampling methods Saunders, Lewis and Thornhill (2007). The researcher saw it befitting to interview chosen clusters of adopters and non- adopters in groups and households for easier comparisons of these divisions.

The purposive sampling technique was used as the number of adopted oil palm farmers (sample population) at Isubilo oil palm scheme was small. It comprised three female farmers and six male farmers. Among the male farmers one was a lead farmer. At the time of interview, two female farmers had migrated for two months to harvest and sell their cassava. Some wives of the male oil palm farmers had migrated for cassava harvesting at the time of interviews too, hence the unbalanced number of respondents by sex. However the researcher managed to follow two female farmers under difficulty road terrain. Therefore eight farmers were all selected from the village as they were the only ones involved in oil palm production.

From the list of the Isubilo cooperative members and from the lead farmer, it was learnt that only nine non-oil palm farmers were present out of 21 non- adopters. The researcher decided to interview all of them by way of a focussed group discussion as it was possible to bring them together after having been notified by the extension agent. These farmers were the only ones present at the time of interviews as other farmers had temporarily migrated for other farm and off farm activities.

As the research question desired investigation of management practices practiced by oil palm farmers and benefits and claims hindering farmers from oil palm production, it was feasible to interview all the farmers. According to Saunders, Lewis and Thornhill (2007), purposive

sampling uses owns judgement; cases may be selected based on the research question and is often used with small samples and populations within qualitative research.

With respect to purposive sampling therefore, the list of all 29 oil palm input beneficiaries (targeted farmers) in Isubilo cooperative was provided by the secretary of the cooperative. However, it occurred that only nine farmers were involved in Tenera hybrid oil palm production. The rest were involved in other crop farming activities as they either sold their seedlings or seedlings died due to mismanagement. Therefore clusters comprised the adopters and non-adopters. From the nine adopters, one oil palm female farmer that had temporarily migrated was not interviewed together with some wives of oil palm male farmers as they had migrated for cassava harvesting among other activities. Nine non-oil palm farmers who happened to be around at the time were therefore interviewed to investigate claims and benefits of oil palm.

5.5 Primary and secondary data collection

Field data collection began on 27th of July and ended on 18th of August, 2012. The pre-test of the questionnaires was done on three farmers after which questions were refined to be answered within 1.30hrs, maximum being 2hrs as the researcher had to have time to move around the farm for observations as a way of crosschecking the findings. The interviews were so conducted that findings obtained could be traced and provable by another researcher. This is exemplified in Easterby-Smith et al. (2002) where it was stated that reliability is concerned with whether alternative researchers would review similar information. Interviews involved primary stakeholders. These comprised the full adopters and part adopters that included both men and women farmers.

Individual farmers were asked questions pertaining to management aspects of oil palms as they were some differences between each farmer from field observations.

To ensure credible and reliable data collection, the researcher tried to source secondary data primarily from sources deemed trustworthy like journals, PhD thesis, organisational reports and symposium documents from the library, internet and unpublished agricultural department Luapula province registry file reports. In both primary and secondary data collection, the researcher ensured data collection followed the oil palm adoption concept and its dimensions.

5.6 Interviews

To avoid biasness as much as possible the camp extension officer was not called at the interview site nor was he interviewed .Also to avoid gender biasness, both men and women were involved in the interview despite women shunning the oil palm production venture. The tone or non -verbal behaviour of the researcher was in such a manner as not to influence biased responses from the farmers. The researcher's own beliefs and frame of reference were not imposed and the researcher tried not to interpret responses biasedly (Easterby-Smith, et al., 2002).

To explain the purpose of the interviews, eight oil palm farmers were mobilised with the help of the block extension agent and the lead farmer. Nine non-oil palm farmers were also mobilised and interviewed by way of a focussed group discussion to understand their opinions on not adopting oil palms. The meeting place was the lead farmer's place as agreed by the farmers. This was done one day before the commencement of the interviews and it was agreed with farmers when each farmer would be interviewed for them to allocate time for interviews. The individual interviews were carried out in their fields and others at their houses (see appendix 6 photos during interviews).

The essence of the interviews was explained to the farmers as being purposely for education research and that the results of recommendations were to be availed to them should they be interested. This was to ensure that unnecessary suspicions of the interviews were put at bay. Also that some farmers were thinking that after the interviews inputs would be distributed to them, as such biased responses would ensue thus compromising research findings. This was made clear in the explanation of the purpose of the interviews so that unbiased responses from farmers' free minds would result. It was emphasised that the research was eventually for their own benefit and hence need for them to open up and participate actively and fully. Time requirements for the interviews were made clear as not being more than two hours so as not create deterrence to the interview participation.

Photo 5.1 Claims and benefits farmer discussion

Individual interviews were carried out as the testing of the questionnaire reviewed that farmers have different approaches in the management aspects of oil palms. The focussed group discussion on claims and benefits was carried out in the field for one farmer as agreed by the other farmers. The researcher carried out the moderation role. He explained to the farmers what was needed to be done and asked the farmers to feel free to seek clarification where not clear. The farmers chose the secretary of the cooperative as secretary of the discussion. The moderator afterwards asked them whether certain issues if necessary could be added that he felt the farmers might have forgotten. The discussion was dominated by the lead farmer but the moderator requested him politely to allow other farmers to also contribute especially old farmers who merely were passive in the discussion as opposed to young farmers.

The focused group discussion for the non-oil palm farmers was conducted under the lead farmers' oil palm trees. The researcher, who happened to be the moderator of the discussion on why they are not involved in oil palm production, explained the purpose of the meeting to them. It was also explained to them what was expected of them. They then chose a secretary and came up with a list of items to answer the question paused to them. The moderator kept them in track by reminding them of themes needed to be considered as eluded by Saunders, Lewis and Thornhill (2007). Saunders, Lewis and Thornhill (2007, p 340) say that, "keep the group within the boundaries of the topic being discussed; generate interest in the topic and encourage discussion". The discussion took about one hour thirty minutes.

The researcher's mode of dressing was typically farmer friendly field attire that was not to divert the farmers' attention and/or intimidate them. The researcher mingled with the farmers in such a way as to become part of their community for ease of free and relaxed interaction between the researcher and the farmers. For example, the researcher would sit on the ground in the field with the farmers, drink and eat with them. This way the interview environment was made ambient to both the interviewer and interviewees.

5.7 How the findings were analysed

The analysis of the findings focused on the full adopters and the part adopters. Inferences were also made between the adopters and non- adopters. Noticed differences and similarities affecting adoption between men and women farmers were also elaborated.

With respect to generalisation as posited by Marshall and Rossman (1999) in Saunders, Lewis and Thornhill (2007), where one is expected to be able to relate the respective research project to existing theory, findings were related to literature for analysis.

5.8 Limitations and Constraints

The researcher had planned to interview all three oil palm women farmers. However one was not interviewed as she had temporally migrated for her other off farm activities for two months during the interview period. It was also not very easy to follow one woman who had equally migrated for her cassava harvesting. The researcher had to follow her over a long distance on a very bad pot holed and hardly passable feeder road as can be seen in annex 6 (13).

Equally, the researcher could not interview some of the non-oil palm farmers in the Isubilo Cooperative as they had temporally migrated for their off and other on farm activities. As such he had to do with what was available and thus interviewing the nine present farmers.

Logistical resource limitations could not allow the researcher to spend more time than a week in the field as the researcher had wanted to wait for harvesting of ready oil palms so he could see the nature of labour and time involved in oil palm processing.

The visual findings on weeding could have not reflected reality as the interview period coincided with the launch of the Oil Palm Irrigation Project by Hon. Major Kapaya, Luapula province minister then. This meant some farmers had to clean their fields after being told by the agricultural staff to do so in preparation for the minister's visit.

Intra household gender roles findings may not fully reflect the views of the wives as women had migrated for cassava harvesting. The researcher however kept in mind of such likely biased responses during the interviews to ensure objectivity by the respondents.

Although the researcher had no problems accessing files for oil palm promotion in the province, reports detailing the situational analysis of oil palm in the province were lacking. For example, the researcher could only find the report on the evaluation of oil palm project in Luapula province from Lusaka province. A few reports found with scanty data were often reviewing inconsistent figures on tree population, yields etc.

The mild winter (around 16 degrees) season during which interviews were done could have portrayed wrong visual findings as it was barely two months after the rain season. Findings in the hot dry season could also have been different due different humidity and moisture level contents in the soil. Also during the hot dry season, often the beginning of the rainy season, farmers have more work clearing land for the maize crop and hence have little time to look after their oil palms. The opposite is true during the cold dry season when the interviews were carried out.

5.9 Consequence for the reliability/representativeness of the research outcomes

The representativeness of the sample chosen for interviews can be said to be highly representative in the sense that of the adopters only one out of the nine farmers was not interviewed. Of the non-oil palm adopters, it was not very representative as only the farmers who happened to be in the village were interviewed since the others had migrated for their other on farm (cassava fields) and off farm activities. However, all the farmers interviewed as a group in this cluster had similar reasons for not adopting hence the absence of the other members did not matter much. Findings from farmers were considered handier due to inadequate information found from secondary data from reports.

6. FINDINGS

6.1 Introduction

The chapter divided into the following parts: The First is the interviewee characteristics, findings on the management practices, The group interview findings for adopters and non-adopters showing benefits and claims associated with oil palm adoption. Interview questions to the findings are in appendix 1.

6.2 Characteristics of Interviewees

Table 6.1 Categories of Interviewees

Adopters	Total	Sex	Age category
Full adopters	2	2 males	1 young farmers; 1 old farmer
Part adopters	6	2 females; 4 males	All old farmers
Non-adopters	9	3 females; 6 males	4 young farmers; 5 old farmers
Young farmer: less than 50 years Old farmer: Older than 50years			

6.3 Individual Interviews (palm management practices)

Table 6.2 Findings on management practices

Soil type	
composition	largely Sand loamy soils in all fields
acidity or basicity	The soils are acidic
Land preparation	
land clearing	All farmers follow the same procedures of land clearing i.e. slashes grass, digs out trees with hoes and axes, does pegging with measuring tape. Dug out tree leaves are burnt and slashed grass is used as mulch, the excess is burnt
Removal or burning of the dead grass	No burning, grass used as mulch, nothing added to grass as it is left to decompose on its own in rain season
Planting holes depth and spacing between plants	All farmers follow the size of the poly packs in length (35cm) as the depth of the hole. In addition the lead farmer leaves an allowance of about 15 to 20cm for filling of fertile soil
Depth and tillage of the land	Land is not tilled except digging of planting holes and making of basins by all farmers
Season when tillage work is done	No tillage done except preparation of land for oil palm transplanting starts from the dry season to and during the rainy season
Harrowing the tilled land	No harrowing done on entire fields except two farmers break the clogs by raking during basin making

Land gradient and spacing between plants on such slopes and plant spacing is the same as on flat land	The farmlands for all the farmers are slightly sloppy tending to the stream. The spacing for all fields on very flat and slightly slopping land is the same (9m between plants and 8m between rows and 9m x 9m for palms planted before 2000 in the lead farmer's field)
Location of field in relation to water source	About 20m from the stream on the nearest end and 200m on the furthest end for all the farmers except for the lead farmer's field which extends to almost 500m from the water source
Drainage of the field	All fields show no drainage systems and furrows planned for the oil palms
Prevention of field from fire	Most fields have overgrown grass shadowing the palm trees. Such fields are threatened by fire outbreaks during the dry and windy periods. The lead farmer's fields planted before 2000 were observed to be well looked after without long grass that would render the fields susceptible to catching fires. Farmers try to slash on the edges of the fields leaving a space of about 2m between the fields' boundaries. Slashing in basins at radii ranging from 80cm to 3m is seldom practiced as observed

Transplanting of seedlings	
Season of transplanting palms	Planting ranged from September to March during the rainy season
length taken for the plants to be transplanted after being received from the nursery	Period varied from 1 week to three months as some seedlings were collected before finishing clearing the fields.
Appropriateness of planting this time of the year	Onset and during the rainy season to provide necessary moisture for the plants
Mulching practice	All farmers cover with grass around the plant for manure and preservation of moisture. Nothing applied to enhance decomposition of grass which only does so in the rainy season.
Spacing of seedlings	All farmers use the 9m between plants and 8 m between rows spacing except for the lead farmer's palms planted before 2000 which used the 9mX9m spacing
Basin preparation	After transplanting, five farmers made 20cm radius basins while two made 60 to 70cm radius. In second year ones who made 20cm at transplanting, increased to 70cm

Manures and Fertilizers	
Frequency of fertilizer application	Three farmers applied 0.2kgs per plant at transplanting stage. Two farmers applied 0.5kg in first and second year. The young farmer applied 0.5kg, 1kg and 1.5 kg per plant in first, second and third year respectively. The lead farmer applied 70g per plant twice in first year and 0.5kg in second year.
Quantities of NPK fertilisers needed	Farmers do not know of the different ratios for the compound fertilizer
Amount of fertilizer applied in first, second and third year per palm	Varied from 140gms to 500gms. Although one farmer did not apply at all
Radius around the palm tree where fertilizer is applied	Two farmers said they leave about 10cm from the plant while the other farmers including the lead farmer broadcast unevenly with fertilizer in contact with the plant as seen from the demonstration conducted after request
Plant protection and Weed control	
Frequency of weeding	Once a year in July and August. Until 2000, the lead farmer weeded twice a year. The common weed is Imperata.
Distance kept clear of weeds around the palm	Weeds visibly in contact with the palms, farmer not sure of exact radius to be free of weeds from the palm tree. Most of the palms for the lead farmer were observed to be weeded by slashing and short weeds grass left in the basin as observed in the fields.
Methods of weeding	Hand weeding, slashing and mulching, no hoeing for as roots are near the surface. Hands also used to remove vines and creepers
Dilutions and types of herbicides used	One farmer uses Round up and Gramaxone: dilutions are 500mls to 20-25lts water for both and the lead farmer uses Gramaxone and roundup: 300 and 350ml/20ltr respectively. The rest of the farmers do not use herbicides
Time taken and types of sprayers used	One farmer takes 45min to finish 25litres and roundup reacts within 1-2wks; Gramaxone reacts within 1 wk. Knapsack sprayers are used with unspecified nozzle sizes while the lead farmer sprays 100ltrs of herbicide in about 3 to 4 hrs. when cool and not windy
Common pests and control	Moles and termites. Farmers have problems controlling these pests. All farmers were not using any chemical except for the lead farmer who used termides according to label specifications
Planting of other crops within oil palms (Intercropping)	
distance of intercrops from the oil palms	Ranges from 2m for plants such as sweet potatoes and maize and about 4m for citrus fruits as observed
When to stop intercropping	Lead farmer and the young farmer stops when palms are four years. Others wait till the leaf canopy is fully formed and one man would not stop

Pruning	
Frequency of pruning and reasons for pruning	The lead farmer often prunes twice a year while the rest of the farmers do it once. improve water capillary to the health parts of the plant, pruning helps prevent disease infections
Target leaves during pruning	All farmers indicated the target leaves were yellowish, drying and diseased leaves
How severity of pruning is disadvantageous	Plants become too tall and produces fruits at greater heights
Irrigation	
Why oil palms require a lot of water.	Produce bigger fruits, grow fast, grow tall as learnt from all farmers
Tools used to irrigate the palms	The lead farmer and the young farmer use buckets and treadle pumps while other farmers do not at all irrigate.
Frequency of irrigation in a week	Seven farmers do not at all irrigate their palms. During first and second year, the lead farmer and the young farmer irrigated their plants at the rate of 10ltrs and 20ltrs per plant respectively. Now irrigate only where plants look too dry
why stopped or reduced frequency of irrigation	The young farmer and the lead farmer reduced the irrigating frequency as labour requirements became increasingly high as the plants grew and with expansion of the field.

Harvesting	
Age of start of yielding	Four for the young farmer and lead farmer. The rest of the farmers' palms even at seven have not yet started producing
How the harvest is done	Standing and use of axes and sickle up to 9 years then climb
Products from oil palm	mesocarp oil for cooking, kernel oil not extracted but nuts often used for brick making
Current yields	4-5 fruit bunches per palm per cycle for a palm aged 4 to 9 years; 2.2lts of oil per bunch weighing 10-15kg twice a year learning from the young farmer. 4year old produce about 4kgs fruit bunches and produce about 4 to 10 bunches up to 8 years; 1 bunch of 10kg yield 3 litres of oil as learnt from the lead farmer

6.4 Group Interviews (Claims and Benefits)

6.4.1 Adopters views

i. Table 6.3. Oil palm current benefits and how the farmers coped before oil palms

Product	Benefit	Coping before oil palms
Red oil	Used for cooking and income from sales. See chain map for sales in annex 5	Hardly had relish with cooking oil, In few cases would buy from nearest selling outlets.
Fibre from the fruit	Manure for oil palm fields and vegetable gardens	Rarely put manure in the fields. Dependent only on Farmer Input support programme (FISP) for subsidised fertilizer which is used in maize fields. Decomposing cut grass provided manure
Sludge from pressing	Used to feed pigs, fertilising vegetable gardens	Animals were feeding on free range. Fertiliser was rarely applied in vegetables
Kernel	Source of energy for brick making , cooking and red oil processing	Firewood and charcoal were sources of energy
Kernel shell	Energy used for brick making, cooking, boiling in palm oil processing	Firewood and charcoal were sources of energy
Empty bunch	Energy used for brick making, cooking, boiling in palm oil processing and as organic fertilizer in oil palm fields	Firewood and charcoal were sources of energy and fertilizer was from FISP
Trunk	Energy used for brick making, cooking, boiling in palm oil processing and source of building poles	Firewood and charcoal were sources of energy. Building poles were obtained from the trees in the wild.
Leaves, petioles and rachises	Building constructions, house thatching and protection of fields from trespassers.	Twigs and poles were from trees in the wild while fencing of fields was not done at all.

ii. Claims

Table 6.4: The adopters and part adopters' views on claims

Part adopters	Full adopters
- Time and labour intensive (lacked labour saving technologies)	Inadequate labour (field management and lacks improved processing equipment)
- Six farmers said lack of agribusiness know how contributed to their lack of focus to follow recommendations	-
- Five part adopters indicated that they could not easily follow the manual used on their own.	-
- Inaccessibility to micro-credit schemes	Lack of loans
- Fire outbreaks	-
- Five farmers indicated that they lack trainings	-
- Lack exposure visits	

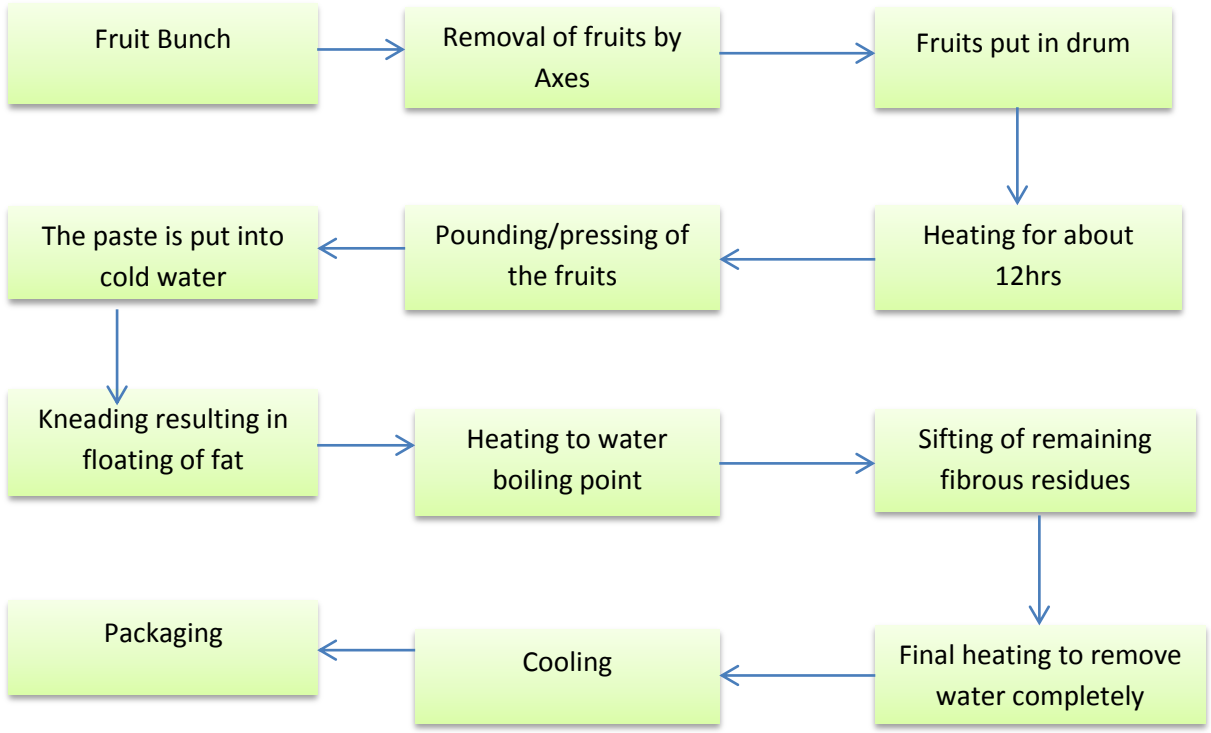
iii. An example of the amount of time consumed in palm oil processing is shown below as described by the full adopters.

Fruits are removed from the fruit bunch carefully with an axe. These fruits are then put in the drum in readiness for boiling. *Hired labour and family members* are involved in this process. Boiling then follows and it takes about *10 to 12hrs*, often this task is done overnight. This implies processors often women have to be alert throughout the night to ensure consistent heat emission from the fire source often firewood and oil palm tree trunk and kernel shells.

The fruits are then removed and separated by hand from the main stem spikelet. *Pounding* or pressing follows to produce a paste. Cold water is then added and kneading follows. This results in floating of the oil which is then put in a big pot and heated to boiling point of water to ensure evaporation of water. This process takes about *two to three* hours depending on the heat intensity. Here, colour starts changing from yellow to brownish. Sifting follows to remove the remaining fibre and other particles before the oil is subjected to the second heating process. The second heating process takes about *1.30mins* to ensure all the water is evaporated and at this point colour continues changing from yellow brownish to brick red. Cooling for an *hour* then follows into the preparation dish. From this dish packaging is then done into the containers in readiness for sell.

The process of palm oil by Isubilo farmers can be represented schematically in fig 6.1 as follows;

Fig 6.1: Palm Oil Processing at Isubilo in Chebele Village



Source: Own research primary data 2012

6.4.2 Non-adopters views

Table 6.5 Non-adopters views on claims and benefits

Claims	Benefits
Do not know the recommendations of oil palm husbandry but have basic indigenous knowledge	More profits than maize and cassava they are currently growing.
Acquisition of inputs- fertilizer, herbicides and insecticides was a problem	Assured of cooking oil
Fire outbreaks	More side products especially for heat energy and manure
Long maturity period	
High labour requirements for weeding and irrigation	
Government support frustrating as it concentrates on the lead farmer expecting diffusion of knowledge	

7. DISCUSSION OF RESULTS

7.1 Introduction

The chapter discusses results on oil palm management, household division of labour, access and control to resources affecting oil palm production, benefits and claims of oil palm to the adopters and non -adopters.

7.2 Individual interview outcomes: Oil Palm Management Practices

This part looks at climate requirements, terrain and soils; land preparation and transplanting; fertilizer application; irrigation; plant protection; pruning and intercropping and harvesting.

i) Overview of climate in relation to oil palm management

Isubilo oil palm project being located within the tropical climate of within 10^{o} North and South of the equator as shown in map 2.1 and its maximum mean temperature range of 26^{o}C to 30^{o}C is suitable for oil palm production. This is supported by Griffee, Diemer and Chinchilla (2003) and Arulraj and Suresh (2009) where they stated that oil palm growing is suitable within climates of 10^{o} N and 10^{o} S and 15^{o}N and 15^{o} S of the equator. However, the best regions are those with 7^{o} N and 7^{o} S according to (Verheye 2010).

The optimum growing temperatures of oil palm are 25^{O}C to 35^{O}C. At 15^{O}C its growth stops, but the tree is not damaged and the same is the case with temperatures over 40^{O}C (Griffee, Diemer and Chinchilla 2003). This further shows how temperature in Isubilo is favourable. However the low minimum temperatures experienced as shown in table 2.2 are detrimental to the well growing of the oil palms. This would mean that during the cold dry season oil palm growth should be negatively affected. However with the cold tolerant Tenera variety, such temperatures are not detrimental as it has been proven to have shown high precocity in cold temperatures. “Precocity and cold tolerance in oil palm have been developed during the past 20 years by FAO and ASD de Costa Rica with ‘Dura’ germplasm from Cameroon and Tanzania crossed with several ‘Tenera’ sources” (Griffee, Diemer and Chinchilla 2003). This is also supported by Corley and Tinker (2003) and by Chapman, Escobar and Griffee (2003) as they state that Tenera is able to tolerate temperatures lower than those suitable for classic oil palm hybrids and still produces four times more oil in cooler conditions than with less adapted cultivars.

The annual mean rainfall experienced in Mwense annually is between 1000 and 1600mm (DoA, 2011). This is not enough to sustain proper growth of oil palms in the entire year as oil palms need an average of 150mm per month for maximum yields according to Alvarado and Sterling (2005) and (Verheye 2010). Therefore 1800mm to 2500mm per year of rains is appropriate for well growing of oil palms as equally supported by (Basiron, 2007) and in the oil palm manual by Griffee, Diemer and Chinchilla (2003). The case of Isubilo oil palm poor growing could be partly explained by Basiron (2007) when he says, “Although countries located within 10 degrees latitude of the equator are said to be suitable for oil palm cultivation, some of them experience several months of drought, which drastically reduces yield”. Fairhurst and Hardter (2003), however point out that oil palm is successfully cultivated in agro-ecological zones where production constraint is low and poorly distributed rainfall like Thailand. Therefore in Isubilo this rainfall deficit can only be met through adequately irrigating the oil palms although the farmers have not exploited fully the potential offered by Mwense River running across their farmland.

ii). Terrain and soils

From the observations and farmer responses, it was clear that the land was slightly sloping towards the Mwense River, the source of their irrigation water. This is good for provision of adequate drainage as posited by Griffee, Diemer and Chinchilla (2003) in their oil palm production manual. The nature of sloping did not warrant farmers to use the planting distances applied in slopping lands where spacing should be slightly longer than on flat surface for well development of the roots. However it was clear that most farmers had no idea of this difference in spacing on different sloping lands as their manual used was not clearly simplified.

All farmers responded that they had no problems with the soil type. They described it as acidic, sand loamy rich in organic matter. This appropriate for oil palm production as exemplified in the oil palm manual by Griffee, Diemer and Chinchilla (2003) where they state that, "It can be grown on a variety of soils. But moist, deep, loamy and alluvial soils, rich in organic matter with good water permeability are best suited for its cultivation. Highly alkaline, saline, waterlogged and coastal sandy soils should be avoided. At least 1m depth of soil is necessary. The soil pH should of around 5.5 to 7.5 is convenient. Oil palm is sensitive to high pH soils and hence alkaline soils are not suitable". In addition deep sandy (loam) soils with limited water holding capacity are suitable for oil palms according to (Verheye 2010).

iii). Land preparation and transplanting

Literally all farmers used similar methods in land clearing for oil palm planting. They used basic tools like slashers, axes, and hoes. Grass was either burnt or used as mulch and other household chores like thatching. Mulch is a good source of manure in the rain season when the grass decomposes. It is a cheaper way of accessing fertilizer. Due to environmental concerns, it is highly advocated that farmers follow the zero burning method (Verheye, 2010), a practice that the DoA in Zambia is recommending. The part adopters did not prepare drainage canals in their fields as water drained by gravity on its own. On the other had the adopters in some fields drainage works were visible although in some fields the sloping nature of the fields allowed the water to flow into the stream. All farmers left about 5m from the main road. Internal access paths were visible in the older lead farmers' field unlike in the other fields. From Griffee, Diemer and Chinchilla (2003), cleared areas should be at least two meters wide along the planned drainage canals, internal paths and palm alignment and 5-8 meters along the access ways.

Failure to leave enough space on the boundaries of the farm by the part- adopters has resulted into their oil palms vulnerable to fires. Fires destroy the palms or retard their growth if survive the ravages of heat. Also failure to properly clear the grass during land preparation has proved challenging clearing it during the growing of oil palms. This was visible in most farmers' fields where grass outgrew oil palms except for the fully adopters who had fewer of such instances. In addition, not clearing this stubborn weed (Imperata) results in serious competition of nutrients with the palms as it tends to have well developed rhizome roots.

Unlike the part-adopters, the full adopters use non-selective herbicides like Gramaxone during land preparation and selective herbicides like Round-up after having planted the oil palms to clear the weeds. This can be observed from the little weeds visible in their fields compared to the part-adopters' fields. According to Verheye (2010), "*Imperata* can be eradicated by mechanical means, i.e. ploughing and harrowing, or by chemical treatment using a systemic herbicide". However for the Isubilo oil palm farmers, it was learnt that they neither harrow nor till

their fields except for the full adopters who also however do not till the entire field. This has contributed to difficulties experienced in clearing such weeds by the farmers.

All but the full adopters followed the size of the poly-pack (35cm) as the depth of the planting hole. The adopters left an allowance of 15 to 20cm for easier root development and addition of some humus soil on top. The holes according to Verheye (2010) should have 50cm x50cm sides and 50 to 70cm depth while Griffee, Diemer and Chinchilla (2003) recommend cylindrical holes 10cm wider and 5cm deeper than the poly-packs. From this information, it is clear that the adopters are following Griffee, Diemer and Chinchilla (2003) and Verheye (2010) postulated standards although these differences may be due to differences in regional topographies. For both adopters and non-adopters however, the planting spacing is the same. They follow the 8m x 9m between rows and plants respectively as posited by Veheye (2010) and Rachler, et al., (2008). The full adopters initially followed the 9mx9m system referred to in Griffee, Diemer and Chinchilla (2003) and Verheye (2010) but later changed to the former system. This was believed to save on space but still maintained the oil palm yield potential.

iv). Fertilizer application, mulching and irrigation

Photo 7.1 Water source

Photo 7.2. Mulched palm tree

All farmers applied fertilizer provided by the project team at transplanting. The part adopters applied 200grams to 500grams per plant while the adopters some applied 500grams while others applied twice of 70grams of 'D' compound in the first year. The part adopters never irrigated their oil palms after transplanting even in dry seasons. They complained that the exercise was too laborious. On the other hand, the fully adopters although they largely did not irrigate in later years, they irrigated in earlier years and still irrigate only in selected areas. They irrigated at the rate of 20ltrs per palm per week in the first and doubled the rate in the second year. This however was not enough compared to the recommendations. However it may have sufficed as the moisture in the soil dictates the amount of water to add to the plant. However all farmers mulched their palm trees for moisture conservation and provision of manure when the grass decomposes.

In both cases, with reference to Griffee, Diemer and Chinchilla (2003) and Fairhurst and Hardter (2003) where about 400g, 200g and 400g of NPK fertilizer is recommended in the first year and increasing by the initial factor every year for three years. However it is important to note that the actual amount of fertiliser needed depends on the nutrient status of the soil at planting. Among the adopters some applied even in the second year 1000grams per plant. Oil palm management is critical in the early years as mistakes made in earlier years manifest in delayed yielding and eventual low yields of the oil palms. This has been observed at Isubilo where those who applied fertilizer twice and continued watering especially in the first years, had their first harvest at four years. Tenera oil palms start producing at about four years and reach maturity at 6 to 7 years (Verheye 2010). However the part adopters applied inadequate fertilizer and never watered their oil palms after the rainy seasons.

This explains why their Tenera oil palms have not started producing fruits even after seven years of planting. Water deficit in palms causes inflorescence abortion and poor leaf formation. With reference to Nandanjain (2011), the most critical months of irrigation before fruit bunch maturation are 24, 18 and 6 before when sex selection of the flowers happens. Water is critical in the photosynthesis of the plant, lack of it not surprising retards or dries the plant. According to Alvarado and Sterling (2005), the Tenera cold tolerant palm has shown tolerance to water stress as basic management with irregular irrigation showed high yields in Malawi and Zambia and FAO project. This is the case of the full- adopters in Isubilo able to produce 4 to 10FFB from four years. This means that if the farmers adequately water their oil palms and apply required amount of fertilizer or manure, the yield would be far higher than what is prevailing. “Intermittent water stress (rain-fed) reduced fresh fruit bunches yield by 88.46% compared with the non-stressed treatment (irrigated)” (Gawanker 2003).

v). Pests, disease, weed and fire control

Photo7.3: Weeding

The most common pests were moles and termites that attacked the palm trees especially young ones from the roots into the stem. The termite threat is evidenced in Verheye (2010), where he portrayed that they are most damaging in palms planted in peat soils and they tunnel through the palm, preferring to attack the upper stem tissues. Ultimately, the trunk is so weakened that it collapses.

Photo7.4: Oil palms in grass

Most farmers have problems getting rid of these pests. The full adopters however try to use termides though not often do they manage due to the costly nature of the chemical. As explained in 7.2.2, weeds are controlled by the selective and unselective herbicides. Only the full adopters use these chemicals however. Slashing and hoeing are used to cut the grass especially around the plant in the basin (circle weeding). This however for most farmers is done once a year and often boundaries and access ways to fields had tall grass. As such, the fields were vulnerable to fires. It is not surprising to observe overgrown weeds (see photo 7.5) that hamper the growth of oil palms as stated in 7.2.2. The fact that the poor adopters fail to do anything about moles and termites leads to poor performance of their oil palms compared to the full adopters. However, there have not been diseases of major economic importance apart from water stress associated upper stem rots among the poor adopters especially.

v). Pruning and Intercropping

Pruning is done on average once among the poor or part-adopters while it is done twice among the full-adopters. The lower yellowing and dead leaves are targets of pruning. This act helps the improvement of water capillary to the health parts of the plant. It helps in the prevention of disease spread

Photo 7.5: Pruning

within the plant and from one plant to the other. Lack of pruning is as bad as severe pruning which according to Griffee, Diemer and Chinchilla (2003) leads to poor growth and eventual low yields. However, severe pruning is also detrimental as it damages the plant growth.

Intercropping is common among the part adopters and the full adopters. It is however more pronounced among the former as they grow a variety of crops that compete for nutrients and sunlight with the oil palm. Unlike the latter who stop intercropping at around three to four years, the former plant cassava, sweet potatoes, and maize even in six year old palms. More over the intercrops are planted very close to oil palms to maximise space. This increases competition for nutrients with the palm trees. Groundnuts and Bambara nuts often planted by women are however useful in the retention of nitrogen into the soil. Labour constraints impel farmers to be using one field for a variety of crops as they do not envisage starting clearing very dense forest of trees considering the amount of time and labour required. However in line with Griffee, Diemer and Chinchilla (2003), if properly done, young oil palms can be safely intercropped for up to two years and if necessary also up to three years to bring finances to the household in addition to food. Besides, funds can be used for oil palm inputs.

vi). Harvesting

Only the full- adopters started harvesting at about four years as is required for Tenera oil palms as supported by Verheye (2010). However depending on the locations, according to Chapman, Escobar and Griffee (2003), Tenera begin producing at 2.5 to 3years. In Malawi for example at four to five years12ltrs/palm with FFB of 60kg/palm of oil was achieved and 20-30lts/palm at six years was achieved with fresh FFB of 150kg/palm. This is in contrast with Verheye (2010), who states that , FFB weights on average 20-30kg depending on the tree age and that the first 3-4 years, the production of the young palms is often small, of poor quality, and sometimes even not economic to be harvested unless at six years.

However in Mwense Isubilo project, four to ten bunches per plant of four to eighty years are being realised. At this age, the FFB weigh about 4kgs each and 3lts of oil from 10kgs of FFB are realised. Had it not been for inadequate fertilizer application, poor irrigating and untimely weeding, yields would have been far more than this. For the same oil palms planted in 2005/6, the part-adopters due to poor management, their palms have not yet started yielding as compared to the full- adopters who are in second year harvesting their palms of the same age. This is reflected in Griffee, Diemer and Chinchilla (2003), where they said that oil palm was like an elephant, it could not forget the treatment it received during its early days.

7.3 Group Interviews outcomes

7.3.1 Adopters

a) Benefits and Claims of oil palm to the adopters and non-adopters
(Oil palm current benefits and how the farmers coped before oil palms)

Oil palm has multiple benefits as can be seen in fig. 4.1 to farmers. It is for similar benefits that the farmers in Mwense and Luapula at large have pursued this lucrative farming system. As a result farmers have adopted oil palm for the benefits they now enjoy as compared to the time they were not into oil palm production. This comparison of benefits is reflected in table 6.3. From this table it is clear that the living of the farmers has been made much easier from the net benefits. Farmers can now consume High Density Lipoprotein (LDL) vitamin A, E and protein rich oil. This means that they are living healthier than before as one farmer put it, 'generally we no longer visit our rural health centre as we used to because we can see and feel that we are better off than before'. Women's firewood collection reproductive task has been lessened due to the many parts of the oil palm tree that provide burning fuel. Farmers can now afford to keep more goats and pigs because of the sludge from palm oil processing. Gardening is getting greener owing to the manure from fibre and sludge. In short adopters of oil palm farmers are better off than non-adopters for the above reasons.

b) Part adopters

Main reasons in a nutshell leading to poor adoption amongst some farmers compared to the full adopters include: Lack of finances as compared to the latter that have more assets that ease their access to microcredits to enable them easily procure inputs and hire labour, weak connectedness to government organisations compared to the former, lack of exchange visits to appreciate oil palm growing as compared to the full adopters who have been exposed to successful oil palm farmers in west Africa. The full adopters understand and appreciate that farming is a business and hence their giving it all the attention it desires. This is the opposite of the part adopters especially women farmers that are content with a few trees that are only enough to produce oil for home consumption. This makes them not to put as much concentration as needed in their management of oil palms. The full-adopters are in addition motivated by the fact that oil palm is a long lasting venture which assures constant generation of income. As such they 'die a little' in the management of their oil palms.

From the findings, it is clear that both the full adopters and part adopters appreciate the benefits offered by the oil palm in the same manner. The latter are however highly hindered from following recommendations by the knowledge gap. This is either to lack of the oil palm manual or failure of the manual to simplify contents to the level easily comprehended by a farmer. This is the opposed of the full adopters who can easily discern units used.

The part adopters' fields are more vulnerable to fires compared to the full adopters as weeds have overgrown the palms as seen from photo 7.4. The full adopters have a strict regime of combating weeds by slashing and use of herbicides that part adopters are unable to access.

7.3.2 Non-adopters

Non-adopters are involved in cassava and maize production mainly besides on very small plots growing groundnuts, sweet-potatoes, beans and bambara nuts. Maize and cassava, the main crops grown are not any nearer profitable compared to palm oil. From Ngoliya et al., (2000), oil palm has a profit margin/ha of about 5million ZMK selling 1ltr at 1000 ZMK (see appendix 2). Maize has gross margin of about 1.8 million ZMK (CSO 2010) while cassava is around below 2million ZMK as its productivity is too low around 9 to 12 ton/ha compared to the 45ton/ha and above potential. Given this scenario it's more meaningful to be an oil palm farmer. However factors inhibiting this group of farmers from oil palm farming are reflected in table 6.5. This is in line with their reasoning of oil palm being more profitable as equally alluded to by the adopters. They equally concur with the adopters that oil palm provides several benefits other than income and cooking oil.

However as opposed to the full adopters, the non-adopters are so impatient that they cannot wait for so long to harvest considering that oil palm is high labour and input intensive. As a result they are more comfortable growing maize and cassava.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The following chapter is in two parts. The first section looks at conclusions derived from the main findings of the research in line with the research questions and hypothesis. The conflicting and contrasting statements among the adopters and non-adopters in relation to literature are portrayed. The chapter ends with recommendations to the conclusions that have been written as SMART as possible, showing actors responsible for needed actions.

8.2 Conclusions

From the outcomes on management practices, it can be concluded that the part adopters largely do not follow recommendations as they do not irrigate, do not apply fertilizer, rarely weed among other practices. This confirms the hypothesis that oil palm has been poorly adopted. Both part adopters and full adopters full have challenges in irrigation and weeding due to labour challenges although the problem is worse to the former. Fertilizer application and plant protection are a challenge among the part adopters due to lack of finances. Lack of irrigation is attributed to lack of labour saving technologies like treadle pumps.

Lack of simplification of the manual used contributed to failure of failing recommendations among the part adopters as it used units difficult to measure by farmers.

Poor access to financial institutions and in the project by both the part adopters and the non-adopters has contributed to inaccessibility of required inputs and labour saving technologies. Poku (2002) summed up this lack of resources as follows, “The management of costly inputs of labour, imported fertilizers, pesticides and farming equipment hampers the yield of plantations”. This therefore answers the question on claims affecting adoption of oil palms.

The knowledge gap created as a result of lack of trainings in oil palm has inhibited the non-adopters from realising their potential in the oil palm farming as noted from the findings. Lack of exposure visits to successful areas also contributed to the knowledge gap.

Both categories of farmers (adopters and non-adopters) understand and appreciate the benefits of oil palm as concluded from their views on benefits of oil palm despite the latter not growing oil palms. For the adopters, it was clear that the net benefits were more than before they dwelt into oil palm farming.

The expected diffusion of knowledge expected from the lead farmer to the rest of the farmers is not working as farmers complain of him being the sole beneficiary of resources meant for the community.

On sustainability of the project, farmers are highly dependent on the Department of Agriculture assistance for inputs and irrigation infrastructure development and maintenance. This is in contrast with the interests of the farmer centered interventions, as it results into lack of sense of project ownership by the farmers. In addition, the youths or young farmers are not very involved as compared to the older farmers, a situation which causes worries and uncertainty to the future of the program.

Weak linkages with some government departments like research, marketing and cooperative with the Isubilo oil palm project have impacted negatively on the farmers’ accessing of needed services. Supporting stake holders are as seen in the oil palm value chain appendix 5.

8.3 Recommendations

There is need to put up a training program for farmers in the management of oil palms. Fresh trainings or refresher trainings to the officers and farmers that were previously trained are needed if the farmers are to be abreast with the required practices of planting spacing differences on different slopes and looking after oil palms. This is vital following the fact that most farmers have no prior experience in local Dura oil palm production. Many farmers and extension agents have not been trained in oil palm since 2006/7 and hence the vital need for this training exercise. In this regard, government partners like Programme for Luapula and Rural Development (PLARD) in their staff and farmer training programmes can include such programmes.

The concept of farming as a business should be emphasized if farmers are to realise the dire need for putting extra efforts in the management of the Tenera oil palms. This would encourage more women headed households and some peasant male farmers not only to concentrate on producing oil for home consumption, but for sale also thus doubling their efforts in fending for their oil palms. The Agribusiness Component of the Programme for Luapula Agriculture and Rural Development (PLARD) can extend its farming as a business messages to this oil palm community.

There is need to conduct exposure visits for farmers for them to learn from their fellow farmers' achievements. Malawi would be an appropriate place where yields have been impressive as the following quote from Chapman, Escobar and Griffee (2003) reviews. "Yields from the Malawi FAO CT palms were 12ltr of oil per palm at 4.5 years rising to 20-30 ltr/palm at six years. Highest yields of FFB at 4.5 years from planting were 60 kg/palm, and at six years, 150 kg/palm (EcoPort 2001)".

The extension of the Farmer Input Support Programme (FISP) subsidised input initiative to oil palm farmers would help farmers to easily access needed inputs for their oil palms. Although this dependency syndrome may be viewed as unsustainable, it would be a spring board in the early stages of oil palm farming.

Micro financing institutions should be made accessible to the farmers by strengthening the cooperative collaboration for enhanced bargaining power by the farmers. In this respect, the marketing and cooperative departments of the Ministry of Agriculture and Livestock should closely work with Isubilo oil palm co-operators to provide agribusiness focus to the farmers. In this regard, it would be easier for farmers to acquire processing and tillage equipment among other labour saving technologies. Farmers can take advantage of slashed down importation duties on agricultural machinery through assistance from the cooperative department and associated departments. A tractor would easy farmers' tillage and weeding constraints.

The DoA and associated partners should provide an enabling environment where farmers are sensitized, provided with subsidized starter up inputs, provide affordable and accessible tillage, irrigation and processing equipment. Cheaper and labour saving technologies like treadle pumps can be made by the Farm Power and Mechanization workshop of the DoA in Mansa, Luapula. Therefore, this department would need complementary budgeting in this line in the initial stages for purchase of required materials. Programmes like the Participatory Villages Development in Isolated Areas (PAViDIA) and the Citizens Economic Empowerment

Commission (CEEC) offering grants should be involved to render their empowerment services to Isubilo farmers.

During the Provincial and Districts Development Coordinating Committees (PDCC and DDCC) monthly meetings, there is need for the agricultural heads to stress the need to other government departments whose mandates are in line with rural development to be aware and take interest in the oil palm project.

On sustainability of the project, it would be necessary to ensure that farmers understand that the project is theirs and they are central to its development. By combining efforts, they can dig irrigation canals on their own. Waiting of the government to do maintenance works and construction of every canal would not help. As such, the cooperative should have a plan of how to manage irrigation works for instance on their own. They should learn to promote local savings from which they should pay labourers if they do not want to do the canal digging works for example by themselves. In short, the cooperative should be self- sustaining, not relying on external support for its performance.

The Department of Agriculture needs to simplify the oil palm manual to the level easily understood by farmers for example stating number of table spoons equivalent to grams of fertilizer

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APPENDICES

1. Interview questions

A. Interview questions based on the Knowledge dimension to seek answers to management practices - Individual Semi-structured Interviews Checklist

Household Characteristics

Who is the head of the household?
What other crops is the household involved in?
What is the oil palm plot size?
How long has the household been involved in oil palm production?
Why and how did the household decide to venture into Tenera oil palm production?

How are the management practices?

Soils

- How is the organic matter content of your field and how do you ensure that the soils have organic matter content?
- How is the nature of the soils in terms of high acid (salty) or low acid levels? How do you ensure that the soils are not acidic (limy)?
- Are the soils sandy, waterlogging, moist, deep, loamy or alluvial?

Land preparation

- What distance for internal paths and for the irrigation canals is created for the oil palms?
- Do you remove the dead grass or burn?
- How is making of the planting holes done and what is the spacing between plants?
- How do you till the land and to what depth?
- When is this tillage work done?
- How often do you harrow the tilled land to reduce compaction?
- If the land is sloppy, how is the spacing done as compared to flat land?
- How is the location of your filed in relation to water source?
- How is the drainage of the field?
- How do you prevent your field from fire?

Planting

- Which season did you transplant your palms?
- How do you ensure high moisture content before transplanting?
- Upon receiving the palms, how long did it take before being transplanted?
- Why is it appropriate to plant at this time of the year?
- How do you ensure proper moisture conservation in the soils?
- Do you have an idea about mulching?
- If so, how do you make use of it if at all you do?

- How do you transplant your oil palms?
- What spacing do you use?

Manures and Fertilizers

- How often do you apply fertilizer?
- What do you use to apply fertiliser: spoon or what?
- What quantities of NPK fertilizer do you apply?
- How much fertilizer do you apply per palm per year?
- Within what radius around the palm oil do you apply the fertilizer?
- How often and how much of Borax do you apply per tree if you do?

Pests, Diseases and Weed Control

- What are the common pests and diseases and how do you control them?
- How often do you weed the palm fields?
- What is the distance kept clear of weeds around the palm?
- What methods do you use to weed your palms?
- For weeds like vines, creepers invading the palm trunks and leaves, how do you get rid of them?
- What types of sprayers do you use and their nozzle sizes and application rates?

Pruning

- How often do you prune your oil palms?
- What type of leaves do you target during pruning?
- How can severe pruning harm the plant?

Irrigation

- What do you use to irrigate your palms?
- How often do you irrigate your oil palms in a week?
- How much of the water is required by the oil palm per day when moderately warm and in hot weather?
- How is the frequency of irrigation in light and heavy soils?

Intercropping

- Do you practice intercropping?
- If so, what kind of crops do you intercrop with oil palm?
- What radius around the palm is left clear of intercrops?
- How long do you intercrop?
- What makes you to stop intercropping?
- To what extent do you use leguminous cover crops in your field?

Harvesting

- When do you start harvesting?
- How do you harvest?
- What products do you get from oil palm?
- What is your yield at this time for palm oil?
- What is the weight of the fruit bunches at first harvest?

B. Group Interviews

i. Adopters

- From your SWOT, what threats are affecting your oil palm production?
- What value (claims and benefits) are you getting from oil now and how did you cope before in any case?
- What claims are associated with processing of oil palm?

ii. Non-Adopters

- What farming activities are you involved in?
- What could be the benefits of oil palm farming?
- What is hindering (claims) you from farming oil palms?

2. Estimates of cost of producing oil palm per hectare in Luapula Valley

Description	Amount	Unit cost	Total cost/ hectare
Seed	150	K5,000	750,000
Labour for raising seed	60 man days	K15,000	900,000
Cost of irrigation	60 hours	K4,500	270,000
Land preparation or cultivation	30 man days	15,000	450,000
Transplanting	25 man days	K15,000	375,000
Weeding costs	25man days	15,000	375,000
Chemicals		772,000	772,000
-Ant-kill			
-Nutrafos			
-Bravo			
-Termidan			
-Dithane			
-Mancozeb			
-Boxer			
-Malathion			
Fertilizers	8 x50 kg bags	250,000	2,000,000
Tools and equipment	various	400,000	400,000
Harvesting	10 man- days	15,000	150,000
Transportation			300,000
Other costs			450,000
Total			**5,272,000**
Expected yield (fruits)			**9 – 13 tones**
Expected yield (Processed oil)			**800 -1000 litres**

***Source**: Farming Systems and Social Sciences Survey report, 2000 – Ngoliya et.al. (2000)*

NB 1: Information indicated in the table was collected in 2000 and is likely to have changed due to inflation. Other costs may include emergency needs that a farmer encounters such as mulching costs, pruning and replacements of seedlings.

NB 2: Oil palm will continue producing fruits for over twenty-five years and the optimum harvest is obtained between 8 and 10 years. The cost of variable cost recedes after the initial capital injection in the first year

3. Prospective Oil Palm Areas in the province

Areas have been identified in Mwense, Kawambwa, Nchelenge and Chienge for expansion of oil palm production in the valley districts. These areas according to the (DoA, 2011) are as follows:

Mwashi Area in Mwense. The land is approximately 300 hectares. The Chief, His Royal highness Kashiba willingly offered the land for oil palm production. The land is served by a stream and has since been surveyed.

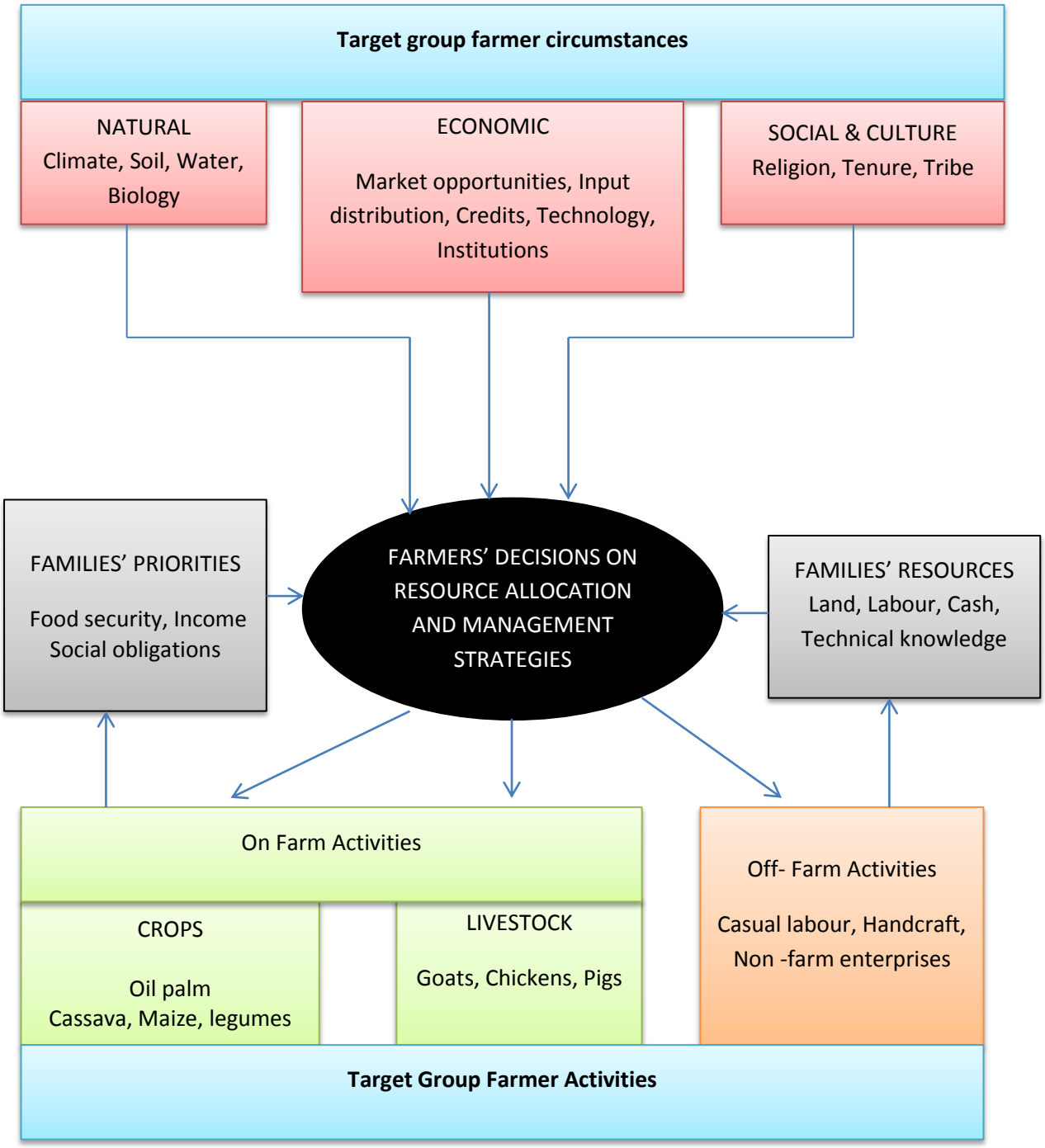
Koni- Kabalenge in Kawambwa. The land is approximately 2,000hectares just below the Ntumbacushi hill. The land is overlain by Mbereshi River with a canal constructed by the government. The land was offered by the Chief, His Royal Highness Senior Chief Kazembe.

Mulwe area in Nchelenge. The land is estimated to be approximately 6,000 hectares and is between the Mantampala River in the east and Lake Mweru in the west. The land was offered by the chief, His Royal Highness Kambwali.

Kapako Area in Chienge. The land is situated at Mununga mid-way to Chienge from Nchelenge and is estimated to be 400 hectares. His Royal Highness senior Chief Mununga consented to offer this land for oil palm development by the government.

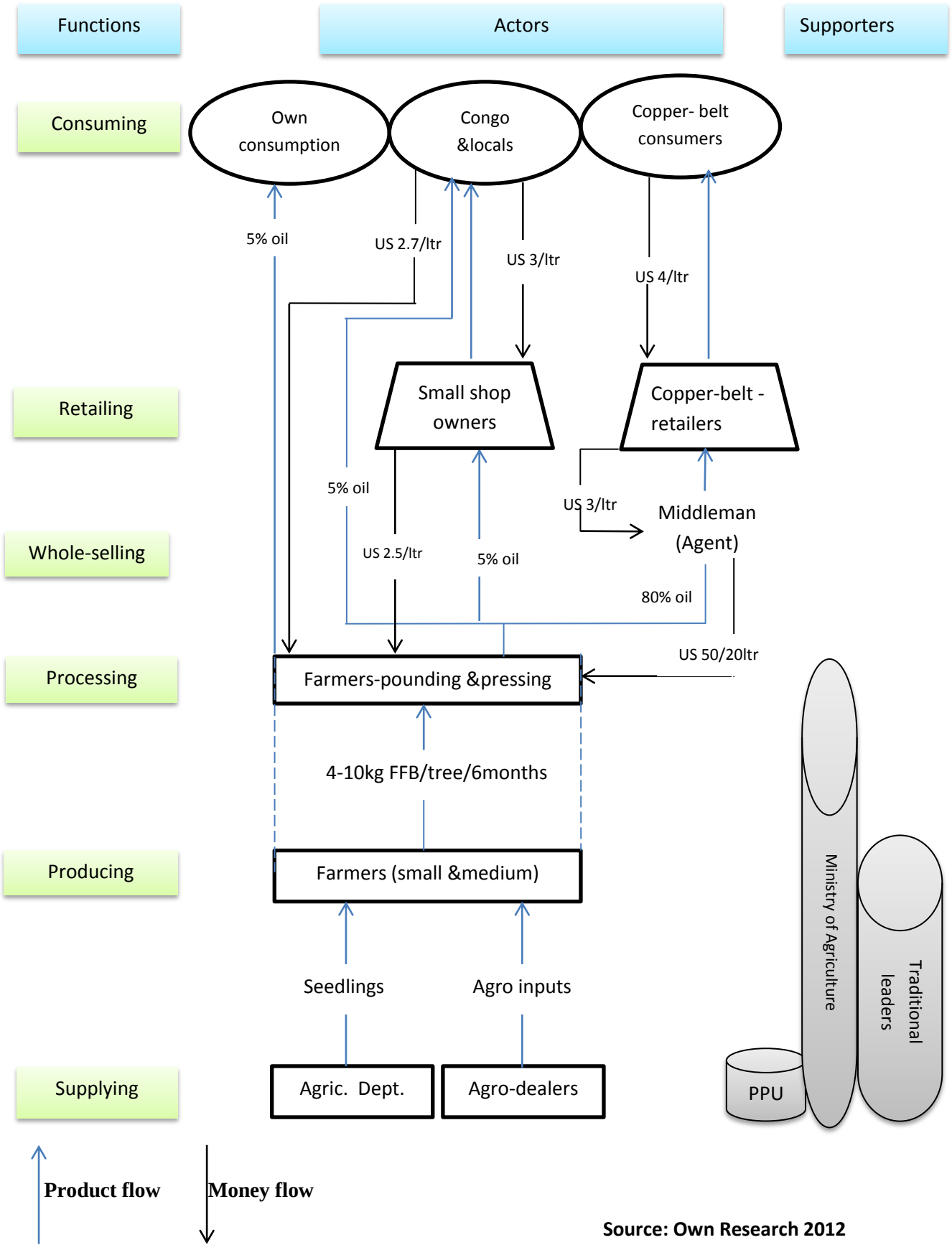
Lambwe-Chomba situated a few kilometres from Chienge towards the North. This land is probably the most fertile of them all. The land is approximately 3,000 hectares. It is bordered by Lake Mweru in the west. This land was not offered by the local chief as no consultation was made. The land is serviced by poor road network and is far from the power line.

4. The Farming system model showing relationships for Isubilo farmers' farming system



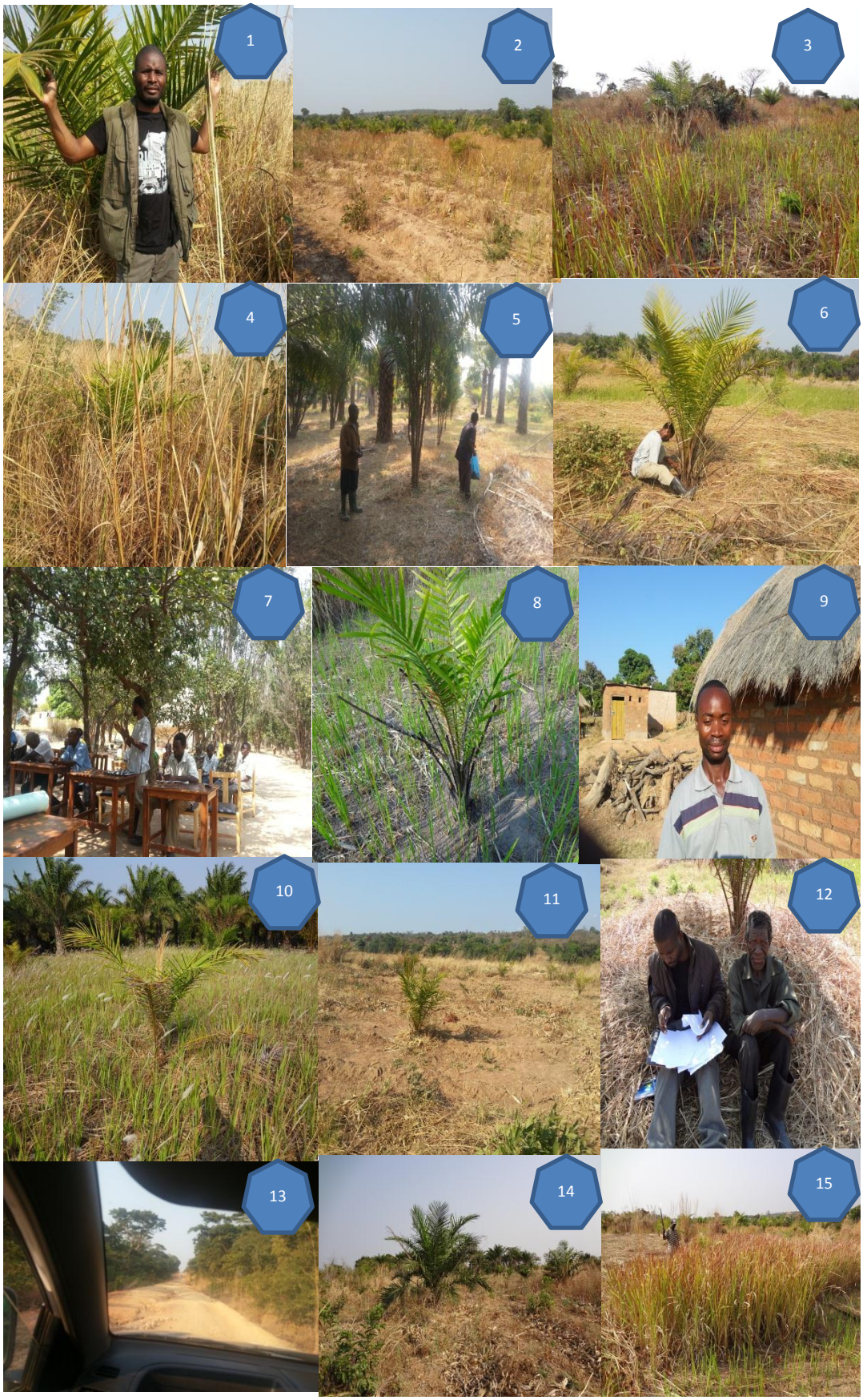
Adapted from Behera and Sharma (2007)

5. Oil Palm Value Chain in Isubilo



Source: Own Research 2012

6. Interview Photos

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Key to the photos in Appendix 7			
s/n	**Description**	**s/n**	**Description**
1	overgrown weeds	16	weeding in dry field
2	maize intercropped in this field on ridges	17	woman farmer at her temporal hut for cassava harvest
3	dry, field with overgrown weeds	18	proud lead farmer in his field
4	overgrown weeds	19	prevention of fire
5	citrus in palms	20	water source
6	pruning palms	21	farmer after interviews
7	focussed discussion	22	group discussion
8	recovering from fire burn	23	group discussion
9	young full adopted farmer	24	woman farmer after weeding
10	growing in weeds	25	individual interview
11	oil palms where maize is also grown	26	individual interview
12	interview on a mulch	27	woman and her grandchildren
13	potholes limiting reaching out to migrated women farmers	28	fruit bunch and palm oil
14	maize leaves showing maize intercropped with oil palm	29	From visiting migrated women farmers
15	overgrown weeds	30	lead farmer seedlings

Glossary

Agro-ecological Zone III: It is a high rainfall region receiving over 1000mm of rainfall annually. It is suitable for crops requiring high amounts of water.

Farming system: A farming system is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. The household, its resources, and the resource flows and interactions at this individual farm level are together referred to as a farm system (Dixon, Gulliver, and Gibbon, 2001).

The farming system model as attached in appendix 6 was used as a system thinking tool to understand the farmers' as decision making units better. For decisions made are influenced by the environment they live in. Knowledge, ability, willingness or aspiration and being allowed are among the endogenous factors within the household's influence (Dixon, Gulliver and Gibbon, 2001).

Household: For the sake of this research, the household is defined as collection of individuals living together, headed by a man or woman, not necessarily sharing the same roofing of a housing unit as housing units may be clustered. These individuals carry out productive, reproductive and sometimes are involved in communal roles for their collective benefit. They also pool some, or all, of their income and wealth and consume certain types of goods and services collectively.