INTER AIDE - AGRO PHALOMBE PROJECT

# ANALYSIS DIAGNOSIS OF AN AGRICULTURAL REGION OF SOUTHERN MALAWI

## Phalombe District, Traditional Authority Jenara, Group Village Headman Tamani

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# Table of illustrations

# 1. General framework of the study

## 1.1. Institutional context of the study

Inter Aide is a French NGO created in 1980. A first team was established in Malawi in 1990 and started working on agriculture, health and water supply projects.

Malawi is a small, landlocked country in east Central Africa lying entirely within the tropics. It is 896 kilometres in length and varies in width from 80 to 160 kilometres. It is bordered by Mozambique on the east and southwest, by Tanzania on the north and northeast, and by Zambia on the west and northwest (cf. Appendix 1) Malawi is a democratic, multi-party government. The country is composed of three regions, which are divided into 28 districts. In parallel, 250 Traditional Authorities stay under the control of traditional chiefs. Traditional Authorities are further divided in Group Village, gathering several villages.

This study occurs within the framework of a food security project entitled **Agro Phalombe Project** which was **opened in July 2008** by Inter Aide in the Phalombe District, Southern Region. After implementing the first activities, the necessity of studying the farming systems was raised. The agricultural practices presented specific characteristics that needed to be better understood. The Agro Phalombe Project already had implemented activities in the year 2008/2009 in the Traditional Authority Jenara.

The survey was led **from April to September 2009** and concentrated in villages under the **Group Village Tamani**, which is part of the **Traditional Authority Jenara.** Initially, villages alongside the Phalombe River, from Mwanga Village until Mianga Hill were surveyed. Afterwards, four villages were selected around Mianga Hill till the Phalombe River: **Finyamoa, Tawanga, Tsekakhomo and Tamani 2** (cf. Appendix 3 and 4)

In this report are presented the results of the fieldwork study. It consists of an analysis and a diagnosis of a small agricultural region.

## 1.2. Methodology of the analysis diagnosis

The purpose if this analysis diagnosis is the understanding of the agrarian system of the area.

> *"**An agrarian system** is a way of exploitation of the environment that evolved through time and lasting, a system with growth of production, adapted to bio-climatic conditions of a given area and answering the current conditions and needs".* (Mazoyer, 1985 in Bedu et al., 1987)

**An agrarian system is composed of three main elements**:

- Human elements: socio-economical, demographic and cultural conditions, history;
- Natural environment: soil, climate, vegetation, animals, pests... ;

- Techniques: tools, farmer know-how, practices, cropping and breeding systems.

The farmers exploit the environment by using the relations and interactions that occur between the components. The study is conducted at three different levels: zone level, farm level, plot or herd level.

**The fieldwork was divided into four main stages**:

- The first stage consisted in describing the agrarian landscape in order to identify several homogeneous zones. The aim was to highlight the agro-ecological (geomorphology, pedology...) and socio-economic elements which enable to explain why and how the farmers do what they do. Isolated hills were used to have an overview of the area. Transects were realised, walking from the tops of the hills to the shallows and Phalombe river. This first step was useful to determine which village should be studied later on. I also got to know the main agriculture and livestock practices, which was essential step to be able to interview farmers.

- Then, the historical analysis was carried out. This second stage consisted in interviews with older famers, in order to identify the main stages of the evolution of the past farming systems. This allows to explain the appearance of the current agricultural situations. Open discussions took place, where the farmer was able to take his time to express his ideas and opinions.

- From the month of June, the study focused on technical and economical study of cropping systems and livestock systems. Interviews were led in four selected villages, covering an estimated surface of 24 km². Measuring economical outputs was difficult. The questions had to be adjusted to take into account the farmers' references. For example, the quantities of seeds sown or grains harvested were evaluated in bags, basins, winnowers and baskets. In first place, the weight of each of those traditional containers was measured. The aim was to calculate the gross margin for each cropping system and livestock system identified.

- The last month of the fieldwork was dedicated to economical study of farming systems. A farming system is: *"the combination of the productions and the means of production (land capital, working capital and labour force) in the farm"* (J Chombart de Lauwe, J Poitevin and J-C. Tirel, 1969). One farmer always combines several cropping systems, and breeding systems. The aim was to understand how the different systems relate to access to land, capital and labour. A pre typology of farmers' types based on the information collected during the previous stages was built. Thus, interviewed farmers were representative of the diversity of situations in the area.

Around 170 farmers were interviewed. Among them, 50 have been fully interviewed (technical and economical study of farming system).

## 1.3. General description of Malawi

### *1.3.1. Relief*

The Lake Malawi covers almost the fifth of Malawi's total area (cf. Appendix 2). Beyond the beaches and low plains, the Rift Valley wall rises steeply in a series of escarpments to high rolling plateaus that cover much of the country. Malawi's main highland areas are the Nyika and Viphya plateaus in the north, and Mount Mulanje in the south. Malawi's highest point is Sapitwa (3001m) in Mulanje Massif. There are also several isolated hills and smaller mountains. The largest is the Zomba Plateau (around 1000 m), near Zomba town.

### *1.3.2. Climate*

There are **two main seasons, cold-dry and hot-wet.** The hot-wet season is from mid-October to early December until mid or late April. Temperatures vary with topography, averaging 14 to 32 degrees. The cold-dry season is from May to mid October or early December. It is cool from May to August, with July being the coolest month. At the end of the dry season from September until the rains start it can become hot, especially in low areas. Daily temperatures in the lower areas do not fluctuate much, with average daytime maximums around 21°C in July and 26°C in January. In the highland areas, average daytime temperatures in July are usually between 10°C and 15°C, while in September they get up to 20°C and above.

Most Malawians, particularly the smallholder farmers, are **vulnerable to environmental hazards** such as droughts (one in every 3 to 5 years), floods (every year), and storms (every year). The whole country has been hit by a very important famine in 2002 where 30% of the population needed food help and assistance.

### *1.3.3. Population*

The population in Malawi is 13,066,320 millions[1]. Between 1998 and 2008, the total population increased by 32 percent, representing an intercensal annual growth rate of 2.8 percent per annum. 45 percent of the people live in the Southern Region while 42 percent and 13 percent are in the Central Region and Northern Region, respectively (cf. Appendix 2). The density of population is 139 per kilometre square (106 in 1998, 85 in 1987). The Southern Region has the highest density of population. Ten major ethnic groups are historically associated with modern Malawi : the Chewa, Nyanja, Lomwe, Yao, Tumbuka, Sena, Tonga, Ngoni, Ngonde, and the Lambya/Nyiha. All the African languages spoken are Bantu languages.

### *1.3.4. One of the poorest countries in the world, by any indicator*

[1] 2008 Population and housing Preliminary Report

Malawi ranks 164 among 177 countries for Human Development Indices, according to UNDP[2]. The per capita annual income is US$ 149 (in PPP US$ 646). Between 1990 and 2004, 41.7% of the population was living with less than US$1 per day and 76.4% were under 2 US$. Adult literacy rates are 54% for women and 74.9% for men. Birth rate is 6.1 children per woman. Life expectancy was around 40 in 2004, due to high infant mortality (68/1000). HIV/AIDS is of immense concern in Malawi. It is creating a massive drain of resources. Malawi has one of the highest national HIV prevalence rates in the world: figures vary from 11% to 15% according to sources.

#### *1.3.5. An economy dominated by agriculture: cash crop estates and subsistence smallholders*

Malawi economy is dominated by agriculture which represents almost 38% of the gross domestic product (GDP). 83.5% of the population lives in rural areas. 85% of the population is engaged in this sector either as subsistence farmers or as employees on commercial farms or plantations. Malawi's agriculture is bipolar: cash crop estates and subsistence smallholders coexist.

**Estates** growing tobacco (60% of estate land area), tea (20%) and sugarcane (18%), account for 90% of foreign exchange earnings. The country's export trade is dominated by tobacco, tea, cotton, coffee, and sugar. Commercial estates occupy about 20% of arable land. Major export partners are South Africa, US, Germany, Netherlands, and Japan. Those main cash crops are mainly grown in plantations, but tobacco is also grown by smallholders.

**Smallholder agriculture** accounts for 80% of Malawi's food production but only 65% of agricultural GDP. **Main agricultural products are: maize, tobacco, sugarcane, cassava, sorghum, millet, rice, pulses, tea, cotton, sweet potatoes, cattle, goats and chickens.** Most rural farmers in Malawi own very small land, and the average size has halved since 1970. Land pressure is an ongoing problem. Many farmers have to cultivate on steep hillsides and other marginal lands, often with inadequate soil and water conservation, creating problems such as soil erosion and declining soil fertility. Many smallholders are looking for other sources of income. Local markets have been growing and small businesses exploded in both rural and urban areas.

[2] Malawi Human Development Index Trend, UNDP 2006

| **Malawi in figures**[3] | |
|---|---|
| Area | 118,484 sq km |
| Population | 13,066,320 |
| Density of population | 139 |
| Annual growth rate | 2,8 |
| GNI (current US$) | 52850[4] |
| GNI per capita (current US$) | 7995 |
| GNI (PPP) | 65752 |
| GNI per capita (PPP) | 9947 |
| GDP value added per sector | services 69%, agriculture 2%, industry 28% |
| Land use | Agriculture land 38.2%; forests and woodlands 39.4%; irrigated land: 1.7% of arable land |
| Mortality rate under 5 | 68 / 1000 |

[3] World Development Indicators Database, World Bank, April 2009

# 2. Environment

## 2.1. General description of landscape in the surveyed area

### *2.1.1. Physical relief and geology*

The physical relief is **relatively flat** with isolated granite massifs (cf. Appendix 4 and Appendix 6, picture 1). In the surveyed area three main hills are observed (Mianga, Sanje and Chizugulu hills). In the southern background stands Mount Mulanje (2890 m). Lake Chilwa is located north of the surveyed area. Slope is slightly descending from the south of the Phalombe Plain towards Lake Chilwa. The southern lakeshore is a large swamp.

**Lake Chilwa** was once more extensive, reaching the western foot of Mulanje Massif. Most of the hills in the Phalombe Plain have been islands in the original Lake Chilwa. Superficial deposits observed are **lacustrine deposits**. Those sediments are black-dark grey and yellow-grey clays, muds and silts. In the Phalombe Plain, the surface of the rock floor below the lacustrine deposits is irregular. The greatest thickness of lacustrine deposits are to be found at the mouth of the Phalombe River[5]. The original high level alluvial platform was tilted. Raised beaches around the hills and narrow sandy spits in several localities are observed. Afterwards, recent sandy colluviums formed a thin superficial layer.

### *2.1.2. Climate*

Rainfall is low and irregular in Traditional Authority Jenara compared to other areas of the Phalombe District. As farmers say, clouds come from the Mulanje Mountain, travel through Phalombe plain and go to Zomba without rainfall. Extension of the rain season varies from one year to the other. First rain can fall from mid October to early December. Sometimes a very first rain occurs but the real start of the rain season happens only a few days or weeks later. In addition, rainfall is erratic: dry spell can happen during rain season. Rainfall varies considerably according to the year, between 460 and 700 mm. In 2008/2009 season, total rainfall was 685 mm[6].

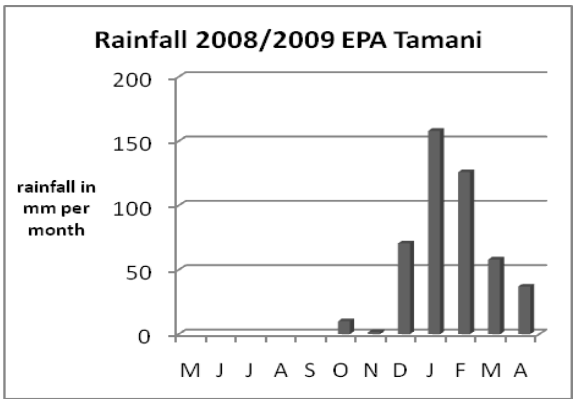



*Figure 1 Rainfall in mm/month, data EPA Tamani*

[5] The geology of the Mlanje Area, Geological Survey Department, Malawi Ministry of Natural Resources, 1969
[6] Data from Tamani EPA (Extension Planning Area)

### *2.1.3. Demography*

The population in **Phalombe District** is an estimated 313,227[7]. The intercensal annual growth rate is 3,1%. The density of population is 227 people per kilometre square (166 in 1998 and 156 in 1987). Phalombe District formerly belonged to Mlanje District. The evolution of the population in Mlanje District is illustrated on the graph below.

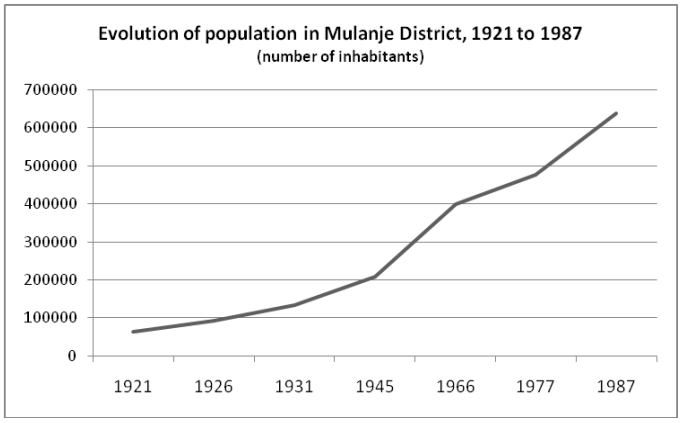



*Figure 2 Evolution of population 1921-1987 Mlanje District, data NSO Zomba*

The surveyed villages belong to the Group Village Tamani, which is part of Traditional Authority Jenara. TA Mnkhumba was split into two Traditional Authorities in 2008: TA Mnkhumba and TA Jenara. The population in the former Traditional Authority Mnkhumba is estimated at 207,797 in 2008. The evolution of the population since 1966 is represented on the graph below.

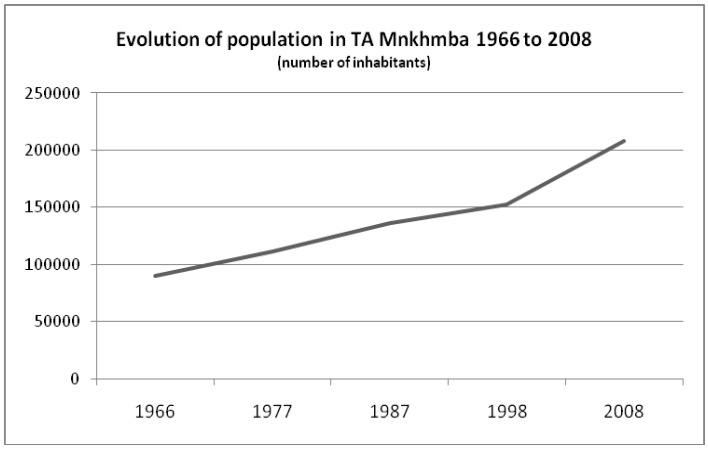



*Figure 3 Evolution of population 1966-2008 Ta Mnkhumba, data NSO Zomba*

[7] 2008 Population and housing Preliminary Report

## 2.2. Identified agricultural landscapes

Six agricultural landscapes have been indentified during the first stage of the research. Drawings of each zone are visible in Appendix 5.

### *2.2.1. Zone 1: hills*

On top of the hills, eroded granite rocks are observed. Spontaneous trees grow between the rocks. Soil is in little quantity. Trees are used to be cut. No crops are observed. Goats and cows are pasturing under the supervision of children (cf. Appendix 6, picture 4)

### *2.2.2. Zone 2: slopes and bottom of the hills*

On the bottom of the hills, a sand-clay soil is mixed with lateritic gravel. Deeper digging, the gravels are more concentrated. It is orange to brown coloured. This soil is called *kathondwe* in Chichewa. This zone is not very extended: it covers a 200 m radius surface after the rupture of slope.

This area has been intensively eroded by various flash floods, the last one being in 1992. The top of the soil has been washed away. Farmers use to say that this soil was more red coloured before. Several erosion prevention techniques are observed. Ridges are usually made perpendicular to the slope. Large waterways are dug. Vetiver *(Chrysopogon zizanioides)* is planted on ridges perpendicular to the slope.

Land is forsaken for groundnuts cropping systems. Yields are excellent and harvest is easy because of soil composition. Competition for renting land is going on, and rent is on high prices. Maize and tobacco intercropping systems are also found.

### *2.2.3. Zone 3: sandy-clay soil areas*

Going down the slopes of the hills, sand dominates in composition. Two types of soil are found, but the exploitation of the environment is unique.

- *mchenga* (grey to brown sandy-clay soil in which sand dominates in composition),
- *dark soil* (dark sandy-clay soil in which clay dominates)

This area is the most populated and intensively cultivated: the slope is almost nonexistent, the soil composition does not favour water logging in rainy season. All cropping systems are observed. Maize, tobacco, groundnut and sweet potatoes predominate.

Many trees are planted around the numerous dwellings, especially eucalyptus, fruit trees, and trees grown for construction and firewood.

### *2.2.4. Zone 4: Dambo*

*Dambo* is a generic Chichewa term standing for different realities.

*Dambos'* soil is called *makande* (cf. Appendix 6, picture 5). It is a brown, sandy clay soil, in which clay dominates. In the dry season, this soil is very hard and cracked. In the rain season, it is hydrophilic and waterlogged. *Dambo* areas work as water collectors during rainy

season. Many streams cross *dambo* areas and join the Phalombe River, gathering water descending from the hills and driving it to the river.

Physical relief varies, with upper and lower places which correspond to different agricultural landscapes.

- **Upper places** where the soil is sandier are cultivated with sunflower and sweet potato, and maize intercropping systems. During rainy season, those fields are the less waterlogged areas of *dambos.* Ridges are higher in *dambos* than in areas where sand dominates in the soil composition. Contour ridges are not built to prevent from water stagnation.

- The lowest part are **waterlogged** during several months in the rainy season. Farmers grow rice, digging dikes to keep water for a longer time (cf. Appendix 6, picture 7). In those parts of dambos streams and water holes are observed. They dry up from July to October. Indeed, very few places are suitable to be used as *dimba*, for irrigated crops during the dry season.

- *Dambos* also include **woods and bush** (picture 6). Woods are private or communal. Spontaneous trees grown in a few years if land remains uncultivated, like small spiny trees: acacias auriculiformis (*minga*) and polyacantha (*mthethe*). Grass growing under trees is short. Goats and cows pasture in grassland areas, under the supervision of children or sometimes cattleman. Many owners of uncultivated *dambo* land do not allow animals to pasture because it hardens the soil, making the next clearing of the land more difficult.

#### *2.2.5. Zone 5: Loam soil areas*

Going closer to the river and streams, or on the *dambo* boundaries, soil is sand to loam and light in colour, from grey to orange-brown. Its consistence is powder-like. Maize and tobacco cropping systems, sunflower, cassava and sweet potato are observed. Cassava is more observed than in other zones. The soil along the river is very fertile (by the surveyed area standards), so land is more expensive than in any other zone for renting or selling. Fewer quantities of chemical fertilizer are necessary to obtain the same maize yields than on any other type of soil.

#### *2.2.6. Zone 6: riverbanks*

The land alongside or sloping down to Phalombe River is cultivated or not according to places (pictures 8 and 9). Metamorphic rocks show on the surface. In some upper places, cultivation is possible during the rainy season: maize cropping systems are observed. In dry season, irrigated crops are led from March to October In dry season, irrigated cultivation is conducted. Virtually, three cycles of irrigated crops could be led. But farmers tend to cultivate only once or twice, from May to October, because of lack of labour force. Bananas trees, bamboo and other trees, vetiver (*chrysopogon zizanioides)* and elephant grass (*pennistum purpureum)* prevent soil erosion.

The appearance of the riverbanks all changed under several major flash floods (*napolo*) in 1953, in the 70's and in 1991. The Phalombe River overflowed its banks. All the crops, trees, houses close to the river were carried with flowing water. The bank is now larger, and the

sides slope is gentler than before. One positive aspect of this situation is that the top soil left by the water is fertile. Various programmes of Government and NGOs have been concentrating on prevention of soil erosion, through trees planting.

One village usually includes several agro-ecological zones. Sandy clay areas (zone 3) are combined with *dambo* areas (zone 4). An area of *kathondwe* soil (zone 2) may be included. The Riverbank is shared out between villages located alongside the River. This spatial organisation is intended to facilitate the access to grazing land, water and firewood. The aim is to avoid conflicts linked to the access to those resources with surrounding villages. This organisation also helps the farmers to carry out all types of cropping systems in their own village, avoiding land access issues in other villages.

### 2.3. Organisation of parcels, habitations and other constructions

Small tracks connect constructions the one to the others. Footpaths run around the fields.

**Houses** are made of mud bricks or burnt bricks. The roof is larger than the base of the house, creating a *veranda* that farmers use to dry their tobacco leaves if they did not built a dedicated wood shelter (cf. Appendix 6, picture 10). Roof is made with grasses cut in *dambo* areas and has to be renovated after 2 years, in August to September. Under the grasses is placed a plastic sheet to avoid water dropping in the rainy season. Few houses have iron sheeted roofs. Sometimes a kitchen is built apart; in other cases cooking is made at open air. Basins and dishes dry at the air on a table made of wood poles. Male teenagers reaching adult age build their own house close to their parents' but keep on eating with the family.

Shelters for goats are built off the ground with wood poles, which enables to collect the manure. Goats pasture along the tracks and houses under the supervision of children. Chicken run around the house and are kept inside at night. Granaries, rabbit hutches and dovecotes might be built. Cattle is kept in a collar made of wood poles at night or when not pasturing.

Outdoor **granaries** (basket silo) are used to store maize. are kept inside the house for fear of thieves. Tools observed around houses are mortars, different sized hoes, machete (*panga knife*), watering canes, sickles, and bicycles.

Each construction comes with a least a few **trees** planted around. They provide shade, protection against the wind, wood for construction and fire, and fruits. Trees are also found in the fields, but in minor quantity. The most widespread fruit species are: papaya trees, banana trees and mangos. Other multipurpose trees include: eucalyptus, *mtangamtanga* (albizia, Woman's Tongue), *chitimbe* (piliostigma thonningii, Monkey Bread), *kankhande* (Buffalothorn), *keshya* (senna spectabilis and senna siamea), *Ndya* (Chinaberry, melia azedarach), ziziphus mucronata), *malaina* (Beechwood, gmelina arborea), and *sendrella* (red cedar, toona ciliate).

Some families own old trees of species that make good timber (for construction). Those trees have been planted several decades ago and have never been cut. This ensures a safety margin, in case a problem arises. Indeed, those trees are not traded. Their economical value is inestimable and has not been taken into account in the economic calculation in this report.

As the predominant tribe in the surveyed area is the **Lomwe** one, the **society is matriarchal**. The land is divided among married daughters. As a consequence, the land usually belongs to women. When getting married, the man goes to live in the woman's village. The couple builds its house on a land inherited from the woman's parents. The case of the chief's family is different: land belongs to the chief and is shared to men: when getting married, the woman moves to their village. Of course this traditional organization meets many exceptions and is in constant change!

The fields of the exploitation are not all gathered around the house. One plot is always cultivated around the habitation: most of the time maize and associated plants. Other fields are located further away, very often in other zones of the landscape. For instance, a family is settled in the zone 3 and cultivates a field around the house; another plot is located a few hundred meters away in zone 3; a third plot is located in zone 2 near the hill, (this plot is part of another village); the household cultivates a few boxes of rice in the *dambo* area of its village (zone 4). All this land belongs to the woman. In addition, her husband owns a field in his "home village", a few kilometres away.

# 3. History of agricultural transformations

### 3.1. On the background: Nyasaland estates and Lomwe migrations

Europeans came to Malawi in the second half of XIX$^{th}$ century. In 1870 the British missionary **David Livingstone** was in charge of establishing a civilisation missionary. The religious and commercial circles wanted to put an end to slave trade. This practice did not only appalled Humanist consciousness but it prevented realising needs and outlets for "legitimate" trade too[8].

In 1907, Great Britain established the **Nyasaland Protectorate**. The rivalry between the English and the Portuguese in central Africa determined the London decision. Nyasaland was a rural country almost deprived of manufactures. Thus, Nyasaland economy was dominated by conflicts linked to agriculture. Land and labour opposed European agriculture with its plantations, to local farmers' agriculture. Colonialists and big commercial companies invested in agriculture sector during the Protectorate.

The colonialists inaugurated a practice which would generate serious consequences on land issues. A colonialist could buy a big area of land from a traditional authority, against inexpensive goods. This brought up an ambiguity: colonialists thought they were achieving a land transfer, whereas the chiefs saw a traditional right of usufruct of the land.

Colonialist appropriated themselves a practice called ***thangata*.** Traditionally, it consisted in a voluntary and reciprocal cooperation. Work could be exchanged between neighbours in peak labour periods. It could be also a collective work for the chief in exchange of his protection, considered as a tribute, not as a free service. Colonialists required a **hut tax** from the local farmers settled on their land, which was paid with work in their plantations (from several weeks up to a few months per year). They called this disguised forced work, often violently imposed, *thangata*.

The colonial State was a real ally of colonialists, but since 1903 it disapproved these excessive practices. The hut tax system allowed that the total could be paid by working during one full month on a European plantation. In 1902, the tax was divided by two for payers who could work one month on the plantations. The goal was to encourage labour force on the plantations, but it was not very successful as the native labour force preferred better paid jobs. Some emigrated to South Africa or to South Rhodesia and that money allowed to pay the tax without working on the plantations.

The **arrival of Lomwe people** solved a great part of colonialists' labour force problems. From the end of the XIX$^{th}$ century, Lomwe people coming from Mozambique established a settlement in the South of Nyasaland protectorate. They were running away from bad treatments, and then from drought and famine raging in the neighbour country. The new comers contributed to accentuate land pressure. In the surveyed area, oldest Lomwe farmers

[8] Philippe L'Hoiry, Le Malawi, karthala, 1988

report that their family came from the Mozambique to Malawi toward Mulanje Mountain in years 1890 to 1910.

As they did not possess any land and could not pay the tax imposed they were massively employed on the plantations owned by Europeans around Mulanje Massif. There was no land available for Lomwe farmers as European land owners were using local farmers' land for tea estates, leaving no other possibility than working in estates. **Lomwe emigrated toward Phalombe plain from 1912**, after they were forbidden to settle on the public land belonging to the Crown by the colonial States. Migrations were not forced but many left to avoid conflicts.

### 3.2. Agrarian system before 1912

The predominant tribe before 1912 was **Nyanja**, literally meaning "people from the lake", a sub-tribe of Chewa tribe settled around the Lakes Chilwa and Malawi.

As there was no land pressure, the most fertile soils and areas facilitating water supply were elected for settlement. Thus, **the population concentrated in areas surrounding the Phalombe River and the rest of the agrarian landscape was unoccupied.** People were staying away from dangerous areas that were *dambos* and hills. The **hills** were covered with indigenous tree species. Animals such as hyenas and leopards lived there. ***Dambos*** were public areas of grassland and woodland. No one lived there or had any activity, except hunting. Tree species in *dambos* were acacias such as senna spectabilis, senna siamea, acacia galpinii (Monkey thorn, *mkukhu*) and *chitimbe* (Monkey Bread, piliostigma thonningii), *mpakhasa*... Dambo areas were home to animals such as lions, zebras, leopards, waterbucks, reedbucks, antelopes....

The Nyasaland Protectorate was prohibiting the cultivation on the **riverbanks** at a 15 to 20 m distance to the water. The interdiction was intended to avoid soil erosion. Many trees were growing on the riverbanks: baobab trees, *mkundi* (Parkia filicoidea), *Buemba* (Tamarind, Tamaricus indicus), *Mbawa* (Mahogany, khaya nyasica), and many other fruit trees. Monkeys and birds were numerous.

Cultivation was concentrated around the houses, in the areas close to the River. Crops were sown in **mounds. Millet** (*Eleusine coracana*) and **sorghum** (*Sorghum bicolour)* were the main staple crops.

There was **no land market**. Land had to be given by the Village Headmen to new comers and villagers requesting some. There was no local market for agricultural products either: it was subsistence agriculture. Food was shared between neighbours to needy people. A **mutual help system** existed between people for agricultural activities.

### 3.3. From 1912 to 1940

**Lomwe emigrations** modified the tribe composition of the surveyed area, and the human occupation of the landscape. Arriving in the Phalombe plain, the new comers addressed to the traditional chiefs to be attributed land. They were given land far away from the previously settled villages, creating their own one in sandy-clay soil areas. There was no land pressure so it was not necessary to cultivate *dambo* areas, which soil is sticky and waterlogged in rain season.

Land in the Phalombe plain was not attractive to British land owners for tea or tobacco cultivation in estates such as the one surrounding the Mulanje Massif. To put it in other words, the colons' control was reduced in the surveyed area. There was no *thangata* system going on there. On the contrary, outside the surveyed area, in the surrounding parts of Mulanje District and Zomba District, married men living in the colonialists' land were forced to work 6 month a year for them. In the surveyed area, one **colonialist** was settled and cultivated tobacco. But only wage labour was employed, among the smallest local farmers, who were cultivating their own land in parallel.

Tobacco was introduced in the Phalombe plain through British farmers in the years 1920. It was *Dark Fire* tobacco. Some local farmers were involved in tobacco cultivation on their own land. Colonialists settled in the area provided them with seeds, fertilizers and technical knowledge. They also bought the production, but only if it was of good quality. It seems that other wealthier local farmers were growing tobacco independently, and were going to Phalombe by bicycle to sell their production. Ridges and land preparation techniques such as ploughing, breaking the clogs, etc., were introduced by British farmers, local farmers were taught those methods for tobacco cultivation.

Local smallholder farmers were sowing their crops in mounds of 30 cm height and 50 cm width. Every year the crops residues and weeds were burnt, and then new mounds were made. The main cereals were sorghum (red and white) and millet, followed by maize. Maize was associated with pigeon peas and cow pea, sown together in the mound. Cassava and sweet potato were common. According to field interviews, leguminous plants were cultivated on pure stand in rotation with maize, sorghum or millet in order to renew the fertility of the soil: groundnut, *mphodza* (grams, vigna radiate), *nzama* (bambara groundnut, vigna subterreranea), and *nseula* (of the family of cow peas). There was a mutual free assistance system between farmers for agricultural operations.

**At the end of the period**, boundaries of the *dambo* areas and the bottom of the hills started to be cultivated as space was needed for numerous new comers. Wild animals disappeared with the colonization of those areas. The first crop initiated in *dambos* was rice. The soil was dug and the rice sown when the place was waterlogged, without transplantation. Later on, other crops were introduced in *dambos*: sorghum, maize, pigeon pea and cow pea. As soon as the bottom of the hills was cultivated, it appeared to be a good soil for groundnut cultivation.

### 3.4. 1940 to 1964

Lomwe people kept arriving massively in the surveyed area, joining their relatives previously settled here, in a place where colonialist control was lower.

**Colonialist power was decreasing in the area** and the last white farmer left in 1959. Educated Malawians were nominated by the chiefs to interact with the government to rise up the problems of native people. **Nevertheless, some measures still remained imposed.** For example, those who did not prepare their land before the rain, or did not have proper latrines were denounced and sanctioned. Those who were not able to pay the Hut Tax had to go to work to British farms or offices in Phalombe. Cultivation along the riverbanks was still prohibited. The construction of the track crossing the surveyed area, going from Phalombe to Lake Chilwa was a major event. This track made the commercial exchanges easier, especially the fish business with the lakeshore and tobacco selling in Phalombe. Many houses moved from other areas to settle along the track. This could be explained by the colonialist will of controlling arrivals and departures, but according to field interviews, this transfer was not forced. The situation of forests was dramatic: trees were cut to build houses, and hills were almost bold. Authorities forbad cutting trees and from then on houses were of mud bricks.

As a consequence of increasing land pressure, clay soil *Dambo* areas were seen as suitable land for cultivation as much as sandy-loam and sandy-clay areas from the years 1940. *Dambos* were also used for grazing animals. Farmers started buying cattle from the end of 40's, thanks to the cash coming from labour migrations in foreign countries (Rhodesia, Zimbabwe, South Africa...). The number of sheep and goats increased, according to interviews with older farmers.

Local **farmers gradually gave up millet and sorghum and turned to maize and cassava**. One of the possible explanations for this change is that maize has a shorter cycle than millet and sorghum (5 and 7 months against 4 for maize) and higher yields. Cassava was part of the step food. It was the relay-food after maize was finished. It was consumed as *ntandacha*, which is *nsima*[9] of cassava flour, mixed or not with maize flour. It was also consumed into *makaka* (dried chips). It seems that pigeon peas and cow peas generalized in this period. Grams, *mseula,* sweet potato were still used to renew the fertility of the soil. Cassava crops were rotating with maize, still planted in hips. Cassava was associated with grams, *mseula* or *kalongonda.*

1949 was the year of a historical drought which caused a severe famine. No rain fell, and crops dried after being sown so cassava was the only food available. Protectorate authorities distributed food (maize flour). Many farmers migrated for the year to other regions in order to find work. As a long term response, the Protectorate authorities supported the growth of food

[9] ***Nsima*:** mush - a cornmeal product and the staple food nowadays in Malawi. The maize flour is first boiled with water into porridge and then paddled to create a thick paste with the addition of more flour with the aim of achieving the correct texture. It is almost always eaten with two side dishes: a protein source (egg, dried fish, groundnut) and a vegetable (rape, pumpkin leaves, mustard, amaranth, okra, tomato...).
*Ufa* (ground meal) mill grains after removing bran, good quality, fine and smooth texture, white but low in nutrition.
*Ufa* (white flour) mill and then dry grains soaked in water for three days (*mphale*) after hulling, smooth and white but low in nutrition.
*Mgaiwa:* mill whole grains of maize without sifting, nutritious, slightly yellowish.

crops' production, as maize and cassava, in order to prevent future food shortages. From the 50's, agricultural advisers of the Protectorate recommended the use of chemical fertilizers (*wasugar*) and manure. The use of ridges for maize and cassava cultivation was taught massively and started spreading. Mounds were abandoned because the plants density per hectare was higher with ridges, giving better yields. The renewal of soil fertility started being ensured by associations, which replaced rotations.

At the end of the period, the same plots were cultivated with maize or cassava year after year. The problem of the reproduction of soil fertility appeared together with first erosion signs.

By the middle of the XX$^{th}$ century, before Independence, the agricultural society was divided as follows:

1) A small white settler population owned capitalist exploitations and employed wage labour.

In the surveyed area, tobacco (Burley and Dark Fire varieties), cotton, maize, and sorghum were the main productions, cultivated on ridges using mineral fertilizers. Around Mulanje Mountain tea predominated. The existence of tractors and ploughs is reported, but most of the operations in the fields remained manual.

2) Local farmers:

The smaller local farmers cultivated on ridges. Maize was associated with pigeon pea, cow pea and cassava. Sorghum and sweet potato were grown on pure stand.

Some smallholder farmers grow tobacco. Production is supervised and bought by colonialist settled in the area. Thus, chemical fertilizers are used.

The wealthiest local farmers grow cotton and tobacco and sell it by their own means in neighbourhood markets (Phalombe, Mulanje...). They have cattle. They employ wage labour for all operations in the fields.

In 1944, the Nyasaland African Congress (or NAC) was formed by the Africans of Nyasaland to promote local interests to the British government. In 1953, Britain linked Nyasaland with Northern and Southern Rhodesia, forming the Central African Federation. This provoked opposition from African nationalists, and the NAC gained popular support. One influential opponent of the CAF was Dr. Hastings Kamuzu Banda, a doctor trained in Europe who can back to Nyasaland to assist the cause. He was elected president of the NAC and worked to mobilize. In 1961, Banda's Malawi Congress Party (MCP) gained the majority in the Legislative Counsel and Banda was elected Prime Minister in 1963. On July 6, 1964, Nyasaland became independent from British rule and renamed itself Malawi. Colonialists left the country during the years before Independence. In the surveyed area, the land of colonialist exploitations was split between the managers of the farm, who became part of the largest land owners.

### 3.5. From the Independence to 1994, the Banda era

Under a new constitution, Malawi became a single-party state and Banda declared himself president-for-life in 1970. Until the 1970's, Malawi was self-sufficient in food crops, and the economy was stable. Through the 1980's, the situation has been degrading as a result of several factors.

#### *3.5.1. From 1964 to the end of the 1980's*

Malawian authorities based their economic development strategy on resources and outcomes of the agriculture sector. They focused on **export crops** (tea tobacco and cotton) of estates. Concerning tobacco, the Burley tobacco, the most profitable variety, was reserved to estates and forbidden to small farmers. Development plans favored assistance to farmers by a credit structure. A marketing structure called Farmers marketing board (FMB) aimed to protect farmers from price fluctuations. The agricultural policies were turned towards farmers who already succeeded into growing profitable cash crops i.e. the estates not the farmers from the surveyed area.

The policies changed after the first years. The government encouraged farmers to use the land in the best possible way, arguing that ***"wealth is in the soil"*** as remember interviewed farmers. The FMB (Farmers Marketing Board) was replaced by the **ADMARC** (Agricultural Development and Marketing Corporation), in charge of agriculture development. The ADMARC provided all farmers with a market for agricultural products: this institution had the monopoly on purchases of food crops and cash crops. This assistance favored large holder farmers who produced surplus. Selected farmers were distributed fertilizers, pesticides and seeds on credit for tobacco and cotton cultivation. They owned at least 2 to 4 hectares, so they were among the largest land owners in the study area, and they were able to practice rotations between tobacco, cotton and maize. But prices were not attractive and farmers sold less and less to the ADMARC. In the mid 70's, the monopoly of the ADMARC on purchases is cancelled (except for maize). At the same time, international tobacco prices fell, forcing farmers to reduce their surface planted in tobacco to the profit of maize. **Maize prices were controlled** by the government. The distribution of chemical fertilizer and improved seeds was also regulated. Farmers were able to finance the purchase of improved seeds and chemical fertilizer by low-interest loans from the **Smallholder Agricultural Credit Administration (SACA)**, run by the Government. The farmers paid their loan plus interest when selling harvested maize to the ADMARC.

But the smaller farmers did not receive direct help. As a result, agricultural policies led to an **increased social differentiation**. Therefore the *ganyu* understood as free assistance among farmers disappeared. The wealthiest farmers did not work anymore for the poorest. From then on, many small farmers sold their labour force to larger holder farmers, and the *ganyu* became only wage labour. This social differentiation is still visible nowadays even if those farmers are among the oldest.

Cultivation in ***dimba*** area (zone 6) was authorized. Irrigated crops developed along the Phalombe River: sugar cane, maize, and vegetables. Surfaces under cultivation in *dambo* areas increased. Farmers built their houses in their fields. Settlements were not grouped around the tracks any more but scattered. About breeding, the number of cattle and goats decreased from the Independence. Agricultural policies favoured cultivations to the detriment of grazing surface, so development of livestock was made impossible.

The surface dedicated to **maize increased to the detriment of cassava and sorghum**. To improve maize yields, closer ridges were recommended, (90 cm apart, with 60 cm spacing between maize plants), with box ridges for cassava. Pumpkin and pigeon peas were associated. Burying crops residues was practised. Maize yields improved compared to the sorghum ones. The use of fertilizer and hybrid seeds for maize could explain why sorghum was left behind.

### *3.5.2. The end of Banda era: general economic deregulation*

Government of Malawi **forbad the labour migrations to South Africa** in 1989 for political reasons. Migrant labour to the South African gold mines dropped. When coming back, those men formed an elite in their villages as they were large land holders and owned cattle bought with the money saved abroad.

Frequent **droughts** since 1989 have seriously destabilized maize production, often failing to meet the minimum requirement to satisfy the needs of the population, causing severe hunger. General economic deregulation measures were taken. The **structural adjustment programme** was introduced by the MIF in 1988 and 1995. The agricultural product distribution was liberalized. Private operators were able to purchase harvested maize. Private buyers were allowed in 1987 to engage in the distribution of agricultural products under a license system. ADMARC branches throughout the country were progressively closed. **Maize prices increased**, which affected the poorest. Cotton international prices fell from 1987, so most the cotton growers give up. But bigger farmers who were able to sell maize made profits and started Burley tobacco. Until 1991, smallholders were not allowed to grow high value cash crops, such as burley tobacco. But Banda's policies changed, and development of **Burley cultivation was encouraged from the beginning of the 90's** through *Burley Clubs* and credits of the Malawi Rural Financial Company (MRFC). The number of growers increased quickly and those who began this activity significantly added to their income. Social differentiation between farmers increased again. The MRFC is an agricultural credit institution which provides loans at market interest rates. It replaced the SACA, which went bankrupt in 1994 due to low credit repayment rate. After this reform, many farmers lost access to the credit market together with access to improved seeds and chemical fertilizers.

In the surveyed area, the land was already saturated in the 1990's. All areas are used for settlement, including *dambo* areas waterlogged in rainy season. This is explained by demographic growth, which resulted both from migrations and increased life expectancy (due to development of health care at the national level). A plot coming from grand-parents is divided by 8 in two generations' time. Leguminous as pigeon peas are systematically associated with maize and tobacco to renew the soil fertility. **Associations are substituted to rotations as a consequence of land pressure.** The 1991 **flash flood** (*napolo*) was a natural and human disaster. Water flooded from Mulanje Mountain toward Phalombe plain and the River over flooded its banks. The riverbank is now larger and its slope is gentler than before.

From then on, farmers stopped cultivating sugar cane on the because of the risk of flood, as it is a permanent crop. Soil erosion signs became visible around the hills (zone 2), due to the combined effects of intensive cultivation on the slopes and heavy floods. Deforestation was observed in all the landscape's zones, caused by modern construction techniques with burnt bricks.

### 3.6. From 1994 to 2004: economical liberalization

Since 1995, with the end of Dr Kamuzu Banda time and the introduction of **free-market economy**, Malawi regained investors' confidence. A resumption of foreign aid also helped to boost the economy. All inputs and agricultural products' prices are market prices, except maize which is still regulated. The license system for the trading of agricultural products was abolished in 1996, giving freedom to private traders. In parallel, with the end of the war in Mozambique, the access to the sea was established again. The new government introduced economic changes including a liberalisation of foreign exchange laws and easing of borders tariffs.

**Labour migrations to Mozambique** increased a lot from 1994 (after the Peace Treaty) up to 2004. The border between southern Malawi and Mozambique is characterised by a large difference in population density, with much higher densities on the Malawian side. Cross-border *ganyu* was common because on the Malawian side of the border the main constraints were lack of land and food, while on the Mozambican side lack of labour and lack of markets predominated. Between 1994 and 2004, many smallholder farmers were used to go to Mozambique by bicycle twice a month for at least a week, eight months per year. In parallel, cross-border businesses developed among medium and large holder farmers, in particular the one of food crops one, in order to take advantage of the differentiated comparative prices, of maize upon everything.

The diversification of food crops and rural development were encouraged through The Agricultural and Livestock Development Strategy and Action Plan (ADLSAP) in 1995 and the Malawi Agricultural Sector Investment Programme (MASIP) in 1999. Since 1994 successive programmes have distributed free seeds and fertilizers to farmers, in order to **improve food security** at both national and household levels. The **"Starter Pack Programme"** was launched in 1998/1999, until 2004. This programme has encouraged intercropping of maize with seeds adapted to the agricultural region. But in the surveyed area only a minority benefited from this system. However at the national level in the programme implementation period, maize production fluctuated widely due to bad weather, causing a serious food shortage every few years.

At the end of the 90's started a period that farmers describe as insecure: many thieves occurred. Cattle growers were stolen animals, others stole beforehand. From that period, livestock systems (cattle and goats) declined in the area. The study region was marked by the intervention of the NOG Cadecom (Catholic Development Commission in Malawi). It is visible in the landscape through trees planting (agro forestry and forestation). Seeds and stems distributed in these years are still in use today: groundnut type CG7, sweet potato and cassava varieties. Groups of mutual lending of poultry and goats were created, and this practice is still going on today.

## 3.7. The current agrarian system

### *3.7.1. Current agricultural policies*

After the 2005 harvest, the Bingu government implemented an **input subsidy programme**. During the 2005/2006 cropping season, approximately 130,000 tonnes of chemical fertilizer were distributed through a coupon-based distribution program to more than 1.3 million households. The following year, approximately 1.5 million farmers received coupons for 150,000 tonnes of fertilizer and two million farmers received coupons for free maize seed. In 2007/08 more than 1.7 million farmers received coupons for 170,000 t of fertilizer and almost 3 million farmers received coupons for seed[10]. Since 2007/2008, almost all farmers have access to 2 bags[11] of chemical fertilizer at one tenth its commercial price in the study area. As a result at national level between 2005 and 2007, agricultural growth has accelerated to over 8% per annum, with agricultural GDP growth for the year 2007 standing at 9%. Other African countries and the African Development Bank have announced similar subsidies programmes. Over 50% of the budget of the Ministry of Agriculture and Food Security is allocated to this programme. Donor funds are paying administration costs and the most of the seed subsidies. But donors question the sustainability of this initiative, especially on financial aspects. It seems that so far, no alternative strategy has been prepared.

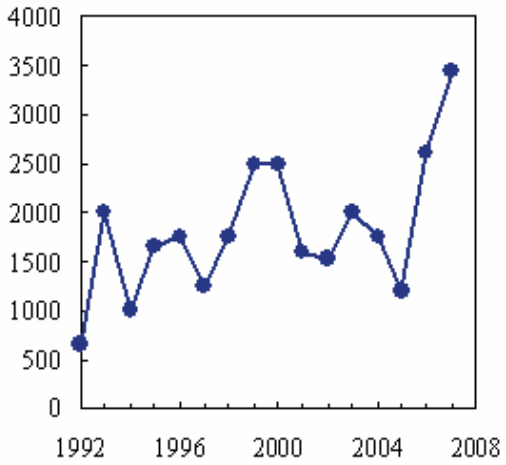



*Figure 4 Trend of maize domestic production 1992 to 2007 (data Ministry of Agriculture and Food Security, "Crop statistics 2007")*

### *3.7.2. Land issues*

**Land pressure** is visible, as houses are built everywhere in the landscape, and every inch of ground of the exploitations is used. Even largest holder farmers can undertake consequences of the lack of arable land: once they have shared their land to their children they become medium holder farmers, and their children may not have enough land. Young couples frequently lack land and have to rent fields. Otherwise, they turn to off-farm activities. Houses are built everywhere, even in areas where the soil is waterlogged in rainy season. Impact of massive plantation of eucalyptus around dwellings is felt in some areas. The soil is less

[10] World Band

[11] A bag contains 50 KG of fertilizer. In 2008, two coupons were used for purchasing a bag of urea and a bag of NPK (23:31:0+4S), 950 kwacha each

waterlogged that it used to be. Streams flooding from upper lands toward *dambo* areas to the Phalombe River now run dry during dry season whereas they were used for irrigated crops before.

There is a **market for the land** since the 1980's, but it is limited. Each Village Headman keeps available some land that is in theory intended to be given to needy people with no place to cultivate or build their house. Available non-cultivated arable land exists in all villages, but is scarce. To attribute land, the Village Headman must meet the agreement of all his relatives. In any case, according to interviews, it seems that only people originally from the village can be given land by the chief. People coming from other villages cannot benefit this system and have to rent or buy land. The cost of the land is not the main obstacle to purchase. Instead of selling a land, many owners prefer to "give" it. This means that they keep the property of the land. The cultivating farmer only has a traditional right of usufruct, until his death or decision of giving up. It seems that in practice, a "given" land is not taken back by the original owner unless the cultivating farmer no longer needs it.

Many farmers have to **rent fields** because they do not possess enough land to feed the household. Others rent fields to be able to cultivate more cash crops (groundnut and tobacco). Finally, farmers may seek land with better soils to be able to rotate maize, tobacco and groundnuts fields. But land owners only rent for a year contract to the same person. The aim is to avoid a situation where the cultivating farmer claims his right to be given the land as the owner is no longer using the land himself. The consequence of this one year limitation is that smallholders who need to rent land have to search for additional fields each and every year after the harvest period, which seems pretty complicated.

***Dimba* areas are a case aside** (zone n°6). A small number of owners have the monopoly over these places: the village headman, their relatives and descendants. It is explained by the history of settlement in the surveyed area: first villages were along the River, the villages of new comers settled further away were attributed a band of land along the River. There is no land market for the *dimba* land; the change of owner is only possible by heritage. It is possible to rent a small place to build a tobacco nursery.

#### *3.7.3. The workforce*

***"Ganyu"*** is a widely used term in Malawi that describes a variety of temporary rural work relations. It is a very broad term. It is used in this report because of its common usage.

The *ganyu* corresponds to any **off-own-farm work** done by rural people on a casual basis. It covers a period of days or weeks. Remuneration is made in cash (about 150 Mk/day) or in kind: less than a "5 litres basin" of maize grains for one worked day (ie. less than 4 KG); sometimes cassava or groundnut. It is often calculated as piecework. Ganyu may be done for relatives, neighbours, smallholders, estates... The work is relatively unskilled and agriculturally based. Men, women, old people and children can all do ganyu. The term ganyu covers **a wide range of activities** that were identified threw field interviews. The Appendixes 8 and 9 are dedicated to an analysis of these activities. The day of ganyu usually starts in early morning (5 to 6 am) and ends up from 11 am to 1 pm i.e. 5 to 8 working hours.

The *ganyu* is the most **important source of income after agriculture for most households**. *Ganyu* wages are very low and have not increased with years. This means that

*ganyu* workers are not able to invest in their own farms through this activity. The frequency of an individual going to *ganyu* varies from once in the year to every day, but typically is one to three times a week for one to several months of the year. The most accurate way to estimate the importance of *ganyu* is to look at when households ran out of their own food, with the implication that the deficit is made up by doing *ganyu.* The food shortage's duration varies according to previous maize harvest. Most of the farmers in the surveyed area eat *nsima* twice a day, and also consume maize flour for breakfast as *porridge*. Thus, they consider that they have no food whenever they do not have maize. To get the lacking maize, they go to *ganyu* as a coping mechanism.

#### *3.7.4. The management of soil fertility*

Farmers face a generalized problem of **lack of soil fertility**. Malawi's soil, like almost everywhere across sub-Saharan Africa, is gravely depleted. The unique zone which is quite preserved so far in the study area is the sandy-loam soil (zone n°5). Renewal of the soil fertility is not assured any more.

**Several factors** account for this situation. Maize is the step food and agricultural policies have encouraged its domination upon all other cropping systems. Maize is cultivated since many years on the same plots, without rotations with different crops. Fallows are inexistent due to the land pressure. The use of manure is marginal as the livestock is not very developed. It involves the farmers who keep cattle or goats, but not all of them. Compost making is not very widespread. Manure and compost are applied on maize fields on a surface that represents only a small proportion of the exploitation's total surface. Plots surrounding the house are preferred, to avoid transportation matters. Chemical fertilizers do not compensate the loss of fertility induced by crops, because they do not recreate the organic matter of the soil (humus). The burring of crop residues and weeds as land preparation operation is not always done due to lack of time and labour force. Many farmers prefer to burn the vegetal matter, as it will be further explained in the analysis of cropping systems.

The historical evolution of the farms led to the emergence of little differentiated farming systems differentiated on the cultivated surface (from 0.5 to 5 ha). The majority of those farming systems are based on subsistence farming. They coexist with wealthier farming systems based on agricultural products trade together with auto-consumption. Social relations between farming systems consist in vertical wage labour contracts. It is a rain-fed agriculture. Only simple implements as hoes are used. The most stunning fact is that the tools did not vary over the historical periods. Even the wealthier farmers keep practicing a manual agriculture nowadays (no oxen and ploughs).

# 4. Cropping systems

The main crop in the study area is maize. All farmers cultivate it: they dedicate 50 to 90% of their cultivate surface to maize cropping systems. Maize cropping systems are in rotation with tobacco or groundnut cropping systems. However, all types of farmers do not practice rotations because they do not have enough land, and all types of soils are not suitable for tobacco and groundnut.

- **Three main intercropping systems** are observed.

  - The most widespread is the **maize** intercropping system, all farmers cultivate it. Maize is associated with pigeon peas and pumpkin. Other types of peas and beans, sorghum and cassava may be added. Farmers tend to grow a second crop after maize on part of the surface: they plant sweet potato, sometimes sunflower.

  - **Tobacco** intercropping systems: pumpkin and pigeon pea are the most common associated crops, maize or groundnut are sometimes added

  - **Groundnut** intercropping system: with groundnut, pigeon peas, maize and pumpkins are associated.

- **Hybrid (and OPV) maize, groundnut and tobacco** are also grown on **pure stand**, but in minor proportions.

- **Rice, sunflower, sweet potato and cassava** are grown on pure stand. Sunflower and sweet potato may be associated with grams (*mphodza*) or crownpea (*nseula*, family of cow pea). Soya is scarce is the surveyed area, but is more represented in neighbourhood zones.

- Maize is also cultivated in **dry season**, where irrigation is possible, together with leaf vegetables[12] (pumpkin leaves, mustard, rape, cabbage), and tomato.

Most of crop management operations from land preparation to harvest are common to all cropping systems.

[12] Leaf vegetables are plant leaves eaten as a vegetable, sometimes accompanied by tender petioles and shoots

## 4.1. Crop management: common operations to all cropping systems

### *4.1.1. Land preparation operations*

All farmers prepare the land the same way. Only hoes are used. Land preparation may start in June, after the harvest of maize, while pigeon peas and cassava plants are still in the fields. Farmers try to be ready before mid October in case first rain falls early, but some of them work on these operations until November.

#### *4.1.1.1. Kuojeka : burring of organic matter*

The *Kuojeka* consists in gathering crops residues and weed grown since last weeding in the furrows and covering them with a bit of soil. Tool used is the large hoe. This work is done from June to August. Farmers have to wait for the pigeon peas to be harvested to do *kuojeka*. This work should be done as early as possible to improve soil fertility. Crop residues and weed should be buried before they dry in the air to optimize their decomposition. This operation may be done by children, who are often careless. This operation lasts **30 days for one hectare** (man/day)

#### *4.1.1.2. Kukhusa : intentional burn*

*Kukhusa* is an alternative to *kuojeka*. *Kukhusa* consists in clearing the land with a large hoe, gather the residues and weed in lines, perpendicular to ridges, then burn them. Pang knife is used to cut eventual natural grown trees. This method is less effective than *kuojeka* in terms of reproduction of fertility because there is no decomposition of green vegetal residues in the soil.

*Kukhusa* is always done when the land was not cultivated the year before. Clearing the land is quicker than laying crops residues and weeds in the furrows, so *kukhusa* is preferred if labour force is lacking. It takes **24 days for one hectare**. Farmers also choose this operation when labour force was not available earlier in the season and it is too late to do the *kuojeka*. Farmers tend to choose the *kukhusa* before sowing tobacco and groundnuts. They want to avoid any risks related to incomplete decomposition of vegetative matter that dried in the air. The chemical process can be harmful for seeds because of the heat it produces. *Kuojeka* should be done at least 3 months before sowing, which seems to be difficult to achieve for most farmers. This method is also chosen for termites control (many fields are invaded), to avoid termites to feed on organic matter.

#### *4.1.1.3. Ridging*

Farmers start ridging their fields (*kukwilira*) after the harvest of pigeon peas (July) or cassava (August to September), with a large hoe. Half of the soil of each old ridge is gathered in the furrows to build a new one. It takes **30 days for one hectare**. In fields located in *dambo* areas with clay soils of *makande* type, ridging is often delayed as late as possible before the

first rain. In fact, the soil on top of the ridges tends to become very hard, making the sowing operations more difficult because farmers have to dig holes (one hand depth) with a small hoe

**Many farmers combine the *kuojeka* and ridging in only one operation called *kuwunga*.** But, as *kuojeka*, this operation has to be made well in advance before sowing to be efficient in terms of soil fertility reproduction. If used too late, this method is not satisfactory because the decomposition of vegetal matter is only partial. For this reason, *kuwunga* or *kuojeka* are not used in tobacco fields, unless work ends at least 3 months before sowing.

In addition to ridges, farmers build a ridge around the field, to delimitate boundaries between fields or control the running water in rainy season. Farmers sometimes build "box ridges" perpendicular to ridges inside the field. This is represented in Appendix 10. The aim is to retain water from the rains and allow moisture conservation. Cassava is planted on theses box ridges. In waterlogged *dambo* areas, ridges just stop at the field boundaries, giving way to the water to avoid water stagnation which could asphyxiate plants. Farmers make their decisions about orientations of the ridges and building or not box ridges according to their experience. They know where "contour ridges" and "box ridges" are needed or not, depending on the soil composition and circulation of water. When land is rented, farmers do not question the way ridges are made the previous year. They ridge the field the exact same way, which sometimes is not the most efficient.

Ridges are built perpendicularly to the slope, to prevent from soil erosion. Agricultural advisors worked on that direction since the 1992 flash floods which destroyed the crops around the hills and carried away the superficial part of the soil. On the slopes of the hills, large water drainage ways called *kalonzira* are sometimes built around the fields.

#### *4.1.2. Sowing*

Maize sowing and tobacco transplanting operations start the day of the first rain and have to be completed as fast as possible within a few days. First rain usually falls from late October to early December, but mainly in November. Farmers tend to avoid hiring *ganyu* labor even if they can afford it, because they want to control the sowing operations. Nevertheless, the poorest farmers have to go to *ganyu* in order to get seeds. Those people are forced to plant later in their own fields, which has a negative impact on yields. In addition, if they are paid in maize seeds, they are often bad quality ones. Groundnuts are planted later, when sowing of maize and transplanting of tobacco are over, since it is not as urgent. Sweet potato is planted where the farmers did not manage to plant other crops.

#### *4.1.3. Weeding and banking*

Weeding together with banking is the most labor intensive activity for farmers as it is long and painful**. Ideally, 80 days for 1 ha (1 man/day) are required. Weeding** consists in scraping part of the ridge surface using middle sized hoes. Roots of weeds are hosted and left in the furrows. They will die and decompose under sun and rain actions. This operation is called *kupalina.* Weeding has to be done from late December to February depending on the crops. The latest the weeding is done, the hardest it is, as weed grow bigger. Children are involved, but are often careless, cutting weed instead of removing it.

Farmers **bank** with large hoes, adding soil to top and sides of eroded ridges. Banking is made from late January to February. This operation has three aims: burying the new small weeds, covering roots of plants washed by the rains, fertilizing the crops with the decomposed organic matter coming from the first weeding.

Many fields on the slopes of the hills and sandy soil areas are invaded by **termites**. Termites tend to develop in the furrows where weeds are left. To avoid the invasion of termites, farmers have to weed only on top of the ridges around seedling. Therefore, farmers **avoid banking but make a second weeding instead.**

But, January and February correspond to the hunger gap. In those months all farmers who ran out of food do piecework off-own-farm. Typically, from two days a week to every day, one member of the family is away. In the case of a couple, one goes to work outside when one remains in the fields of the family. **Competition between *ganyu* and own-farm cultivation can be critical**. A two weeks delay in weeding and banking operations can lead to considerable loss of yields. When working in another farm in the morning, the farmer has to work in his fields in the afternoons.

#### *4.1.4. Fertilization*

Mineral fertilization is practiced only on maize and tobacco crops. Almost all farmers receive subsidized fertilizers, two bags in most of the cases. Farmers are registered by Village Headmen to receive either fertilizers for tobacco crops (D Compound and CAN) or for maize crops (NPK and Urea). Farmers are given vouchers, that they present at the Admarc to buy fertilizers bags.

The great majority of smallholder farmers apply only subsidized fertilizers on their fields i.e.: fertilizer application has been generalized only since government support is available. Some farmers among the poorest cannot afford to change their vouchers into fertilizers. Only medium to large holder farmers can afford to buy additional chemical fertilizer at market prices in stores. Few farmers use organic fertilization (compost or manure). It is preferably applied in the maize field around the house to avoid transportation matters. The farmers who grow cattle or goats apply the manure in addition to mineral fertilizers. A small amount of manure is placed in a hole on top of the ridge, sowing is made at the same place a few weeks after.

Fertilization operations are carried out within the family, all members are involved: one person dig a hole with a stick, another deposits the product, and a child covers with soil.

#### *4.1.5. Harvest*

Harvesting is made by handpicking. Peak periods for harvesting are February to March for those who cultivate tobacco, March to May for maize, April for groundnuts, and July for pigeon peas.

## 4.2. Typology of cropping systems

Working calendars will be presented for the main cropping systems.

| | |
|---|---|
| | Land preparation operations |
| | Sowing / planting |
| | Harvesting |
| | Fertilization / weeding / banking |
| | Other operations (watering, grading, processing) |
| | Associated crops |

*figure 5: legend of working calendars*

### *4.2.1. Main intercropping systems*

#### *4.2.1.1. Maize intercropping systems*

#### *a. Description*

The main cropping system in the surveyed area is the maize intercropping system. All farmers cultivate it, on all types of soils except on waterlogged areas **if** they can avoid it. All types of maize seeds are used for maize intercropping systems: local maize and hybrid maize. Maize is always associated with **pigeon peas** *(cajanus cajan).* In addition, any of the following may be planted: pumpkins, cassava, sorghum, cow peas, sunflower, groundnut.

The **maize varieties** cultivated may be classified into three types: traditional, hybrid and composite. Traditional varieties ("local maize", cf. Appendix 6, picture 11) are dominant in Malawi. Most of them are extremely late varieties grown in the rainy season. Hybrid varieties have considerable yields but are planted only when the government introduces a support scheme, because of the high seed prices and the need of fertilizers. The composite type includes varieties generated by natural crossings between traditional varieties, and commercially available hybrid and synthetic. They are known as OPVs (open pollinated varieties). They are scarce in the surveyed area (until 2008).

#### *b. Main types of associations*

Though any combination is possible, main types of intercropping systems are:

**1-** Hybrid maize + pigeon peas

**2-** Local or hybrid maize + pigeon peas + pumpkin

**3-** Local maize + pigeon peas + pumpkin + **sorghum** (planted in lines perpendicular to ridges and/or around the field)

4- Local maize + pigeon peas + pumpkin + **cowpeas** (a leguminous tropical climbing plant, *Vigna Unguicolata*, producing long pods containing edible pea like seeds, also called black-eyed pea)

5- Local maize + pigeon peas + pumpkin + **cassava** (planted in lines perpendicular to ridges)

6- Maize + pigeon pea + pumpkin + **sorghum + cassava + cow pea**

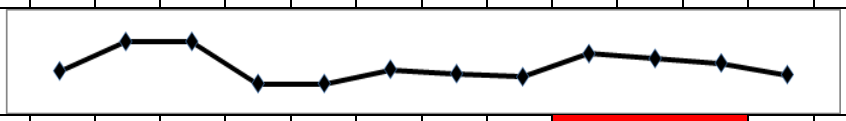
7- Local maize + pigeon peas + pumpkin + **groundnut** (planted between maize plants)

8- Maize + pigeon peas + pumpkin + **sunflower** (planted between maize plants in January to February)

In addition, farmers may sometimes cultivate on a few ridges the following peas and beans (mainly for home consumption on a plot around the house):

- *mphodza* (green grams - vigna radiate),
- *nzama* (bambara groundnut, vigna subterreranea),
- *nseula* (crownpea, variety of cowpea with smaller pods and peas),
- *nchana* (chickpea, cicer arietinum)
- *kalongonda* (Mucuna, velvet bean, stizolobium aterrinum),
- *mkunguzu* (Dolicus beans - Hyacinth Bean, Lablab purpureus),
- *kabaifa* (Lima bean, phasoleus beans)

### *c. Crop management*

| Operations in maize intercropping systems fields | n | d | j | f | m | a | m | j | j | a | s | o | Total work days/man/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| |  | | | | | | | | | | | | |
| Land preparation (kuojeka) | | | | | | | | | 30 | | | | |
| Making ridges | | | | | | | | | 40 | | | | |
| **maize** | 5 | | | | | 10 + (15 process if hybrid) | | | | | | | |
| sorghum | 2 | | | | | | | 5 | | | | | |
| pigeon pea | 5 | | | | | | | | 14 | | | | |
| Cow pea | 0 | | | | | 1 | | | | | | | |
| pumpkin | 0 | | | 1 | | | | | | | | | |
| cassava | 2 | | | | | | | | | 4 | | | |
| groundnut | | 3 | | | | 10 | | | | | | | |
| sunflower | | | 3 | | | | | 4 | | | | | |
| Fertilization | | 8 | | | | | | | | | | | |
| Weeding | | 40 | | | | | | | | | | | |
| Banking | | | 40 | | | | | | | | | | |
| Worked days/month (one man/day) | 14 | 47 | 47 | | | 16 | 11 | 7.5 | 33.5 | 28 | 23 | 10 | 237 (between 191 and 224) |

- *Ridges*

Most of the time, ridges are made after burring vegetal matter. Ridges are built 90 cm apart. As to hybrid maize associated with pigeon pea, ridges are built closer: at a 75 cm distance.

- *Sowing*

- **Maize** is sown in the days following the first rain. Distance between two maize plants is about 60 cm. Farmers never measure! For local maize, three seeds per planting station are used, and a second sowing session is led if it rained heavily and seeds were washed away, or if farmers sew too early and seedlings dried up. For hybrid maize, 1 to 3 seeds are used according to the space left between plating stations. Hybrid maize intercropped with only pigeon pea may be sown with a 30 cm distance.
- **Pigeon peas** seeds (2 or 3) are mixed with maize seeds, and a few more seeds will be sown after a few weeks where plants died. Alternatively, seeds are sown a few days after maize, between maize plants. The pigeon pea is acting as a nitrogen fixer.
- **Pumpkin** seeds are mixed with maize seeds (or pigeon peas seeds if sown apart). It is not planted on each maize plating station as it is a crawling plant, but on ¼ **the plants**
- **Sorghum** is the first crop to be sown after land preparation as it has a longer cycle (7 to 8 months). It is sown around the field, on contour ridge if existing, and on box ridges or in lines in the field. It is frequently attacked by birds, so farmers tend to limit quantities sown.
- **Cassava** stems are planted on box ridges to allow good development of tubers, with the first rain. Lack of stems and goats nuisances limit the development of this crop.
- **Groundnut** is sown a few weeks after maize, between two plants of maize, but density is less than maize (to be differentiated from groundnuts intercropping systems, where groundnut is the main crop).
- **Cowpea** is sown mixed with maize seeds or pigeon peas seeds.
- **Sunflower** is sown from January to February on the ridge between maize plants. It is often used when maize yields are expected to be low because of climate effects or bad crop management.

- *Fertilization and its impact on yields*

Quantities of fertilizers applied vary a lot according to the types of farmers and fields. Some farmers apply chemical fertilizers twice, others once, and a few never. One to two doses of fertilizer are applied per maize planting station. The measure used for application may be a tea spoon (leveled or full) or table spoon (leveled or full). Fertilizers are preferably applied on hybrid maize fields rather than local maize when they are lacking.

- *Harvest*

- **Maize**: local maize is preferably harvested dry in May. Farmers tend to cultivate at least a small plot of hybrid maize because it matures earlier than local maize: from February to March instead of April to May. Some of the maize is harvested while still green because of food shortage, from end January to March. Yields vary from one extreme to the other. Some farmers harvest enough to sell up to five times the quantity that their household

consumes. Others only harvest enough for a few months of food. Harvest is made within the family. Cobs are immediately transferred to the house to avoid thieves. Women use basins or bags carried on a bicycle, or even the head. If quantity is big enough, or if the distance is too long, an oxcart may be rented (about 500 K for a return trip in surrounded villages). Local maize is stored in the form of cobs in granaries (*khokwe*), often hided in the house owing to the fear of thieves. Hybrid maize is shelled and stored in bags (bags known as "50 KG bags"). Deltamethrin products are sprayed in prevention of domestic pests.

- **Pigeon pea** is harvested in July. Pigeon peas are consumed within the family, but part of the harvest is sold. Hybrid pigeon peas are seen as a cash crop by many small farmers. Local pigeon peas yields are lower. Prices were very high in the 2009 season (70 MK/KG, against 30 MK/KG in 2008), which considerably increased smallholders' income. Pigeon pea is a high dietary protein staple. The immature green beans are used as vegetables. The dried stems are used for fuel.
- **Pumpkins** are collected by women from March to June according to maturity. It is only for household consumption.
- **Sorghum** is harvested in June. It is dried on the roof of houses before being processed. It is used for preparing *nsima* or brewing beer.
- **Cassava** varieties used in the surveyed area in maize intercropping systems are harvested from August to September. Cassava is used for household consumption but is mainly sold in dried chips called *makaka* (tuber are peeled, cut and dried). Cassava cannot be stored fresh as it decays very fast. Processing cassava into *makaka* is long (2 hours a day for 1 month for 1 hectare).
- **Groundnuts** are harvested in April. Time spent harvesting includes uprooting the plants and then removing the nuts from the plant's roots. This crop is cultivated to be sold, one to three bags being kept for household consumption.
- **Cow peas** are harvested in April. It often dies when rain received is too important. Quantities harvested are small. It is always sold, at least partly, in small plates (n°10) at the local market.
- **Sunflower** is harvested in July. It is intended to be sold. Women remove seeds from the flower before selling.

### *d. Different types of rotations*

Maize intercropping systems are cultivated in rotation with tobacco, with groundnut, or without any rotation.

- Rotation with tobacco (tobacco intercropping systems or tobacco grown on pure stand)

**Maize** $_{\text{1 to 3 years}}$ **// tobacco** $_{\text{1 to 3 years}}$ [13]

[13] // : form a boundary agricultural years
/ : form a boundary between cropping cycles in the same agricultural year

- Rotation with groundnut (groundnut intercropping systems or groundnut grown on pure stand)

**Maize** $_{\text{1 to 2 years}}$ **// groundnuts** $_{\text{1 to 2 years}}$

- But, maize intercropping systems are often cultivated since decades **without rotation**. In fact, the **poorest farmers** may only cultivate maize intercropping systems. Furthermore, when cultivated, tobacco and groundnuts may occupy from only 1/6$^{th}$ of the surface, and not all types of soils are suitable for tobacco growing. Thus, some fields are cultivated with maize intercropping systems exclusively, even by bigger farmers.

### *e. Adaptations to climate unexpected effects:*

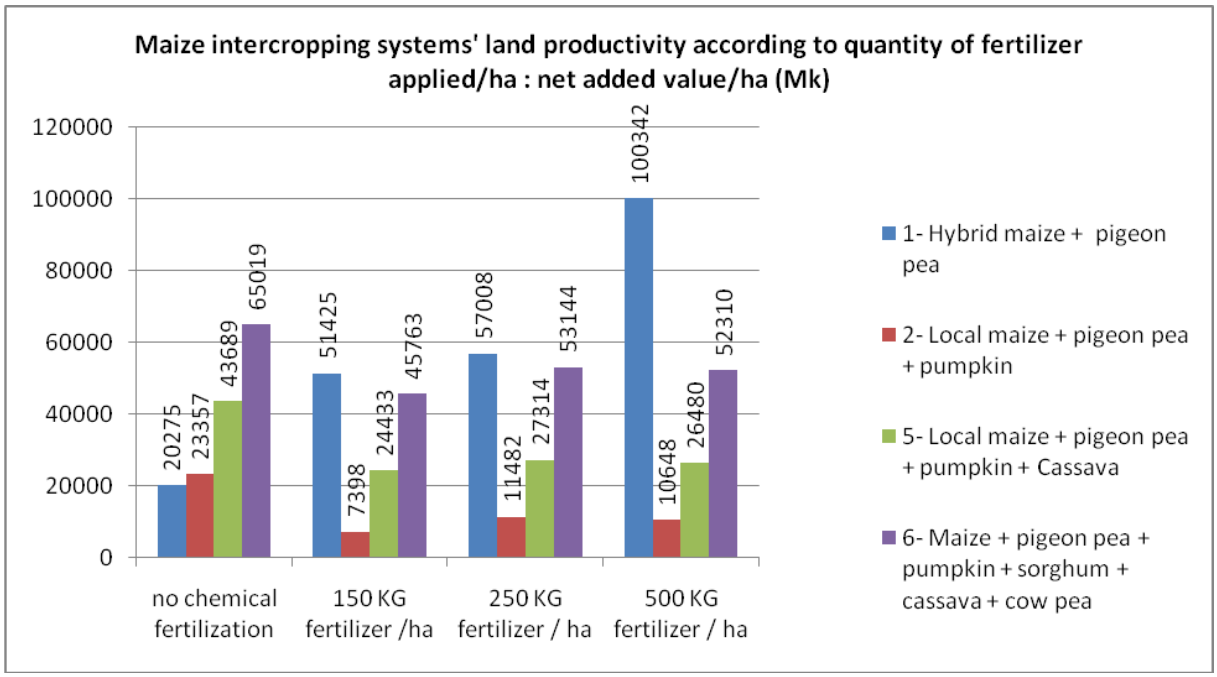
Farmers may grow a second crop after maize in January or February, when maize plants dried up or died under the water.

- Sunflower: **Maize / sunflower // maize** [14]

- Sweet potatoes: **Maize / « late » sweet potatoes //maize**

About 317 days (one man per day) are necessary to carry out this cropping system, between November and July. Operations for maize cropping system are as described previously. Maize and other crops are harvested earlier than usually with low yields. Land preparation (kuojeka) and ridging are led from late January to March.

### *f. Economical results*




[14] // : forms a boundary agricultural years
/ : forms a boundary between cropping cycles in the same agricultural year

*Figure 6 Productivity of the land according to quantity of fertilizer applied, maize intercropping systems (data: personnel elaboration, from field interviews)*

This graph compares the net added value per hectare for the main maize intercropping systems presented so far, according to the quantity of chemical fertilizer applied per hectare (Urea and NPK). The trend of these results is similar to labour productivity results.

The **best net added value** is obtained with the type of association **1-** Hybrid maize + pigeon pea, with intensive fertilization (500 KG/Ha[15]). Even if fertilizers' cost is high, hybrid maize yields increase enough for this cropping system to be profitable. But this cropping system is not accessible to all farmers because of the price of fertilizers.

The **worst results** are obtained with the type of association **2-** Local maize + pigeon pea + pumpkin. The net added value of this cropping system decreases whenever fertilizers are applied, as operational costs increase to much in comparison to the gross product. According to field interviews, local maize yields are about 1000 KG/Ha if 250 Kg of fertilizer are applied, and 2000 Kg/ha if 500 Kg of fertilizer are applied. But as operational costs increase (with the purchase of fertilizers) the net added value reaches a limit.

**The best strategy to increase the labor productivity and land productivity** consists in **associating various plants to local maize**: not only pigeon pea and pumpkin but also sorghum cassava and cow pea. Net added value is 23000 Mk for the system 2 without fertilization (only pigeon pea and pumpkin are associated to maize) against 43 689 Mk for the system 5 (cassava is added), and 65 019 Mk for the system 6 (sorghum and cow pea are cultivated as well = "complete" system).

For **150 to 250 Kg of fertilizer per hectare,** the productivity is maximized either practicing the system 1 (hybrid maize associated to pigeon pea) or the system 6 (pigeon pea pumpkin cassava sorghum and cow pea are associated to local maize).

#### *4.2.1.2. Tobacco intercropping system*

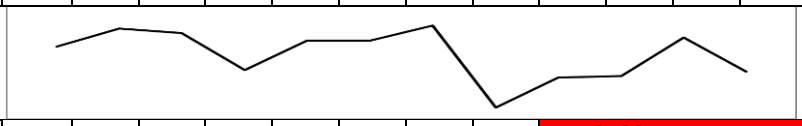
### *a. General description*

Seedlings are planted on all types of soils except in *makande* soil (*dambo* areas, zone 4) if farmers can avoid it. Farmers also try not to plant in stony soils and soils invaded with termites. This cropping system is in rotation with maize intercropping systems in a one-to-three year rotation.

**Tobacco intercropping system (1 to 3 years) //Maize (1 to 3 years)**

[15] 10 bags of fertilizer per Ha

### *b. Crop management*

| Operations in tobacco intercropping systems fields | | n | d | j | f | m | a | m | j | j | a | s | o |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | |  | | | | | | | | | | | |
| Land preparation | | | | | | | | | | 24 (kukhusa) | | | |
| Nursery | | | | | | | | | | | | 20 | |
| Watering of tobacco nursery (about 2 months, twice a day) | | | | | | | | | | | | 16 | |
| Ridges | | | | | | | | | | | 40 | | |
| Transplanting | | 15 | | | | | | | | | | | |
| Fertilization | | 16 | | | | | | | | | | | |
| Pumpkin | | 0 | | | | | | 2 | | | | | |
| Pigeon peas | | 5 | | | | | | | | 14 | | | |
| Maize | | 1 | | | | | | 8 | | | | | |
| Groundnuts (rarely) | | 8 | | | | | 20 | | | | | | |
| Weeding | | | 50 | | | | | | | | | | |
| Banking | | | 40 | | | | | | | | | | |
| Harvest (including sowing and suspending leaves) | | | | | 100 | | | | | | | | |
| Grading | vendors | | | | | 0 | | | | | | | |
| | auction | | | | | 45 | | | | | | | |
| Total worked days/month | | 41 | 53 | 50 | 25 | 45 | 45 | 55 | 0 | 20 | 21 | 47 | 24 |

| | |
|---|---|
| Tobacco + pigeon pea + maize + pumpkin sold to vendors | **320** days/ha (1 man/day) |
| Tobacco + pigeon pea + pumpkin sold to auction floor | **384** days/ha (1 man/day) |

- *Tobacco nursery*

In the surveyed area, the only reliable **source of water** where to build a tobacco nursery is the **Phalombe riverbanks.** Other streams used may dry in October and seedlings die. First step is clearing the land by removing the weed, then burn it. Tilling is necessary to loosen the soil and break the clogs. Average size of a seedbed is 1*10 m. Farmers who do not own a *dimba* have to rent one or more beds, at least 500 Mk per bed. **Seeds** are recycled from last season. The numerous farmers who started growing tobacco in 2008/2009 were often given seeds by relatives or friends, or bought from people who use to work in tobacco estates of Rumphi and Kasungu regions. **Watering** is needed twice a day for about 2 months, depending of date of the first rain. If the first rain comes late, farmers reduce water quantities to prevent excessive growth of seedlings. Work in the seedbeds is made by men. Men and women share the watering duty. Sometimes someone is employed for watering (*ganyu* with long-term contract).

- *Transplanting*

Transplanting is done **with the first rain**, within one or two days to take advantage of the precarious moisture of the soil. Some farmers even work under the rain or at night time. This operation is critical for the future success of the crop and is carried out within the family, all members are mobilized. Children dig 5 to 10 cm holes with a stick, while parents deposit the

seedling in the hole. Distance between two plants is about 60 cm, for a good development of tobacco leaves.

- *Associated crops*

- **Pumpkin** is sown at least one week after tobacco to avoid competition for light and soil nutriments. It is planted on top of the ridge between tobacco plants, but only one quarter of tobacco plants receive pumpkin seedlings as it is a crawling plant. The association of tobacco and pumpkin aims at soil coverage, in order to restrain the growth of weeds.

- **Pigeon pea** is sown at least one week after tobacco to avoid competition. It is sown on the ridge between two plants of tobacco.

- **Maize** is planted on the ridge between two plants of tobacco, but after 3 to 5 plants of tobacco to avoid competition. Alternatively, it is sown in lines perpendicular to ridges.

- **If both groundnuts and pigeon peas are associated, groundnuts** are planted on the ridge between two plants of tobacco and pigeon peas on the side of the ridge.

- **Tomato** plants sometimes are transplanted on the upper parts of the field. Nursery was made close to the house or the tobacco one.

- **Sunflower** is planted in January to February on the ridge between plants of to tobacco, especially where tobacco or other crops were damaged.

- *Fertilization*

Mineral fertilizer is applied one week after transplanting, and then in the third to fourth week after transplanting before rapid growth begins. In fact, many farmers can only afford one application of fertilizer. Each plant receives one to two measures on its sides. In the surveyed area, farmers do not use animal manure on tobacco crops. Tobacco yields increase with quantity of fertilizer applied per hectare.

- *Harvest*

- ***Tobacco***: If the household includes only two workers for more than 0.2 ha of tobacco, the family will need to hire *ganyu* people to assist in swooning tobacco leaves and hanging them for drying. Farmers prefer to lead this operation strictly within the family as it has to be done with care. But those who do not have time hire *ganyu*. Farmers have to grade their tobacco leaves to sell it at the auction floor. Tobacco can be sold to local traders non graded.

- ***Pigeon pea***: yields are better than in maize intercropping systems. Indeed, tobacco is harvested earlier than maize meaning that competition between plants stops earlier.

### *c. Market*

Tobacco is either sold to **local traders** or sent to **auction floor**. Tobacco market is regulated in Malawi. In the Southern region there is only one auction floor in Limbe (in the Blantyre neighbourhood). To sell their tobacco, farmers have to open an account at the auction floor. A margin is kept for “tobacco investment” and “auction fee”, and there is a

minimal required quantity of tobacco. So farmers gather in groups of at least ten members. The production is individual but is sold by the group. In the surveyed area, one farmer recently invested in a lorry and is transporting the bells to Limbe. Transportation cost ranges from 1500 to 2000 MK per tobacco bell according to the period. In addition, renting the tobacco press costs 300 MK per bell. Tobacco is bought by international companies, and farmers get their money several months after.

**Reasons for preferring local vendors** are various. First, production may not be enough to make a bell for auction floor. Second, farmers need cash from late January to March because of food shortage while auction floor is closed. Some need this money to pay the workers they hired to harvest the tobacco. In third place, bad quality leaves which would be rated very low at auction floor get better prices at local markets. Fourth, farmers do not trust intermediaries and are afraid of losing money. Fifth, charges are higher if auction floor market is chosen, especially transportation costs. Finally, when selling their tobacco to vendors, farmers do not need to grade it, so they save labour force.

In the 2009 season, average price at auction floor was 240 MK. Prices at local markets are inferior, ranging from 100 to 180 MK at the beginning of the season, and from 50 to 100 MK after auction floor's opening. Vendors travel around the villages from end January. Alternatively, farmers go to the market themselves. Vendors sometimes are farmers themselves and aim to gather as much tobacco as possible in order to send it to auction floor.

### *d. Four main tobacco intercropping systems*

Four main tobacco intercropping systems are observed. Net added value varies according to quantity of fertilizer applied, cost of external labour, and market.

- *System 1: Tobacco grown by smallholder farmers, with 100 to 200 KG of fertilizer/ ha, selling production at local traders (size of the plot: 0,1 to 0,2 ha)*

Tobacco is intercropped with pumpkin, or pumpkin, pigeon peas or pumpkin, pigeon pea and maize. Sometimes, groundnut is associated.
No chemicals are used in the tobacco nursery, which is rented.
Small amount of fertilizer is applied, often CAN and NPK, 100 to 200 KG / ha
Tobacco leaves are not graded, production is sold to local traders from end January to April.
Those farmers are the ones who produce tobacco when the market is favourable.
Gross margin varies according to associated crops: from 49 607 Mk/ha if only pumpkin is associated to 75 602 MK if pumpkin, pigeon pea and maize are associated.

**Net added value/ ha: 58 007 Mk**
**Net added value /man/day: 341 Mk**

- *System 2: small to medium holder farmers selling tobacco to both auction floor and local vendors, using about 200 KG of chemical fertilizer / ha (size of the plot: 0,1 to 0,2 ha)*

Tobacco is intercropped with pumpkin or pumpkin and pigeon pea or pumpkin, pigeon pea and maize.
Chemicals (COPA and dimethrain) and chemical fertilization are used at the nursery.
200 KG of fertilizer / ha are used: NPK and CAN or D-Compound and CAN
Half of the production is sent to auction floor, and half of tobacco leaves are sold at local markets from February to April.

*Ganyu* might be hired for grading tobacco leaves if family workers do not know how to do it.

**Net added value / ha: 78 595 Mk**
**Net added value /man/day: 223 Mk**

- *System 3: tobacco sold to auction floor (and to local traders up to 10 % of the production), using at least 200 KG of chemical fertilizer / ha*

Tobacco is intercropped with pumpkin and / or pigeon pea.
Chemical pesticides (COPA and dimethrain) and chemical fertilization are used at the nursery.
At least 200 KG of fertilizer / ha are used: NPK and CAN or D-Compound and CAN.
The production is mainly sent to auction floor, and about $1/10^{th}$ is sold at local markets, in February. *Ganyu* might be hired for harvesting tobacco, and grading leaves if family workers do not know how to do it.

**Net added value / ha: 183 457 Mk**
**Net added value/man/day: 487 Mk**

- *System 4: tobacco sold at the auction floor, intensive fertilization, large holders*

Tobacco is intercropped with pumpkin or pigeon pea, rarely grown on pure stand. Chemicals (COPA and dimethrain) and chemical fertilization are used at the nursery. 500 KG of chemical fertilizer / ha are applied: D-Compound and CAN. Some farmers even use up to 1000 KG of chemical fertilizers / ha. All the production is sold at the auction floor. This cropping system is practiced by **medium to large holder farmers**. *Ganyu* is hired to assist the family workers for harvesting and grading operations, sometimes also for watering nursery beds. Those farmers are the one who may buy tobacco to others to sell more bells to auction.

**Net added value / ha: 541 646 Mk**
**Net added value /man/day: 1440 Mk**

### *e. Analysis of economical results*

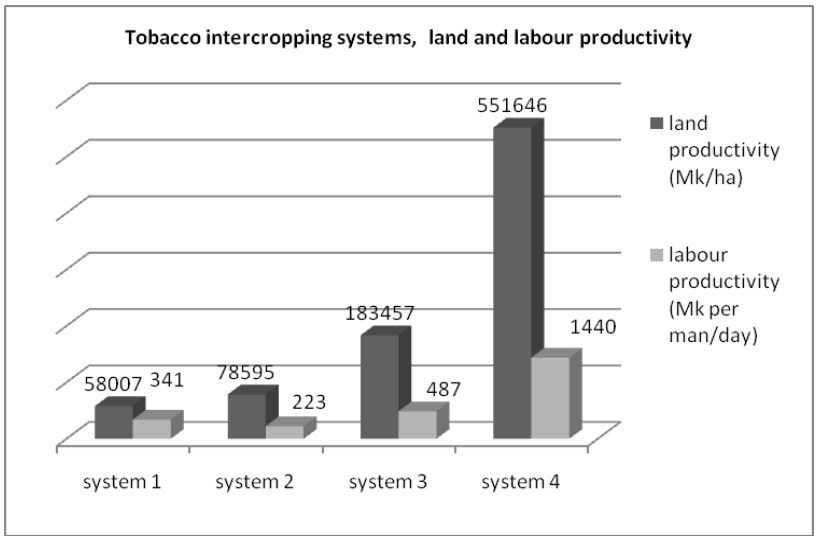



*Figure 7 Labour and land productivity for the four main tobacco intercropping systems (data: personal elaboration, from field interviews)*

As for the system 4 practiced by the large holders, the net added value per hectare essentially depends on the quantities of fertilizer applied: the more intensive the fertilization is, the higher tobacco yields are. Concerning the system 1 practised by smallholders, the net added value depends on the gross product of associated crops, especially the pigeon pea. Market chosen is the key factor for the productivity of the land in the case of systems 2 and 3. Labour productivity decreases from system 2 to system 3 because selling half of the production at the auction floor implies grading the tobacco leaves.

*4.2.1.3. Groundnut intercropping system*

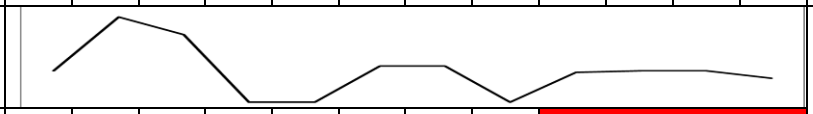
***a. Description and rotations***

Groundnut (*arachis hypogaea*) is preferably cultivated on the slopes of the hills as *Katondwe* soil is the best soil for groundnut cultivation. It may be due to its coarse-grained texture which facilitates the growth of roots and the harvest. On the slopes if the hills (zone 2) land is often rented on high prices and farmers cultivating change on a yearly basis.

Alternatively, groundnut is cultivated on soils where sand dominates in composition (zone 3) if farmers have the choice. Nevertheless, groundnut may be observed on any type of soil except *makande*. Groundnut is never cultivated more than 3 years on the same land, and most of the time in a one to two year rotation with maize intercropping systems.

**Maize** **(1 to 2 years, sometimes 3)** **//** **groundnut** **(1 to 2 years, sometimes 3)**

***b. Crop managment***

| Operations in fields of groundnuts intercropping systems | n | d | j | f | m | a | m | J | j | a | s | o | Total worked days/year/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| |  | | | | | | | | | | | | |
| Land preparation | | | | | | | | | **24** (kukhusa) | | | | |
| Ridges | | | | | | | | | | | 40 | | |
| Groundnut | 8 | | | | | 40 | | | | | | | |
| Pigeon pea | 8 | | | | | | | | 14 | | | | |
| Maize, pumpkin | 3 | | | | | 9 | | | | | | | |
| Weeding | | 90 | | | | | | | | | | | |
| Total worked days/month/ha | 21 | 57 | 45 | 0 | 0 | 24 | 24 | 0 | 20 | 21 | 21 | 16 | 242 |

- *Ridging and sowing*

Groundnut is sown on ridges similar to ridges used for maize intercropping systems. Two varieties are planted in the surveyed area, in the same proportions: **local groundnut** (*chalimbana*), and "CG7" **improved variety**. As most of the farmers do not have enough land to be able to plant groundnut on pure stand, they do associate it with other crops. **Pigeon pea**

is always associated. It is sown on the ridge between two plants of groundnut but not everywhere (after 1 to 4 plants). **Maize** is sometimes planted randomly, on the ridge between two plants of groundnut, where there is no pigeon peas. Incidentally, **cow pea and pumpkin** are associated, on the ridge.

- *Weeding and banking*

Weeding has to be done carefully to avoid damages to groundnut plant roots. Hoeing concentrates in the farrows: only hands should be used to weed on the ridge. Banking is not recommended, as it could damage groundnuts roots, so a second and even third weeding are conducted.

### *c. Harvest and economical results*

The harvest is not an urgent operation; nuts can remain in the soil. The plants are uprooted, and then the nuts are removed in the plants' roots. Local groundnut gives slightly lower yields than improved variety CG7 (an estimated 25%). Net added value is estimated at **135 000 Mk/ha, and 561 Mk/man/day.**

## *4.2.2. Crops grown on pure stand*

### *4.2.2.1. Hybrid maize grown on pure stand*

### *a. Description*

Local maize is never grown on pure stand. **Hybrid maize** seeds are used. Hybrid maize is subsidized by the government since a few years, together with fertilizers. Distributed varieties change yearly according to availability. Alternatively, farmers buy seeds from stores. Very few farmers are used to keep their hybrid maize seeds from one year to the other, on the contrary to local seeds.

### *b. Crop management*

| Operations in fields of hybrid maize grown on pure stand | n | d | j | f | m | a | m | j | j | a | s | o | Total work days/year/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| |  | | | | | | | | | | | | |
| Land preparation | | | | | | | | | 30 (kuojeka) | | | | |
| Making ridges | | | | | | | | | 40 | | | | |
| **maize** | 5 | | | 10+15 (shelled) | | | | | | | | | |
| Fertilization | | 16 | | | | | | | | | | | |
| Weeding | | 40 | | | | | | | | | | | |
| Banking | | | 40 | | | | | | | | | | |
| Total days worked/months/ha | 5 | 48 | 48 | 5 | 10 | 10 | 0 | 0 | 23 | 23 | 24 | 0 | 196 |

- *Sowing*

*"sasakawa"* method is used, according to agriculture services recommendations. Ridges are made 75 cm apart, and sowing is done with 25 cm space between two planting stations.

- *Impact of fertilization*

Fertilizers are preferably applied on hybrid maize fields rather than local maize when they are lacking. If too little or no mineral fertilizer has been applied, almost no maize is harvested.

- *Harvest*

Harvest is made from end February to March. Some farmers cultivate hybrid maize because it matures earlier than local maize. At least part of the cobs are harvested while still green. The green maize grains are dried in the sun before making flour, or cobs are eaten roasted.

### *c. Storage*

Hybrid (and OPV) maize is processed as soon as harvested and stored is bags. Chemicals based of deltametrain are applied. Typically, farmers buy one bottle of *aktelik* for two bags of maize.

### *d. Economical results*

The net added value increases with the quantity of fertilizer applied. The net added value is very low if no fertilizer has been applied.

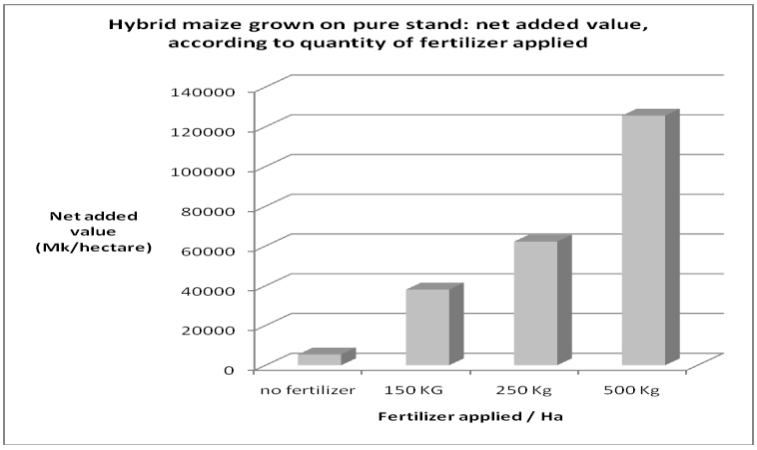



*Figure 8: Net added value for maize hybrid grown on pure stand (data: personal elaboration, from field interviews)*

Operational costs (seeds are fertilizers) are very high: they represent 75% of the net added value.

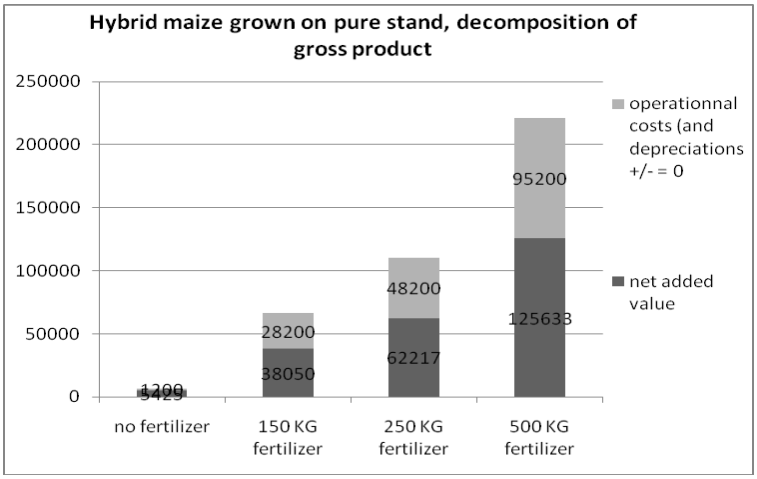
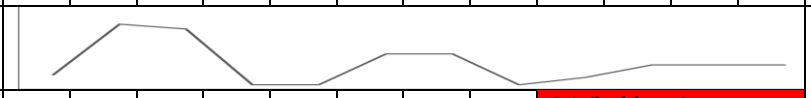



*Figure 9 Decomposition of gross product, hybrid maize grown on pure stand (data: personal elaboration, from field interviews)*

*4.2.2.2. Groundnut grown on pure stand*

This cropping system is rare in the landscape compared to groundnuts intercropping system. Lack of land and lack of seeds are the limitative factors for growing groundnuts on pure stand. Land productivity is estimated at 95 000 Mk/ha for local groundnut and 125 000 for CG7 variety (111 000 on average). Labour productivity ranges between 413 and 613 Mk/man/day (535 on average).

| Operations in fields of groundnuts grown on pure stand | n | d | j | f | m | a | m | j | j | a | s | o | Total worked days/year/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| |  | | | | | | | | | | | | |
| Land preparation | | | | | | | | | 24 (kukhusa) | | | | |
| Ridges | | | | | | | | | | 40 | | | |
| Groundnut | 8 | | | | | | 45 | | | | | | |
| Weeding | | 90 | | | | | | | | | | | |
| Total worked days/month/ha | 8 | 49 | 45 | 0 | 0 | 25 | 25 | 0 | 6 | 16 | 16 | 16 | 208 |

*4.2.2.3. Sweet potatoes*

Sweet potato is cultivated on all types of soil, though it tends to be observed in *dambo* areas (zone 4): it is an opportunity to valorise those fields. Big ridges are built at a 1 m distance and space between two planting stations is about 30 cm. A nursery is built near the house or at the *dimba* to multiply stems if they are lacking. Otherwise, bags of sweet potato vines are bought, which demands less labour. Several varieties of sweet potato are associated. Most of the sweet potato in the surveyed area is planted between January and March, which conflicts with weeding and banking operations in maize and tobacco fields. Sweet potato is planted when farmers did not manage to sow maize, tobacco or groundnut in all their fields. It is also planted after the maize harvest as a second cropping cycle, and maize is planted again the next year (**Maize / sweet potato //maize).** Finally, sweet potato is the first cropping system to be cultivated in a recently cleared area of bush.

On the one hand, some farmers cultivate sweet potato for household consumption on small sized plots frequently located close to houses because goats tend to damage the plants, and to avoid thefts. On the other hand, some farmers cultivate sweet potato on larger plots in order to sell it fresh as soon as it is harvested, or later in the hunger gap (in dried chips: *makaka* of sweet potato).

Sweet potato is usually sold fresh from April to August. The **land productivity** is estimated at **120 000 Mk/ha (labour productivity: 600 Mk/man/day).**

Sweet potato sometimes is associated with grams or *mseula,* planted on the side of the ridge, which increases considerably the **land productivity: 139 400 Mk/ha (labour productivity: 648 Mk/man/day).**

| Operations in sweet potato fields<br>« E » = early<br>« L » = late | n | d | j | f | m | a | m | j | j | a | s | o | Total worked days/year/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nursery | | | | | | | | | | | 10 | | |
| Watering of nursery | | | | | | | | | | | 12 | | |
| Land preparation | | E 30 | | L 30 | | | | | | | | | |
| Ridges | | E 30 | | L 30 | | | | | | | | | |
| Sweet potato | | E 20 | | L 20 | | E 40 | | L 40 | | | | | |
| Green grams or crown pea | | 3 | | | | | | 15 | | | | | |
| Weeding | | | E 80 | | L 80 | | | | | | | | |
| Worked day Early sp | 0 | 80 | 80 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | **200 (222 if nursery)** |
| Worked day Late sp | 0 | 0 | 0 | 80 | 80 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | |
| Worked days Association with sweet potato | | | | | | | | | | | | | **215 or 237** |

*4.2.2.4. Cassava*

Cassava is planted on sandy to loam soils, on large and high ridges similar to sweet potato ridges. In the surveyed area, distance between two planting stations tends to be short, as cassava plants are rarely left in the field more than one year.

Two varieties of cassava are grown in the surveyed area: short and long term maturation varieties. Maturation period ranges from 8 months to two years according to the variety. In the surveyed area, two cases are to be differentiated. On the one hand, short term maturation varieties are used in maize intercropping systems: stems are planted with the first rain, tubers are harvested from July to September, then the plants are removed; the stems stored in the hole made in the field. On the other hand, **varieties planted on pure stand are most of the time 12 month's maturation varieties**, **planted in February and harvested in the same month**.

Cassava crops are sometimes rotating with sweet potato, as the same type of big ridges can be used. Sweet potato is planted after harvest of cassava as a relay crop before planted maize.

**Cassava** harvest February year 1 **/ sweet potato** planted February year 1 **// Maize** planted November year 2

Alternatively, a period of 9 months fallow follows cassava harvest.

**Cassava / « fallow » // Maize**

Cassava cannot be stored fresh, so it is processed into dried chips, which is a very labour intensive activity. Economical results depend on the way cassava is sold. **Net added value is 180 780 Mk/ha** for cassava ***sold fresh*** (**822/man /day**) and **271 572 Mk/ha** (**1191 Mk/man/day**) for cassava ***sold into dried chips***.

| Operations in fields of cassava grown on pure stand | n | d | j | f | m | a | m | j | j | a | s | o | Total worked days/ha/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| Land preparation | | | | 30 | | | | | | | | | |
| Ridges | | | | 30 | | | | | | | | | |
| Nursery | | 10 | | | | | | | | | | | |
| Planting | | | | 20 | | | | | | | | | |
| Weeding | | | | | 100 | | | | | | | | |
| Harvest | | | 40 | | | | | | | | | | |
| Total worked days/ha/year | 0 | 0 | 20 | 100 | 33 | 33 | 33 | 0 | 0 | 0 | 0 | 0 | 220 (230 if nursery) |

*4.2.2.5. Rice*

Rice is cultivated in boxes, in the lowest and most waterlogged parts of *dambos.* Boxes are about 10*10 m. Rice is also cultivated in farrows along the tracks in *dambo* areas to take advantage of the running water as tracks are built upper. Farmers clear the land and gather the residues and adventitious with large hoes on the sides of the field and burn it. Then, they dig the land with large hoes, building the ridges. The aim of this operation is to retain the water on the field as long as possible in the rain season. Lastly, farmers plough the field and break the clogs. Depending on the length of the flood in the plot, one or two weeding sessions are necessary. **Land productivity** is estimated at **58 196 Mk/ha, and labour productivity at 338 Mk/man/day**.

| Operations in fields of rice | n | d | j | f | m | a | m | J | j | a | s | o | Total worked days/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| Nursery (land preparation and planting) | | | | | | | | | | | | 6 | |
| Land preparation (digging, breaking clods) | | | 60 | | | | | | | | | | |
| Transplanting | | | 30 | | | | | | | | | | |
| Weeding | | | | 40 | | | | | | | | | |
| Harvest (including beating and winnowing) | | | | | | | 20 | | | | | | |
| Hulling | | | | | | | 16 | | | | | | |
| Total worked days/ha/year | 0 | 0 | 90 | 20 | 20 | 0 | 18 | 18 | 0 | 0 | 0 | 6 | **172** |

*4.2.2.6. Sunflower*

The crop management is similar to maize. Observing the landscape, sunflower is more likely to be observed in *dambo* area (sown on big ridges), as it gives utility to theses fields. Nevertheless, it is found on all types of soils. This crop is scarce in the surveyed area compared to neighbourhood zones where almost all households cultivate it because there are more surfaces of *dambos* where general cultivation is possible. Farmers who do not have enough land cultivate sunflower in maize intercropping systems, but yields are low. Soya, green grams, crown pea (*nseula*) or sorghum may be associated

**Land productivity is estimated at 17 180 Mk/ha (labour productivity: 116 Mk/man /day)** for sunflower grown on pure stand. When associated to leguminous, net added value increases at **36 620 Mk/ha and 225 man/day.**

| Operations in fields of sunflower grown on pure stand | | n | d | j | f | m | a | m | j | j | a | s | o | Total worked days/year/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | |  | | | | | | | | | | | | |
| Préparation du sol | | | | | | | | | | | | 24 | | |
| billonnage | | | | | | | | | | | | | 30 | |
| Tournesol | | | | 6 | | | | | | 15 | | | | |
| Green grams, crown pea, soya... | | | 3 | | | | | | 15 | | | | | |
| Weeding | | | | 40 | | | 30 | | | | | | | |
| Total days worked/ month | On pure stand | 0 | 3 | 46 | 0 | 0 | 30 | 0 | 15 | 15 | 0 | 24 | 30 | **148** |
| | with leguminous | | | | | | | | | | | | | **163** |

*4.2.2.7. Cotton*

Only one cotton grower is observed in the surveyed area since 2008 (thus, net added value was not calculated in this report). Other growers gave up because of market problem: prices are low and buyers are scarce. Cotton has been given more importance by the current Malawi administrations. Exportation of raw cotton has been recently prohibited, so that cotton grown should be processed in the country, which could boost the production at national level.

Cotton is planted with the first rain. Pesticides have to be applied twice, after weeding and after banking. Weeding has to been done twice, first in January and second after banking. The most labour intensive activity is harvesting. It has to be done on a daily basis with a lot of care from April to June.

### *4.2.3. "Dimba" cropping systems based on maize*

#### *a. General description*

This system is only possible if farmers have **access to land near a reliable source of water**. Irrigated crops are found along the Phalombe River, along a few streams flooding to the Phalombe River, and close to a few waterholes in *dambo* areas. Plots are small sized. The largest are 0.2 ha. Most of them are from 150 m² to 0.1 ha.

In the surveyed area, about **24% of farmers have access to *dimba*** and cultivate it effectively. But many of them do not use all the potential of their surface because of **lack of labour force**.

Some farmers manage to lead three **maize** cropping system cycles throughout the year: one cycle in rainy season, then two cycles in dry season. In parallel, **vegetables** are cultivated in dry season. The most common are leaf vegetables (pumpkin leaves, mustard (brassica carinata), and rape (brassica napus)), tomato, sweet potato. Chinese cabbage (brassica chinensis), eggplant and Irish potatoes are observed. Sunflower and edible pulses (crown pea (*nseula*); green grams (*mphodza*) bambara groundnut (*nzama*)...) are grown on pure stand or associated with maize are also found. Sugar cane is observed. Several cycles of the same vegetables may be led, rotating the beds used.

Watering cane (or sieve in the absence of watering cane) is the tool used for irrigation operations. No treadle pump is found in the study area. Watering takes place early in the morning and in the late afternoon. Men are very much involved in operations at the *dimba*. It seems that this cropping system is socially valorised.

Farmers eat part of their vegetable production. They sell expedients in standard sized baskets.

Regarding **maize**, most of the farmers only cultivate it at the *dimba* in the dry season because the place is under water during rainy season. Furthermore, in many cases only one maize cycle is led in dry season because of lack of labour force. Farmers tend to plant in May and harvest in September, to avoid competition with other operations in the fields.

Farmers favour **vegetables** that do not demand too intensive watering. Pumpkin leaves and sweet potato are preferred to tomato, which is hazardous because watering has to be done with perfect frequency. Mustard, rape, cabbage and Irish potato require more investment: pesticides and fungicide as well as fertilizers are necessary to achieve good yields. According to field interviews, it seems that access to seeds plays a part in the scarcity of rape, cabbage and Irish potato.

| **Crop calendar in *dimba*** | n | d | j | f | **m** | **a** | **m** | **j** | **j** | **a** | **s** | **o** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maize on ridges in upper parts<br>+ pigeon pea + pumpkin... | Maize rain season | | | | | | | | | | | |
| Maize in holes<br>+ pumpkin leaves + crown pea... | | | | | Maize dry season (1st cycle ) | | | | Maize dry season (2nd cycle) | | | |
| Tomato | | | | | | | Peak production | | | | | |
| Sweet potato | | | | | | | | | | | | |
| Mustard *(mpiru)* | | | | | | | | | | | | |

### *b. Crop management*

Maize, tomato and other vegetables are sown either **in beds or in holes**. Digging holes (30 cm diameter) or beds (2*0.90 m) contributes to maintain the moisture around the plant after the watering. The use of beds implies a sowing density superior to holes. 25 beds are equivalent to about 65 m². Using holes, 110 m² are necessary to cultivate the same number of plants. Beds' construction is longer than holes because the soil has to be levelled to ensure proper repartition of the water.

Sites are dug and all large clods broken up to level off the soil. Nursery beds are built 15 cm high, less than 1 m wide and about 2 m long. They are separated by paths 40 wide. Compost or manure may be incorporated. Seeds are sown in the nursery in rows. Straw is placed on top of the seedling for the first days to protect them from the heat and preserve the moisture. Seedlings are transplanted into other beds or holes. In the case of tomato, transplanting takes place 4 weeks after sowing. Watering is continuous for three months from the time of sowing, one to two times a day.

Weeding is made regularly to loosen the soil and reduce competition for plant nutrients, sunlight and soil moisture. Pesticides are applied, especially for mustard and tomato. All farmers do not apply chemical fertilizers. Fertilization improves mustard and maize yields. Banking is practised for maize. Harvesting of leaf vegetables is done by stripping leaves from plants beginning one month and a half from transplanting. All crops are generally harvested as soon as they are mature to avoid robbery, which is reported to be frequent.

*Dimba* cropping systems are very labour intensive. In the case of rainy season cropping systems, land preparation is done is 24 to 30 days (man/day). Afterwards, ridges are built in another 30 days. Land preparation in *dimba* cropping systems takes much longer: 8 days for 25 beds (about 65 m²).

### *c. Economical results*

**Maize** produced at the dimba in the dry season is often sold in cobs to be cooked or roasted. Otherwise, it contributes to increase the maize self-sufficiency of the family. Net added value is estimated at **4500 Mk for 25 beds if maize is sold in cobs, and 3000 Mk if it is for household consumption**. In rainy season, *dimba*'s maize net added value is comparable to the one in other fields, excepts than less chemical fertilizer tends to be applied at *dimba*.

Net added value for **tomato** cultivation depends on the month during which products are sold. Tomato are sold in hips of 4 tomatoes, are in full standard sized baskets. The lowest

prices are observed from June to August (600 to 1200 Mk for a small basket), as most of the producers sell their tomato in those months. Prices rise from the month of September (2500 Mk for the same basket). On average, net added value is estimated at **25 000 Mk for 25 beds.**

**Mustard**'s net added value is estimated at **17 000 Mk for 25 beds**, with fertilization and application of pesticides.

Productivity of the land is thus much higher than for cropping systems led in the rain season. But the labour productivity is not so advantageous. For example, labour productivity for tomato is about 423 Mk per man per day, which is comparable to the most profitable rainy season copping systems.

| Operation for **tomato** cultivation at *dimba* in dry season:<br>25 beds (65m²) OR holes (110m²) | a | m | j | j | j | a | s | o |
|---|---|---|---|---|---|---|---|---|
| **Nursery beds:** clearing the land, burning organic matter, digging the soil, adding compost, breaking clods, levelling. | 2 | | | | 2 | | | |
| **Other beds: "..."** | | 6 | | | | 3 | | |
| Sowing in nursery (and mulching) | | 2 | | | | 2 | | |
| Transplanting seedlings | | | 4 | | | | 4 | |
| Watering | | 33 | | | | 33 | | |
| Fertilization | | 1 | | | | 1 | | |
| Pesticides | | 1 | | | | 1 | | |
| Weeding and banking | | | | 4 | | | | 4 |
| Harvest | | | | 6 | | | | 6 |
| Total worked days per month | 2 | 19 | 16 | 22 | 2 | 16 | 16 | 22 |
| Total worked days per cropping cycle | **59** | | | | **56** | | | |

## 4.3. Conclusions on analysis of main cropping systems

### *4.3.1. Maize cropping systems*

#### *4.3.1.1. About maize prices*

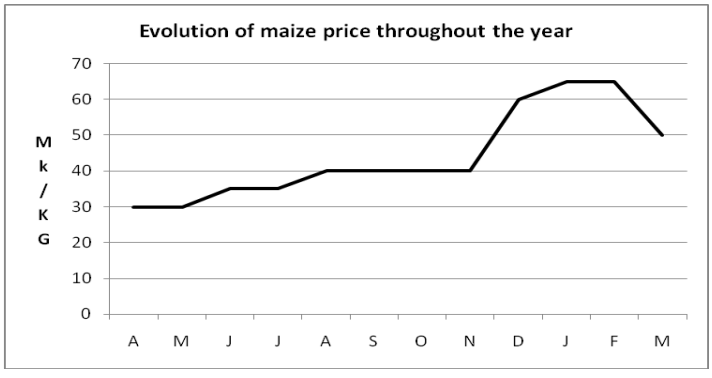



*Figure 10 Maize prices' variations throughout the year -average prices 2007/2009- (data: personal elaboration, from field interviews)*

Average maize price was fixed at 44 Mk per KG for economic calculation in this report. Farmers who are able to sell their maize harvest during the food shortage period (December to February) which increases significantly the net added value of their maize cropping systems. Indeed, the maize prices increase up to an average price of 65 Mk (average estimated price on local markets, 2007 to 2009). The net added value increases by 60% on average: from 15% to 188% according to the maize cropping system.

*4.3.1.2. Maize intercropping systems versus maize grown on pure stand*

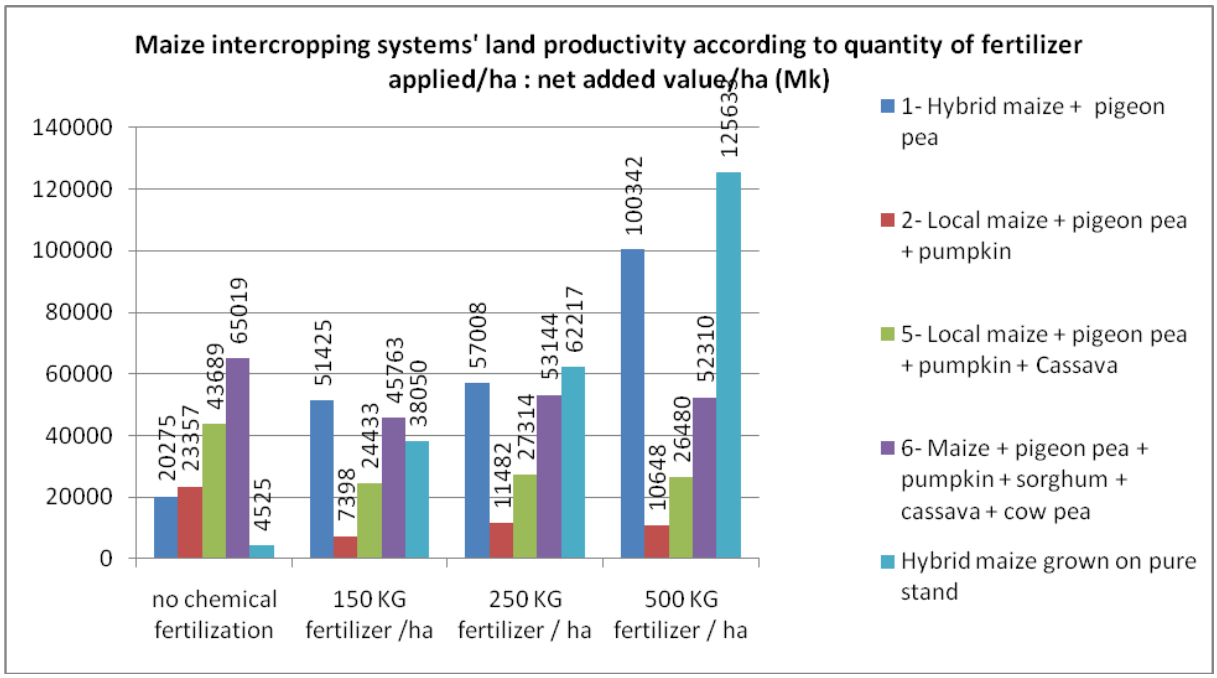



*Figure 11 Comparison of land productivity for cropping systems based on maize (personal elaboration, data from the field)*

**If no fertilizer is applied**, the best choice in terms of economical results is to cultivate local maize intercropping system including many associated plants. The basic local maize intercropping system (maize, pigeon pea and pumpkin) gives significantly better results than hybrid maize grown on pure stand. On average without fertilization, hybrid maize yields are inferior to local maize yields. This trend is reinforced if weather conditions are bad (drought, heavy rains, waterlogging...). Under good crop management (weeding, banking) local maize gives better results than hybrid maize. Furthermore, the gross product of maize intercropping systems is composed of pigeon pea harvest, which can be sold outside the farm.

**If less than 250 KG of fertilizer are applied** per hectare, it is more advantageous to cultivate hybrid maize associated with pigeon pea rather than on pure stand. This explains why smallholders do not adopt massively the *sasakawa* technique but practice associations with hybrid maize. On the contrary, **if more than 250 KG of fertilizer are available**, the net added value increases if maize is grown on pure stand. Largest holder farmers, who can afford to buy more fertilizer, do cultivate hybrid maize on pure stand.

*4.3.1.3. About fertilizers' prices*

2008 fertilizers market prices have been taken into account for the calculation of net added values in this report. This choice was made because fertilizers market prices have been rather stable over the past years. Prices of subsidized fertilizers were no used for the calculation because they change every year, so the results obtained could not have been generalized. Nevertheless, the cropping systems practised in the study area are influenced by the current governmental input subsidy programme. For example, smallholders who cannot afford to buy fertilizer by their own means may change the cropping systems they practice when subsidized fertilizers are introduced. Many of them are currently only using subsidized fertilizers. Let us analysis the same maize cropping systems that previously, taking into account the 2008 subsidized fertilizers prices.

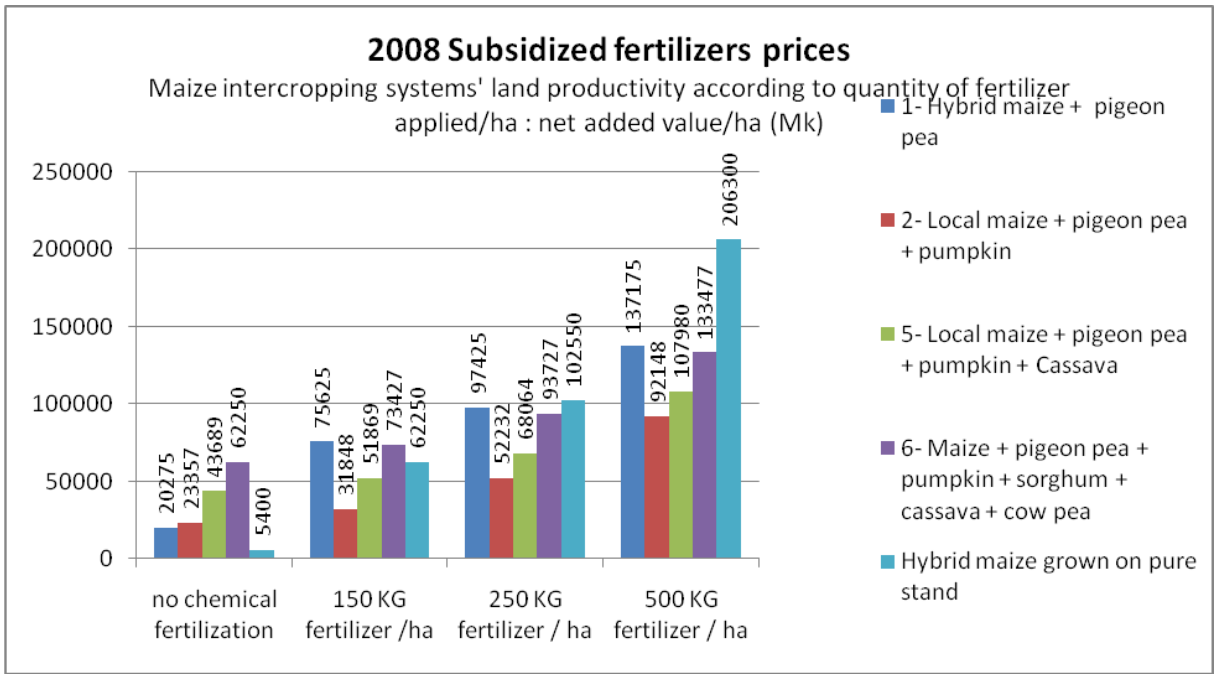



*figure 12 Maize cropping systems: net added value calculated with 2009 subsidized fertilizers' price*

The land productivity (and labour productivity) increases, as operational costs are lower. Local maize intercropping systems' net added value increases more than hybrid maize cropping systems' net added value.

### *4.3.1. About rotations*

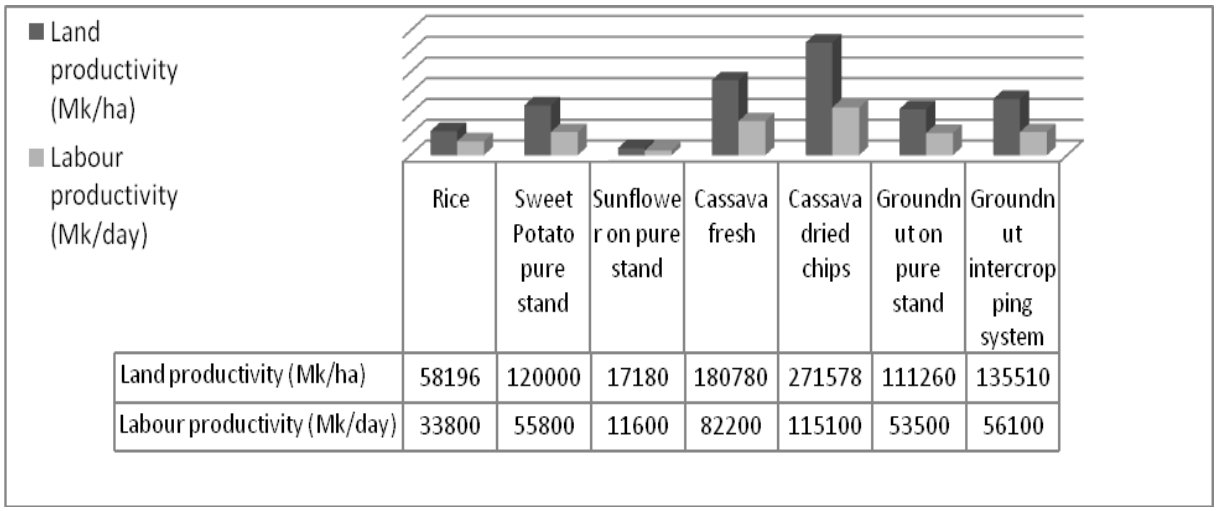
Rotations between maize, tobacco and groundnut exist. Groundnut and maize are cultivated with a one to two year rotation. Tobacco and maize are cultivated with a one to three year rotation. Sweet potato is introduced in the rotation: it is planted after cassava grown on pure stand (which is harvested in February), after the harvest of maize (March to May) or, as the first crop cycle of the year on the plot. But, as it will be explained in the description of farming systems, all farmers do not practice rotations.

<table>
<tr><td>O.52 ha</td><td>Plot 1<br>0.2 ha</td><td>Plot 2<br>0.1 ha</td><td>Plot 3<br>0.05 ha</td><td>Plot 4<br>0.05 ha</td><td colspan="2">Plot 5<br>0.1 ha</td><td>Plot 7<br>0.02 ha</td></tr>
<tr><td>Year 0</td><td>Maize</td><td>Tobacco</td><td>Groundnut</td><td>Maize</td><td>Maize 0.05</td><td>sweet potato 0.05 [16]</td><td>Rice</td></tr>
<tr><td>Y - 1</td><td>Maize 0.15 ha<br>Sweet potato 0.05 ha</td><td>Tobacco</td><td>Maize</td><td>Groundnut</td><td colspan="2">Maize</td><td>Rice</td></tr>
<tr><td>Y - 2</td><td>Tobacco 0.1 ha<br>Maize 0.1 ha</td><td>Maize</td><td>Groundnut</td><td>Maize</td><td colspan="2">Sweet potato</td><td>Rice</td></tr>
<tr><td>Y- 3</td><td>Tobacco 0.1 ha<br>Maize 0.1 ha</td><td>Maize</td><td>Maize</td><td>Groundnut</td><td colspan="2">Cassava 0.05<br>Maize 0.05</td><td>Rice</td></tr>
</table>

*Figure 13 Allotment – smallholder, (5 ha): maize, tobacco, groundnut, sweet potato*

[16] 2nd cropping cycle

### *4.3.2. Comparison of net added value for main cropping systems*




| | Rice | Sweet Potato pure stand | Sunflower on pure stand | Cassava fresh | Cassava dried chips | Groundnut on pure stand | Groundnut intercropping system |
|---|---|---|---|---|---|---|---|
| Land productivity (Mk/ha) | 58196 | 120000 | 17180 | 180780 | 271578 | 111260 | 135510 |
| Labour productivity (Mk/day) | 33800 | 55800 | 11600 | 82200 | 115100 | 53500 | 56100 |

*figure 14 Net added value - main cropping systems (except maize and tobacco)*

Excepting maize and tobacco cropping systems, cassava grown on pure stand is the cropping system that creates the highest net added value. But this cropping system is not practiced by all the farmers. Besides, only a small proportion of the cultivated surface is dedicated to cassava when it is cultivated. Long term maturation cassava varieties are used (one year and more). The occupation of the land competes with maize cropping systems. This issue is all the more serious in the study area, where being maize self-sufficient is the goal of each and every farmer.

On the figure 15, labour productivity and land productivity of all cropping systems are compared. It is quite obvious that the most profitable cropping system is tobacco when fertilization is intensive and the production is sold at the auction floor. This is why many farmers even among the smallholders started this cropping system when prices increased two years ago. Nevertheless, it is not accessible to all as investment in capital is high (shelter, plastic sheet, sacks), as well as operational costs (wool, chemical at the nursery, fertilizers). Alternatively, farmers cultivate tobacco and sell it to local vendors, or turn to other cash crops as groundnut and sweet potato.

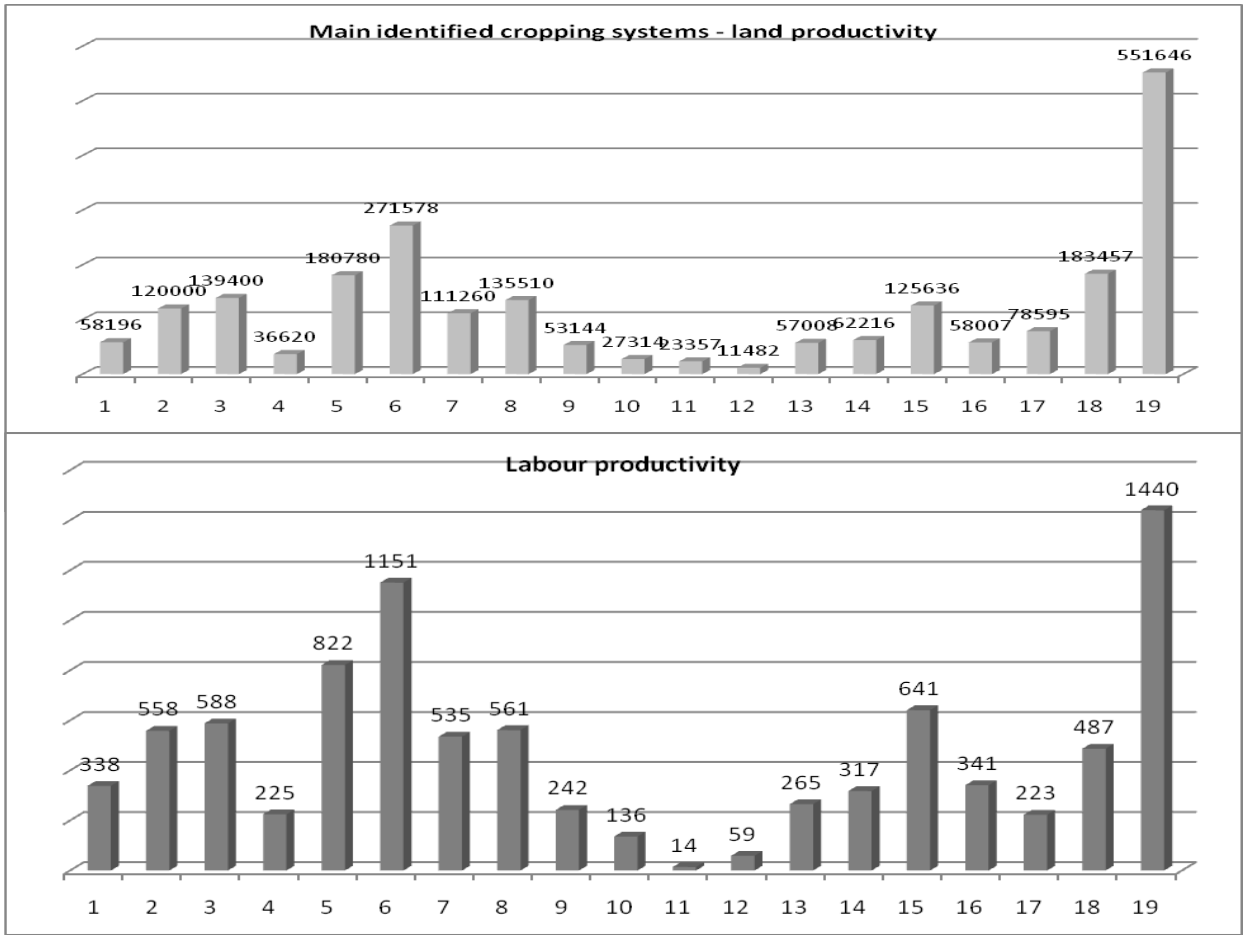



*figure 15 Land and labour productivity - main identified cropping systems*

| | |
|---|---|
| 1 | Rice |
| 2 | Sweet Potato pure stand |
| 3 | Sweet Potato with leguminous |
| 4 | Sunflower with leguminous |
| 5 | Cassava sold fresh |
| 6 | Cassava sold into dried chips |
| 7 | Groundnut grown on pure stand |
| 8 | Groundnut intercropping system |
| 9 | Maize intercropping system 6(pigeon pea, pumpkin, cow pea, sorghum, cassava); 250 KG of fertilizer/ha |
| 10 | Maize intercropping system 5 (pigeon pea, pumpkin, cassava); 250 KG f/ha |
| 11 | Maize intercropping system 2 (local maize, pigeon pea, pumpkin); no fertilizer |
| 12 | Maize intercropping system 2 (local maize, pigeon pea, pumpkin): 250 KG f/ha |
| 13 | Maize intercropping system 1 (Hybrid maize + pigeon pea) ; 250 KG f/ha |
| 14 | Hybrid maize grown on pure stand 250 KG f/ha |
| 15 | Hybrid maize grown on pure stand 500 KG f/ha |
| 16 | Tobacco system 1 |
| 17 | Tobacco system 2 |
| 18 | Tobacco system 3 |
| 19 | Tobacco system 4 |

# 5. Breeding systems

**Breeding has never been very developed in the area.** Before the 1940's each family had a few goats, sheep and hens. Goats and sheep were let free to graze, only supervised in the rain season. Some farmers bought **cattle in the mid 1940's,** with cash coming from tobacco and cotton cultivation and from labour migrations abroad. From the 1940's and until 1964, animals became more numerous. Cattle and goats were grazing upon tight supervision in *dambo* areas (zone 4 grassland). Farmers indicated that the peak number of cattle was reached in the mid 1960's. After the Independence, agricultural policies encouraged the development of crops to the detriment of pastures. Besides, land pressure gradually increased. As a consequence, breeding activities became difficult and the number of animals decreased.

Cattle and goat breeding drastically decreased in the late 1990's to early years 2000 because of **theft**. Nowadays, about one to two household per village keep cattle. Among them, some have an ox cart and boos for transport. However, most of the cattle belong to large holder farmers, the elite that went working abroad and managed to invest in livestock.

**Goats and chickens are the most widespread livestock.** According to field interviews, 73% of households keep at least one hen (50% of them have only one hen). Chickens are bought in first place as short term savings. 40% of households keep goats. So, 40% of households have at least both one goat and one hen.

22% of interviewed households have one **pig** (up to three). After goats, it is the first livestock to be bought as long term saving.

**Small livestock breeding** is developed among middle and large holder farmers. Turkeys, guinea fowls, (each of them are found in 10% of interviewed households), ducks, pigeons and rabbits in minor proportions.

As shown on this graph, the net added value ranges from 2 400 Mk to 21 000 Mk per female per year according to the breeding system. It is important to notice that farmers do not seek the maximization of economical results for breeding systems. Animals are only fed when necessary, fattening is not practised, and veterinary expenditures are null. Livestock stands rather for savings.

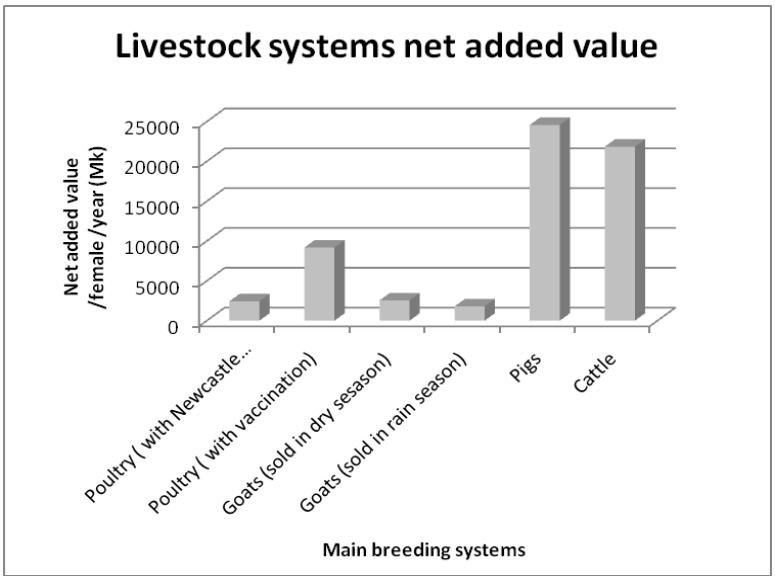



*Figure 16 Main identified livestock systems-net added value (data: personal elaboration, from field interviews)*

### 5.1. Poultry farming

Poultry farming already existed at the beginning of the XIX$^{th}$ century. It was used to pay the hut tax, as colonialists accepted to be paid in kind. Even the smallest farmers breed hens. 50% of farmers have only one hen. The others have in general 3 hens. Poultry in the surveyed area is a local species. Very few farmers among the biggest land holders breed improved species such as Australop[17] because they are more expensive and have to be fed with maize bran and salt. The phenomenon is negligible.

Chickens are left free during the day but kept inside the house at night in a special place because of thieves. Chickens eat vegetal residues in the fields and domestic detritus. They may receive maize bran and salt when the farmers can afford to buy those products (i.e. from May to November). The majority of the farmers do not provide complementary feeding to their chickens. A hen lays eggs every three months: 12 eggs are laid and hatched. 8 chicks will survive up to adult age.

Some of the adults are sold: cocks in priority, young hens at around seven months. Hens seem to be sold at two years on average, even if they could be kept for 5 years maximum. Some are killed to be eaten, if the farmer can afford to eat meat. On the local market (after 7 months of growth) farmers earn between 350 and 600 MK per hen and between 450 and 700 MK (2.5 and 3.5 €) per cock. Prices vary with the months and the weight of the animal. During the food shortage period, prices are low because many farmers sell their poultry in order to buy maize. Prices are also low in August to October because of Newcastle Disease: animals are likely to be unhealthy, and farmers tend to sell them before they get sick. The highest prices are found in July and December: many chickens are bought for National Day and Christmas.

Taking into account this information, calculation **of net added value per year tells us that a female and hers chicks can bring in up to 9,100 Mk.** If farmers feed their hen and chick with salt (1 KG per year) and maize bran (50 KG per year), they spend 550 Mk per year. But as farmers do not vaccinate their poultry against *Newcastle* disease, it is estimated that 75% of the chickens die. In that case, the gross productivity is divided by two: **2437 Mk** per year.

Calculating the net added value for poultry breeding is difficult, for several reasons. First and most importantly, the Newcastle disease rages every single year. If one chicken is infected, then the entire household's poultry will die. That is why farmers tend to sell their poultry before the disease's peak (August to September) and buy new animals when prices are low in January to February. But if they are in a food shortage situation, they have to wait until April to May to renew their livestock. Poultry is seen as a very short term saving. Hens are bought as soon as the household gets cash, and sold to solve any treasury problem in the family (sickness, buying clothes, household goods). So flows of purchased and sold animals are frequent and irregular. De facto, hens are kept for a period of time inferior to two years. Eggs are often eaten, so the average number of eight surviving chicks is not accurate.

[17] *Mikolongwe* in chichewa

As a consequence, the net added value calculated here is certainly largely overestimated. It corresponds to the gross margin obtained by a farmer who keeps a hen two years, sells the chicks at seven months, and does not eat eggs. One of the most common businesses in the surveyed area is the one of chickens. Vendors buy poultry on local markets and sell it back in other markets, or even in Zomba town where prices are higher. For example, a hen bought 400 MK in Sunuzi market will be sold 500 MK in Zomba. Cross-border business of poultry is very developed, as prices are lower in Mozambique.

### 5.2. Goat breeding

From November to April, crops are omnipresent and animals pasture under the supervision of children (in the afternoons after school). Goats are led in *dambo* areas, where grass is abundant in that season. But children are often careless. Many conflicts between farmers arise because of goats eating crops. Goats are particularly attracted to pigeon peas and cassava plants, which remain in the field until July and August. Those damages to crops are non negligible for many farmers. From May to October, goats eat crops residues not buried and domestic detritus.

Goats feed by themselves throughout the year. They are led to drink water from the river, streams or water holes in *dambo* according to the season. They are kept in a shelter built off the ground with wood poles. There are no medical treatments, vaccinations, or any other charge. It is not necessary for farmers who do not have a male to rent one, as animals meet while grazing. Instead of buying goats, farmers "borrow" goats. A farmer who has goats gives one to another farmer who has none. After reproduction, one young goat is returned to the lender. It is an interesting practice to increase the livestock in the area.

Goats are not eaten by their owners, except for weddings and funerals. They are not kept for their milk. They represent a saving and insurance. One goat can be sold at any time of the year to solve a problem in the family. On local markets, the price of a female goat is 3000 Mk, and 4500 Mk for a male. The price depends on weight and health, not on age. Prices vary according to the season. Goats are sold at cheaper prices in the rain season and at higher prices in the dry season. If farmers have no particular problem and can choose the moment to sell their animals, they will do it in June to September. A female reproduces almost twice a year, giving birth to one to two offspring at a time. **The net added value per female per year is estimated at 1865 Mk for goats sold during dry season and 1805 Mk for goats sold in rainy season.**

### 5.3. Pig breeding

It is the third breeding system observed in the surveyed area. 22% of interviewed farmers have pigs, one female in most of the cases, sometimes two females and one male. It is a heavy initial investment. Furthermore only few farmers can afford to buy the required food throughout the year. Production is only aimed at being sold.

A female reproduces twice a year, giving birth to 12 piglets, but only 6 will survive. The price for an adult female of 3 years is 15 000 Mk. The price of a six month piglet is 4000 Mk. Farmers try to sell the piglets as soon as they are weaned to avoid paying for food, or at least before they are 6 months. Concerning charges, alimentation is provided the whole year. One

female pig and her dependants consume each month: 80 KG of maize bran, one packet of soda (5 g.) and half KG of salt. In addition, pigs are given pumpkin when it is available.

Some farmers substitute maize bran with rice bran, which can be bought at the Jali rice mill (about 25 Km away). Rice bran is cheaper than the maize one and pigs tend to eat smaller quantities. Those pigs seem to be healthy.

Animals are kept in small rooms close to the family house, made of wood, mud and grasses. They are left outside a few hours each day under **tight supervision** to avoid crop destruction. Manure is collected and applied in the field surrounding the house. Renting a male for reproduction costs at least three piglets of three month old. **The net added value per female and per year is estimated at 11913 Mk**.

### 5.4. Cattle breeding

Cattle owners were more numerous in the 90's. Some farmers sold their animals for fear of thieves who were active in the early years of 2000, and because they got old. It is important to notice that there is a large *dambo* South of lake Chilwa. Many cattle are kept there by owners who live far away (in town for example). So most of the cattle in the surveyed area has been purchased there, and might be kept there until the cow is in age of reproducing.

Cattle breeding is only aimed at producing and selling the meat to butchers coming from Jali or Zomba town (50 Km away) who travel around villages. One female gives one offspring in two years starting at three years old. Mortality rate of adults is high because they break legs in the rain season when the soil is slippery. Cattle are led to *dambo* areas (zone 4, grassland) or hills (zone 1) for grazing. In addition, when available, stems and leaves of pigeon peas, groundnut, and pumpkin are given in the collar. Animals are under supervision of young boys, who are paid if they are not of the family. From August to November, the only water source where to lead the cattle is the Phalombe River. In the rain season and up to July other streams are available (*dambo,* zone 4). There is no need of renting a male for reproduction if the farmer does not have one, as mating occurs while grazing and meeting other herds. Cows are not always vaccinated and do not receive any preventive treatment. If a veterinary has to come, only medicines are paid. For economical calculation, veterinary expenses will be considered as null. A three year old cow is bought 28 000 Mk (in February, period of lowest prices). It is sold back at 14 years old at 55 000 Mk. Males are sold from 5 to 10 years old, from 55 000 to 70 000 Mk. The collar is cleared once a year. 15 animals will produce about 36 bags of manure, applied on neighbourhood maize fields before sowing. In addition, chemical fertilizers are applied afterwards. The **net added value per cow and per year is estimated at 28930 Mk.**

Only one farmer in the surveyed area has an oxcart. The others used to have one in past years, but it is no longer operational, or they have no oxen trained to transport. It is a very heavy initial investment, and interviewed farmers say that it is not profitable. The cart itself costs 97 000 Mk (wooden cart) or 130 000 Mk (metal cart). Each ox costs 36 000 Mk. Villagers rent it to transport timber and harvested crops if fields are located far from the house.

## 5.5. Small breeding systems

### *5.5.1. Turkeys*

Turkeys lay from 12 to 18 eggs **in the bush** in a span of about four months, so many of them are lost. Around 7 chicks usually survive until adult age, when they are sold. Chicks are fed with "chick mash" for their first month: 25 KG of industrial preparation are necessary in total. Chicks and adults are given maize bran and salt, costing about 2100 Mk per year. A female costs about 2100 Mk, and a chick about 500 Mk.

### *5.5.2. Rabbits*

Only two interviewed farmers breed rabbits. The price of a young one is 400 Mk but so far the new born died. Rabbits seem to be very sensitive to cold and humidity. The mortality rate is very high in the rain season. They are fed with crop residues (pigeon pea, maize, sweet potato...) and weed.

# 6. Farming systems

Now that the cropping and breeding systems have been presented, let us try to consider them in a dynamic way. The aim of the farming systems' analysis is to understand how and why farmers combine different cropping and breeding systems.

## 6.1. Cash flow calendar

**Receipts and expenses calendar** (cf. Appendix 12) enable us to understand the farmers' constraints and logic. Each family faces different types of expenses in a year:

- The **agricultural expenses**. Seeds and fertilizers are purchased in October before the main cropping season. Those who cultivate irrigated crops purchase other seeds from March to May.

- **Land**: the rent of the land is paid after the harvest in cash, sometimes in kind.

- The **food expenses**: salt, cooking oil, sugar, dried fish and tomato, beans, leaf vegetables... are purchased throughout the year whenever cash is available. Maize is purchased only if the harvested maize is entirely consumed i.e. during the food shortage period, when prices are the highest. Some farmers are able to anticipate and buy maize earlier in the year before the prices increase.

- The **household goods**: paraffin, mats, plates and pots, sieves, baskets, winnowers...

- The **expenses linked to religious or traditional feasts**: weddings, Christmas in December, National Day in July...

- **Clothes** (and shoes) represent a considerable post of expenses. New clothes have to be purchased for children once a year. Women have to be well dressed for meetings, social events and ceremonies. Shoes are essential for adults.

- Other expenses such as school materials, Secondary School fees and medical attendance have to be added.

Farmers have difficulties to face unexpected expenses, such as a medical treatment, hospitalisation, or a funeral. On such occasions decapitalisation of livestock may be decided (poultry or goats).

Depending on the farms, different solutions are conceived to face the expenses:
- The sale of a part of maize, leguminous, sweet potato or cassava harvest, or tobacco leaves.
- The sale of livestock: chickens, goats, cattle.
- Labour force sale (*ganyu*)
- Selling of processed products from the farm is rare. Women cook sweet potato, make bread, fritters and sell them on local markets but ingredients are often purchased outside the farm.

The resort to one or another of these solutions illustrates the differentiation between the exploitations. The smallest the farm is, the more often they have recourse to *ganyu.* The sale of maize and other cereals, leguminous and tobacco (proportion of self-consumption, seeds keeping and sale) is also a criterion of differentiation. The majority of farmers sell their

harvest before October. They cannot wait for the price to increase, because they have to pay their agricultural expenses, and to face the needs of their family.

Four main groups of farms have been discerned in the typology. The exploitations are differentiated by the cultivated surface, the number of family workers, the recourse to external labour force, the cropping systems and breeding systems practiced and the access to markets.

### 6.2. Agricultural income per family worker

The graph shows agricultural income per family worker according to the surface per family worker. The scatter plots represent the different types of farmers.

The unit of production is the base for the **calculation of the agricultural income.** In the surveyed area, one **unit of production** basically corresponds to a house. Unmarried young men or women who build a house close to their parents' are still part of the same unit of production as they cultivate on the same fields and eat together. But recently married couples who live in a house closed to their parents' constitute a distinct unit of production, as they cultivate their own fields without the help of their parents and cook their own food: their income is calculated independently.

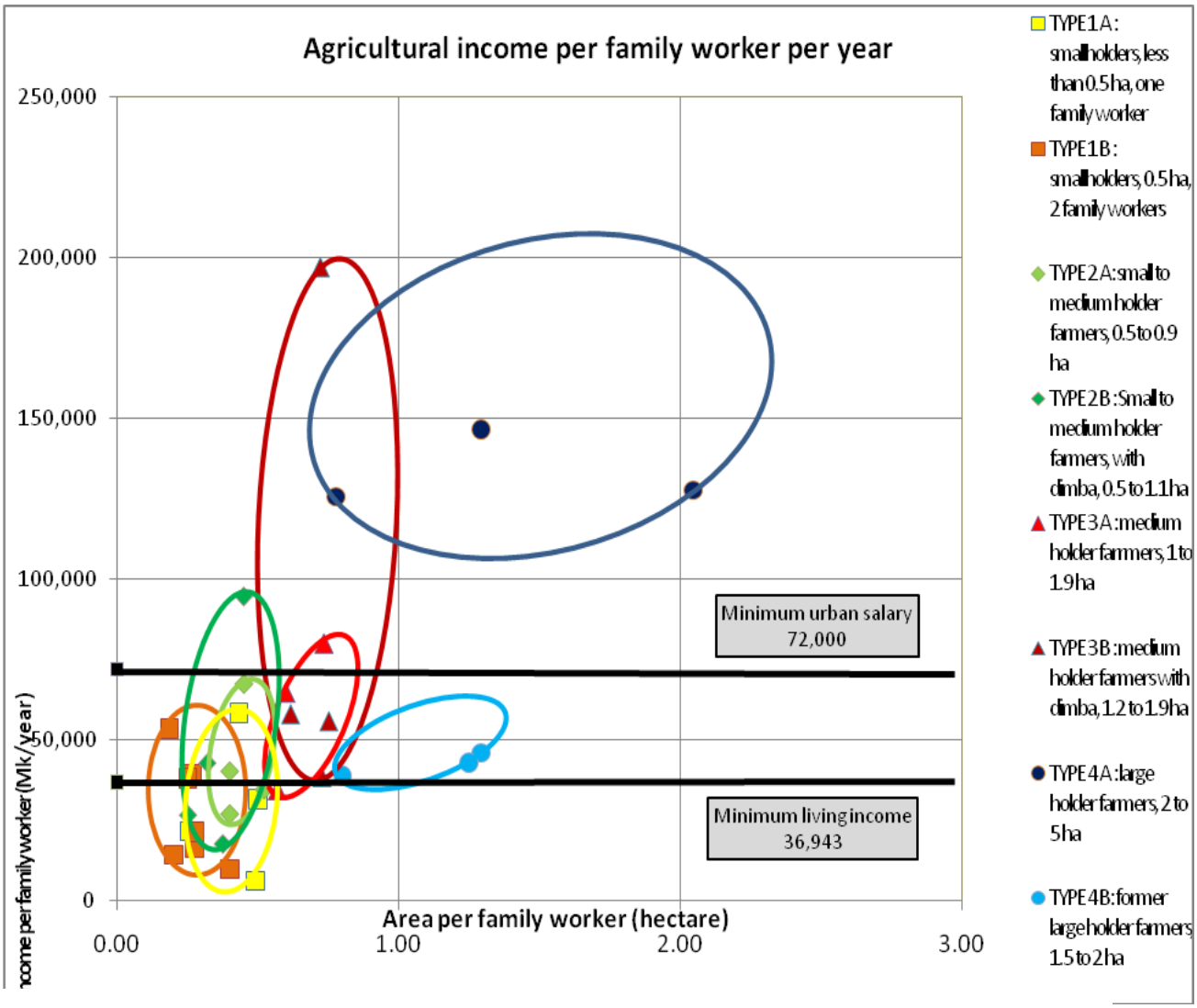



*Figure 17: Agricultural income per family worker per year (personal elaboration, data from field interviews)*

## 6.3. Typology of farming systems

### *6.3.1. TYPE 1 : Smallholders*

Among smallholder farmers, two sub-categories have been identified.

#### *6.3.1.1. **TYPE 1 A**: 0.5 Ha, one family worker*

| |
|---|
| 8% of households<br>Cultivated surface: 0.5 hectare, with 1 to 1.32 family workers.<br>Income per family worker: 6000 to 55 000 Mk. |

Those exploitations are confronted by a **lack of labour force**. They are women-headed households in charge of children, old widows, or households with a sick family worker. In addition, they face a **lack of capital** to buy seeds, fertilizers, and livestock.

They cultivate **almost only maize intercropping systems** (at least 84% of cultivated surface). Local maize intercropping system 2 dominates: pigeon pea and pumpkin are associated to maize. The net added value is the lowest among all maize intercropping systems. Sorghum, cassava and cow pea are sometimes associated, but not everywhere and the planting density is low. Sunflower may be added in January between maze plants. Hybrid maize (subsidized seeds: 0.1 ha) is associated with pigeon pea. Groundnut may be grown on pure stand but in many cases it is included in maize intercropping systems, which implies very low yields. Up to 10% of arable land may be dedicated to rice and sweet potato, but in many cases those cropping systems are impossible because of labour peak period in January to February. Maize is grown without any rotations (except with sweet potato). Subsidized fertilizers are not always purchased as cash is lacking in October.

Those households do not all possess a bicycle. Hoes cannot be changed as often as they should be: one large hoe per family worker. Those farmers only use subsidized fertilizers. They may sell back their coupons because of lack of cash. They have no animals, or only one to two hens.

All the active persons and children **go to *ganyu* from the time they run out of food** until the beginning of March (harvest of green maize or hybrid maize).This **affects negatively the work on their own fields** (especially for weeding and banking in maize fields, cultivating rice and sweet potato). In addition, they go to ganyu throughout the year in order to get cash and meet the needs of the household (food (salt, "relish", clothes....). They rarely sell products from the farm; if they do so the sale occurs as soon as the crops are harvested (groundnut, cow pea, pigeon pea, sweet potato: maximum one bag each)

*Evolutions:* This type of farming system is not sustainable on the long term. The basic needs of the household are not met as the agricultural family income is inferior to the minimum living income. Soon or later those exploitations will disappear. Indeed young widows or divorced women may get married; old women are likely to be helped by relatives, older children and teenagers will go to work off-farm on a regular basis.

*6.3.1.2. TYPE 1 B : 0.5 Ha, two family workers*

| |
|---|
| 23% of households<br>Cultivated surface: 0.5 ha with two family workers (about 0.25 ha per family worker).<br>Income per family worker: 15 000 to 53000 Mk |

Three sub-types are to be differentiated:

1- **Maize intercropping systems dominate** (82% of total surface). Local maize is associated to pigeon pea and pumpkin (system 2). Cassava is also added but planting density is low. Sorghum and cow pea are more common. Hybrid maize is associated to pigeon pea (at least 0.1 Ha, subsidized seeds). Groundnut is grown on 7% of the surface (groundnut intercropping system or groundnut on pure stand).

2- 68% of the surface on average is dedicated to maize intercropping systems. In addition, a **small plot of tobacco** is cultivated; the production is sold to local traders (system 1). Those exploitations only use subsidized fertilizers for maize, and may buy additional quantities for tobacco field (10 to 20 KG). Groundnut is grown on 7% of the surface (groundnut intercropping system or groundnut on pure stand).

3- **Tobacco occupies 40% of the total surface, and about 50% is dedicated to maize** intercropping systems. Production is sold to both auction floor and local traders (system 2). Those farmers cultivate tobacco on a cyclical basis, in order to take advantage of favourable prices. Groundnut is grown on 7% of the surface (groundnut intercropping system or groundnut on pure stand).

Some exploitations also cultivate rice (less than 500 m²), and a small plot of sweet potato. They have one to two hens, and sometimes one goat.

They go to ***ganyu* from the time they run out of maize** (from July to October) up to the beginning of March. The man goes to *ganyu* in Mozambique at least once a year for a few weeks from January to February, and also from September to October. In addition, many of them have a small business that does not demand initial investment (working on fish boats in Lake Chilwa; small maize, chicken and dried fish trading; construction work). In fact, it is in this category that the largest number of households with an additional non agricultural income is found.

Many of those households are **young couples.** They face a problem of **lack of land,** so they often have to **rent fields,** which is an **insecure situation** as explained previously in the description of current agrarian system. Rented land changes each year. As a consequence, they cannot practice rotations between maize, tobacco and groundnut plots. The soil might not be suitable for all cultivations. The field is often found and rented too late (in October) to start a tobacco nursery. **Lack of capital** forces young couples to migrate to tobacco estates in Rumphi and Kasungu regions. Few of them manage to save money to invest in the farm when

they come back. Most of the time the household faces the same problems when coming back. Furthermore, they have to beg food from their relatives during the period before they can harvest their crops.

### *6.3.2. TYPE 2: small to medium land holder farmers, 0.5 to 1.1 ha*

Those exploitations are in a very **unstable position** that depends on the maize harvest. According to the year, those farmers may be able to employ *ganyu* people for a few operations in their fields, or they may have to go to *ganyu* themselves.

External labour force may be employed for weeding and banking (from end December to February), preparing the land and making ridges in the fields (July to September), preparing the land of the boxes before transplanting the rice (January) and planting sweet potato (February), and grading tobacco (April). In many cases hiring *ganyu* is not strictly necessary. Work could be carried out within the family. But employing people allows to rest, to have an off-farm activity, and to take very good care of the crops. Work is remunerated in kind (maize grains and rarely cassava), or in cash (from the sale of maize, tobacco or groundnut).

Two types of small to medium farmers have been identified, differentiated on access to *dimba.*

#### *6.3.2.1. TYPE 2 A: 0.6 to 1 ha*

| |
|---|
| 11.4 % of households<br>Agricultural family income: 25 000 to 67 000 Mk<br>Total surface: 0.6 to 1 ha; 2 with 2.32 family workers (0.4 to 0.5 ha per family worker). |

In appearance, very few elements differentiate those farmers from TYPE 1B.

The main variation is that they cultivate a larger surface: more than 0.5 to 1 ha. As a consequence, their crops are more diversified compared to the smallholders' ones. Groundnut (on pure stand or intercropped with pigeon pea), sweet potato, cassava and rice are grown systematically. They may be able to employ *ganyu* for a few operations in labour peak periods, mostly weeding and banking. They are not always auto sufficient in maize. They are likely to go to *ganyu* themselves depending on the year. Alternatively, they can rely on their cash crop (tobacco, groundnut) to buy the lacking bags of maize.

Three sub-types are observed according to cropping systems practiced.

1- **Maize cropping systems dominate** (80% of the total surface). Hybrid maize is grown on pure stand or intercropped with pigeon pea. Local maize is intercropped with pigeon pea and pumpkin (system 2). Cassava, or cow pea and sorghum are added on most of the maize plots. Tobacco is not cultivated. Groundnut is the cash crop, and is grown on pure stand or associated with pigeon pea. Groundnut, sweet potato, rice and cassava occupy 20% of the cultivated surface.

2- The same as above, except that a **small plot of tobacco** is cultivated as well (system 2). Tobacco, groundnut, sweet potato, rice and cassava occupy 20% of the cultivated surface.

3- Tobacco occupies 50% of the cultivated surface. Those farmers have to employ ganyu frequently from January to March. Maize cropping systems are cultivated on 30% of the surface. Groundnut, sweet potato, cassava and rice occupy the remaining 20%.

They can afford to buy fertilizers in addition to subsidized one.Livestock is more numerous than in TYPE 1: 1 to 3 hens, 1 to 2 goats, sometimes turkeys, guinea fowls, and ducks, and even one pig.

One to two bicycles are used. Different sized hoes are available: one large hoe per family worker, one middle sized hoe per family worker, and small planting hoes. If they grow tobacco they have one watering cane.

#### *6.3.2.2. TYPE 2 B: 0.5 to 1.1 ha, with access to dimba*

| |
|---|
| 9.8% of households<br>Total surface: 0.5 to 1.1 ha, 0.25 to 0.45 ha per family worker<br>Income: 18 000 to 94 000 Mk |

Those exploitations are similar to TYPE 2A, except that they also cultivate a *dimba*

Irrigated crops constitute an important part of the agricultural income for those households. An important part of the working time is dedicated to the *dimba.* In the rain season, they cultivate maize, which improves their food security. In the dry season, they cultivate maize in two sessions: from March to July, and from July to October. In parallel, they grow leaf vegetables (pumpkin leaves, mustard) and tomato. In many cases, the use of the *dimba* is not optimized. The main obstacle is the lack of labour force as each active person works on 0.4 ha (apart from the *dimba*), and *dimba* cropping systems are very labour intensive. Daily watering is time consuming, especially if the family lives far from the *dimba.*

In general the crops are more diversified than TYPE 2A: cassava, sweet potato, sunflower take more importance in the cultivated surface. Some farmers even have one pig (often those who work off-farm because they can afford to buy maize bran).

Ganyu as a coping mechanism may be practised if needed during food shortage period. Men work outside the farm during the rest of the year but it is off-farm work: small business (chicken, cross border business, construction...).

### *6.3.3. TYPE 3 : Medium holder farmers, 1 to 1.9 ha*

#### *6.3.3.1. TYPE 3 A : Medium holder farmers, 1 to 1.9 ha,*

14.7% of households
Total surface: 1 to 1.9 ha, 2 to 2.32 family workers (0.5 to 0.75 ha per family worker)
Agricultural income: 35 000 to 80 000 Mk per family worker

Those exploitations **employ *ganyu* for many operations** in the maize and tobacco fields, not only in labour peak periods. They are **auto sufficient in maize**. Agricultural products are stored and sold when prices are the most advantageous. Maize is thus sold during the food shortage period from December to February.

Maize accounts for 50% of the total surface. Local maize and hybrid maize are cultivated in equal proportions. Hybrid maize is cultivated on pure stand or associated with pigeon pea. Local maize is associated to pigeon pea, pumpkin, and other plants (cassava, cow pea, sorghum, according to the plot). Tobacco occupies 30% of the surface, cropping system 3 or 4 are practiced. Sweet potatoes, cassava sunflower and rice occupy 20% of the surface. Livestock is more developed: 1 to 10 hens, 1 to 4 goats, sometimes one pig, guinea fowls, turkeys and ducks.

In terms of off-farm activities, medium holder farmers have more opportunities than TYPES 1 and 2, as they have higher investment capacities. They can buy and sell bicycles spare parts, plates and pots, baking bread. They practice cross-border business with Mozambique.

#### *6.3.3.2. TYPE 3 B : 1.2 to 1.9 Ha, medium holder farmers with dimba*

14.7% of households
Total surface: 1.2 to 1.9 ha, with 2 to 2.5 family workers, (0.6 to 0.75 ha per family worker)
Agricultural income: 38 000 to 200 000 Mk per family worker

They are very similar to medium holder farmers described previously, except that they have access to *dimba. Dimba* occupies more cultivated surface than in the case of TYPE 2B. The size of the dimba ranges from 0.1 to 0.2 Ha, which represents 12% of the cultivated surface on average. Maize is cultivated in rain season and dry season (two cropping cycles in dry season). In parallel, vegetables are cultivated: tomato and leaf vegetables (pumpkin leaves, mustard, rape); sweet potato, leguminous as crown pea, eventually sugar cane and sunflower are added in upper parts.

Those households are likely to be settled in the zone 5 near the River (but not systematically).

The crops are diversified: sunflower, soya, green grams, sweet potato, cassava and rice are grown. They either cultivate tobacco on a surface similar to the maize surface and sell it at the auction floor, or do not cultivate tobacco.

### *6.3.4. TYPE 4 : large land holder farmers*

#### *6.3.4.1. TYPE 4 A : 2 to 5 ha, specialized in maize or tobacco*

| |
|---|
| 6.5% households<br>Total surface: 1.8 to 4.5 hectares, with 3 to 4 family workers (0.8 to 2.1 ha per family worker).<br>Agricultural income: superior to 125 OOO Mk per family worker |

Family workers cannot provide all the necessary labour, and external workers are employed for all operations in the fields. In the biggest farms, *ganyu* contract workers are hired for the agricultural season. For example they are in charge of all operations concerning tobacco cropping systems.

Local maize and improved maize varieties are cultivated on similar surfaces. Hybrid maize is grown on pure stand or associated with pigeon pea, with intensive fertilization in any case (500 KG/ha). Local maize is associated with pigeon pea, pumpkin and cassava (with high sowing densities). Those farmers practice **organized rotations** between maize, groundnut and/or tobacco fields. They always burry the vegetal matter before making ridges as they can afford to hire *ganyu* early in the season to prepare the land.

Those farmers do not all grow tobacco. To quote one of them "my kids can't eat tobacco". Two sub-types have to be differentiated:

1- **Tobacco growers and traders**. those large land holder farmers produce tobacco with intensive fertilization and sell it at the auction floor (cropping system 4). They buy other farmers' tobacco (non-graded) in order to increase the quantities they sell at the auction floor. Tobacco occupies 20% of the cultivated surface (0.35 to 0.9 ha for the largest farmer). The rest of the surface corresponds to maize (65%), groundnut (9%) and rice, sweet potato and cassava (3%).

2- **Maize growers and traders**. They sell maize every year, at the Admarc (at the opening from May to June) in order to meet their storage capacities. But they mostly store the maize in order to sell it on local markets from December to February (during the food shortage period up to 5000 MK per 50 KG bag). Moreover, they are likely to buy other farmer's maize (from 10 to 50 bags) and sell it back during the food shortage period. Groundnut is the second cropping system: 16% of the surface.

They keep 4 to 20 hens, 3 to 10 female goats, 1 to 2 female pigs, turkeys, guinea fowls, ducks and pigeons. A few cattle keepers are observed in the surveyed area (about 1 per village), up to 3 cows. They are often part of the elite that went to work abroad in the years 1980's, most commonly in South African gold mines. They bought their cattle while still there or coming back. They tend to decapitalise, for two main reasons: 1) for fear of thieves 2) they are getting old (most of them are over 50 years old). Manure is applied on maize fields. A permanent employee is necessary to lead the animals to grazing areas and to the river.

Those farmers have an off-farm business. Some of them dedicate most of their time to it and get almost all the work in their fields done by external labour force. They do not reduce their agricultural activities or decapitalise to the profit of their business. Their children have the opportunity to undertake higher education.

They have big, middle sized and small hoes. They use several bicycles to sell their products at the market. They may even have a motorbike, which is intended to be used for an eventual off-farm business but also for transportation of farm products. This gives them an access to diversified markets.

*Evolutions*: motorbikes are expected to spread in the study area among this type of farmers. Spraying of chemicals as *Round Up* has been introduced. But this technique induces extremely high operational costs so its potential of extension is limited.

#### *6.3.4.2. TYPE 4 B: Former large holder farmers, 1.5 to 2 ha*

11.5% of households
They are currently cultivating from 1.5 to 2 Ha (0.75 to 1.30 ha/family worker). In the past, they were cultivating 2 to 4 hectares, as TYPE 4 A.
Agricultural income: 36 000 to 50 000 Mk per family worker (around minimum living income!)

They **shared out the land** to their children and they reduced or changed their activities in order to reduce the labour intensity of their production system. If they had *dimba,* they gave it to their children or relatives. If they had cattle, they sold it in the early 2000's. They reduced the importance of tobacco in their cultivated surface.

Even those exploitations can undertake the consequences of land pressure. For example, an interviewed farmer of 50 years old was previously cultivating 2 hectares (farmer TYPE 4 **A**) but remained with 0.8 ha after giving one field to each of his three daughter when they married. He is now a farmer of TYPE 4 B cultivating the same surface as TYPE 2A**.** The daughters own 0.4 ha of land each, so they have to rent fields to other farmers to produce enough maize for the family.

*Evolutions:* They live just above the minimum living income. Those people will share more land to relatives as they go older.

### 6.4. External income

Looking at the scatter plots on the graph (cf. Figure 17), it is quite obvious that the agricultural income is inferior to the minimum urban salary in most of the exploitations (about 80% of the exploitations according to field interviews). Nevertheless, rural depopulation is not observed. Furthermore, exploitations seem to hold out. The stability of the current agrarian system is intimately linked to the existence of external work and temporary migrations.

As exposed in the typology, all farmers have off-own-farm activities, which generate **external income**. These activities include the ***ganyu*, many types of labour contracts, informal businesses, cross-border business, handcraft activities, temporary labour migrations to Mozambique...** The part of the external income in the family income was difficult to estimate through interviews. Information on wages or profits made from informal businesses was hard to obtain, especially for bigger farmers.

The graph below represents the income per family worker and the part of agricultural income and external income that it includes for farmers type 1B. All Type 1B farmers have an external activity in addition to *ganyu*. Their agricultural income is inferior or just above the minimum living income. Thanks to their external income, they manage to haul up to the minimum living income level and even higher. Type 1A farmers are able to go to *ganyu*, which is a low waged labour. But they can hardly have any other off-own-farm activity due to their lack of labour force. This explains why the Type 1B households are less vulnerable than Type 1A.

A similar mechanism is observed for other types of exploitations. Type 3 farmers and Type 2 in a lesser extent are able to rise beyond the minimum urban salary through external incomes. Many Type 4 farmers are not seen any more as "farmers" in their village. They are "businessmen".

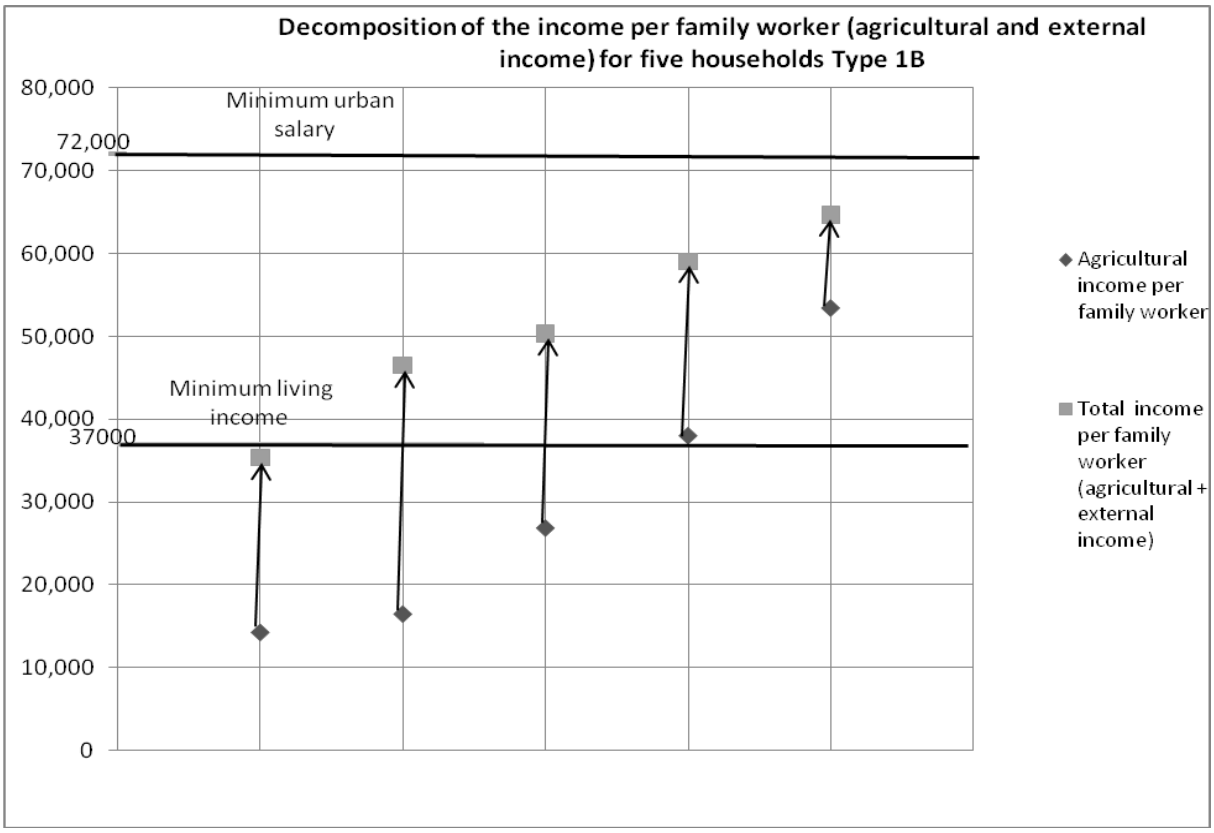



*Figure 18 Part of external income in total income per family worker (data from field interviews)*

# 7. Conclusions and suggestions

## 7.1. Around the typology

- **All types of exploitations can be observed in any zone of the landscape**. The only exception is the medium holder farmers with access to *dimba* (Type 3A) who are more likely to be settling in the zone 5 close to the River.

- Let us note that **this typology is dynamic, in other words "unstable"**. Any exploitation may fall down to another category at any time when a problem arises. On the contrary, interviewed households seem to be able to move up to a better situation from one year to the other. Key factors are climatic effects that influence the yields, and fluctuations of agricultural prices.

- Prices of one agricultural product may advantage one type of farmers one year but the situation can be reversed the next year. For example, many smallholders started **tobacco cultivation** in the 2008/2009 season after they saw the considerable profits that made tobacco growers in the 2007/2008 season. The number of growers increased by 350%. They significantly added to their income with this new cropping system (but profits were not as high as expected as prices fell down). Only farmers of Types 3 and 4 are regular Burley tobacco growers. Types 1 and 2 take advantage of the favourable circumstances.

- **Type 1A** smallholder farmers are the first victims of the low waged *ganyu* system. It is only a copping activity that does not allow investing on the farm. The sale of the family labour force affects the work on the own farm, creating a vicious cycle of degradation of the standard of life and the capital of the farm (livestock, seeds…). Furthermore, most of them do not have time to run a small business or any off-farm activity. Their agricultural income stands under the minimum living income. Those households are seeking immediate relief. They might be unable to take part in long term results activities because of the lack of time. They face social and health difficulties.

- **Type 4A** large holder farmers live on the other extreme. Their agricultural income stands far above the minimum urban salary. They often run businesses in addition to their agricultural activity. As a consequence, they are often named as "businessmen" in their village. Somehow, they run commercial exploitations: they store the farm production to sell it on the best prices, and buy other farmer's products.

- In **between those two opposite extremes, small to medium farmers form the majority of the households in the study area (80% of the exploitations - 0.5 to 2 ha).** Medium holder farmers of Type 3A and 3B (30% of the exploitations - 1.1 to 2 ha) differ in their agricultural income: they live above the living minimum income. Some of them even have an agricultural income equivalent to Type 4A, thanks to very productive cropping systems at the *dimba.* Farmers Type 3 all employ *ganyu* for most of the operations in the field. Farmers of **Type 1B, 2A and 2B altogether constitute 50% of the farmers in the**

**study area.** Their agricultural income is nearby the minimum living income. Farmers of Type 2 can even earn the minimum urban salary, according to the years. They all have an off-farm activity, which explains why their farming systems are sustainable in most of the cases, (on the contrary to Type 1A).

### 7.2. In gereral

- **Alternatives and complements to the use of chemical fertilizers** have to be developed in order to ensure the renewal of the soil fertility, as the soils lack organic matter. In addition, most of the farmers of the study area are not able to purchase chemical fertilizers at market prices by their own means (Type 1 and 2: i.e. more than 50% of the farmers). This trend is not going to change for the better, as fertilizer prices are expected to be on the upgrade in the next decades at international level, due to the oil crisis.

- The **food security of smallholders seems to be affected by climatic effects in first place**. The erratic nature of the rain season in the surveyed area constitutes the main obstacle to the growth of yields. Maize yields increase whenever fertilizers are applied. But this conclusion is based on an "average" year, which does not exist in agriculture. In case of a drought or heavy rains, maize yields are low anyway, whatever the quantity of fertilizer is applied. Therefore, **intercropping systems** should be encouraged in order to reduce the risks linked to the climate. Associated plants contribute to increase the net added value (land and labour productivity), especially if they are various. Leguminous are necessary to renew the organic matter of the soil. Maize intercropping systems including various associated plants are thus advisable. Intercropping systems can be practiced for tobacco, groundnut, sweet potato, sunflower....Ideally researches could be carried out on maize to stabilize local varieties adapted to each area at the national level. The use of manure and compost has to be widespread, relying on traditional techniques. Collection of poultry manure could be encouraged, as it is the most widespread livestock. The development of small breeding systems could contribute to improve the renewal of organic matter in the soil. As for the development of breeding systems, veterinary services and access to vaccination are lacking.

- **Conservation and processing** of vegetables will become essential if irrigated crops keep on developing (dried, canned...). Local markets and close urban markets are saturated during the peak production in the dry season. In general, processing methods of other crops as groundnut could benefit to all types of farmers as it would increase the productivity of all cropping systems and offer alternatives to *ganyu*.

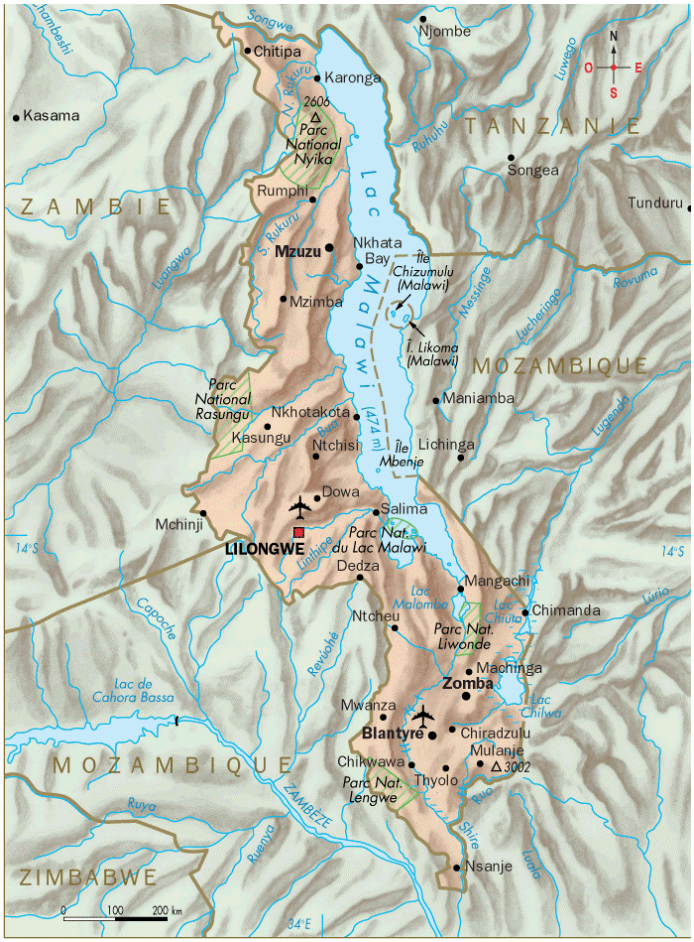
# APPENDIXES

## 7.1. Maps of Malawi (1)

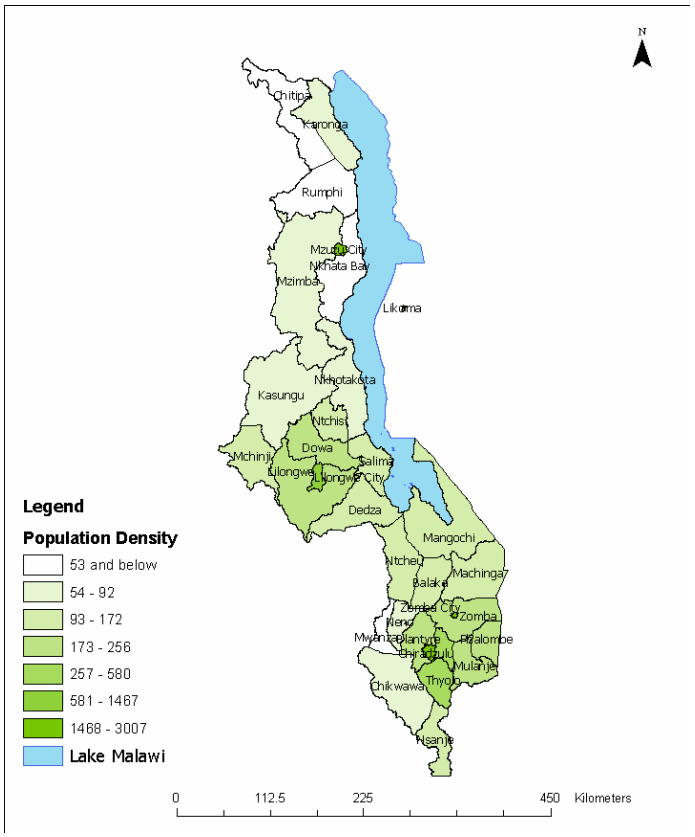

*map 1 Malawi in Africa*


*map 2 General map of Malawi*

## 7.2. Maps of Malawi (2)




*Map 3 relief*




*map 4 Density of population per District (number of inhabitants per km²) data NSO, 2008 Census Preliminary Results*

## 7.3. Localisation of the study area


*map 5 satellite picture of Phalombe Plain (data Google Earth)*

Area studied in April (landscape observation)

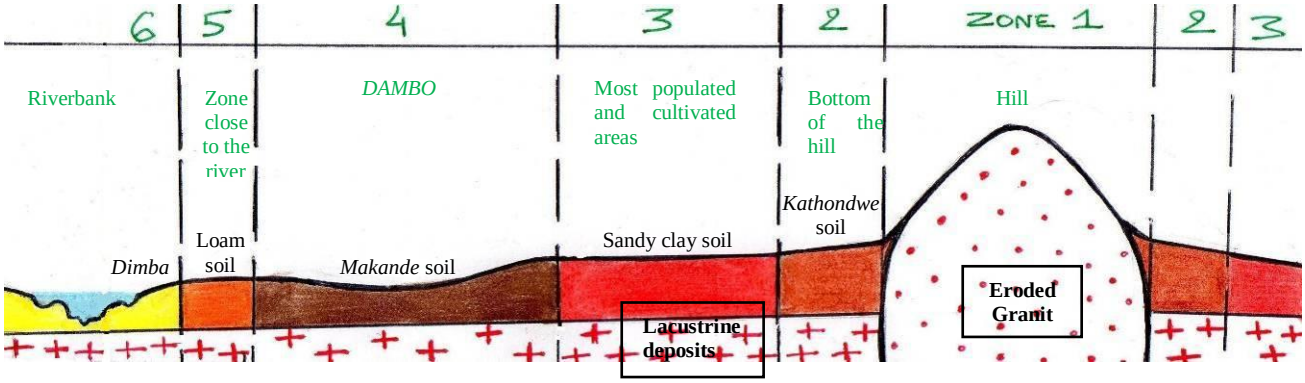
Selected villages for the study (May to September):
Tsekakhomo, Tawanga, Finyamoa, Tamani 2

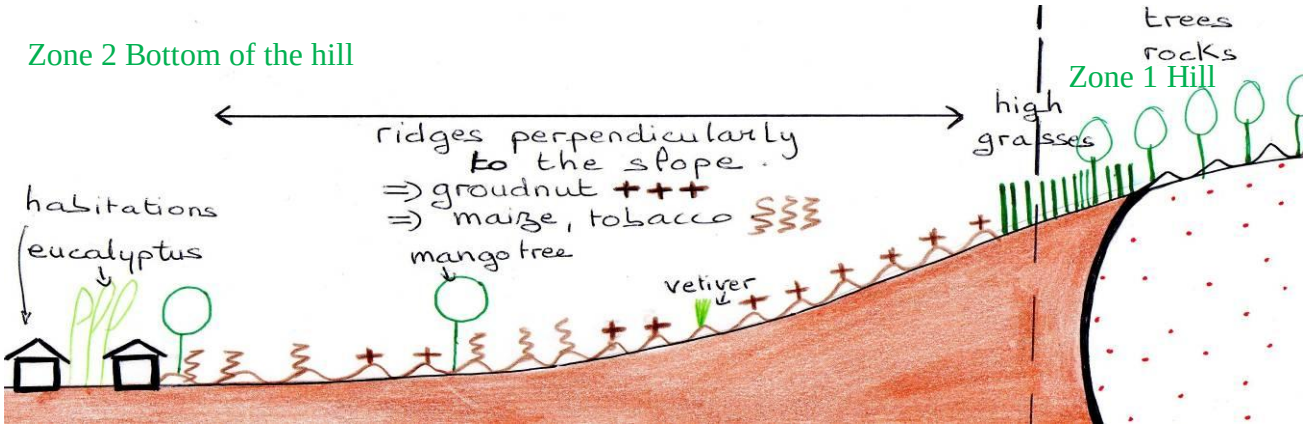
## 7.4. Satellite picture of the studied area


**map 6 satellite picture of studied area (data Google earth)**

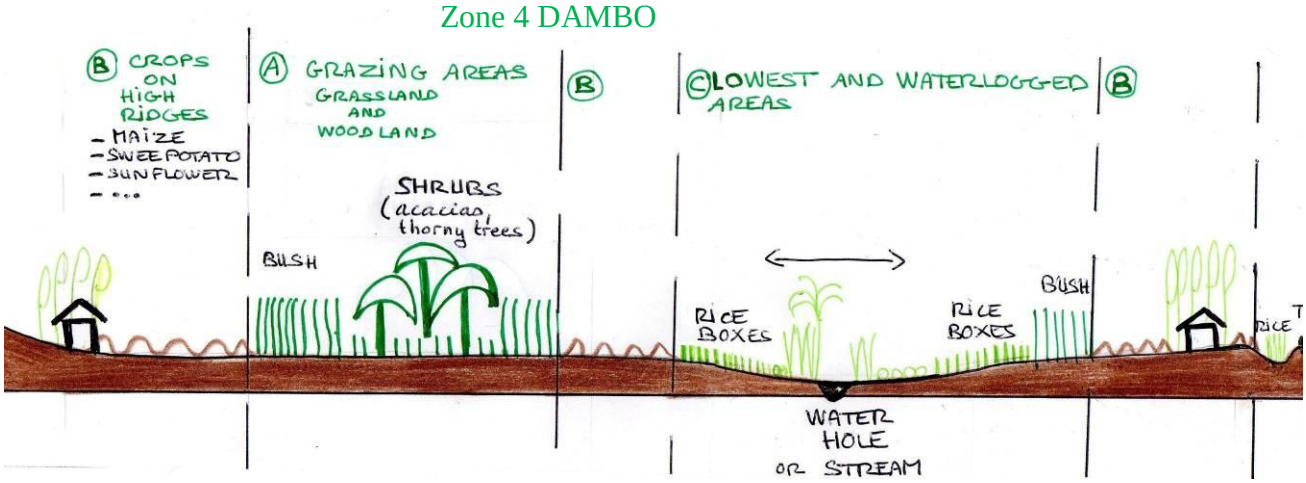
Selected villages for the study (May to September):
Tsekakhomo, Tawanga, Finyamoa, Tamani 2

## 7.5. Cross section of the landscape

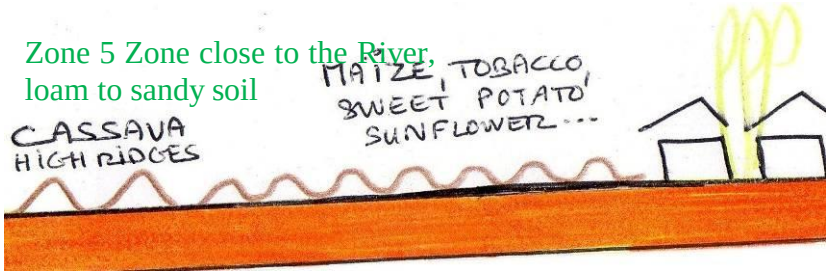


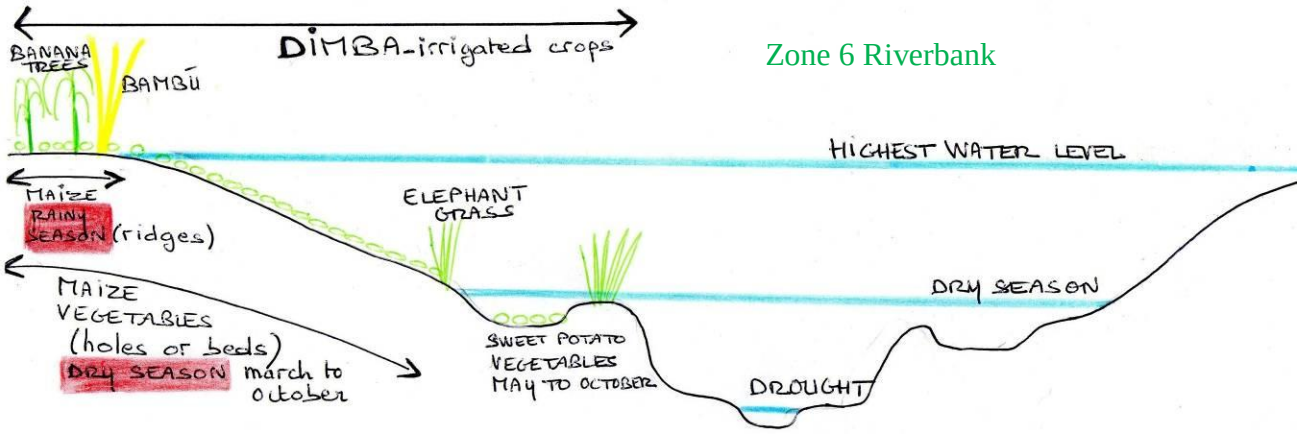




Zone 5 Zone close to the River, loam to sandy soil




Zone 6 Riverbank



## 7.6. Pictures

*Picture 1 : landscape from the top of Mianga hill, Sanje hill in the background (April, end of rainy season)*

*Picture 2 : Zone 3 in April*

*Picture 3 : Zone 3 in August*

*Picture 4 : Hill in August (zone 1)*

*Picture 5 Makanda soil in Dambo (zone 4)*

*Picture 6 : Grazing area in Dambo (zone 4)*

*Picture 7 : Rice boxes in Dambo (zone 4)*

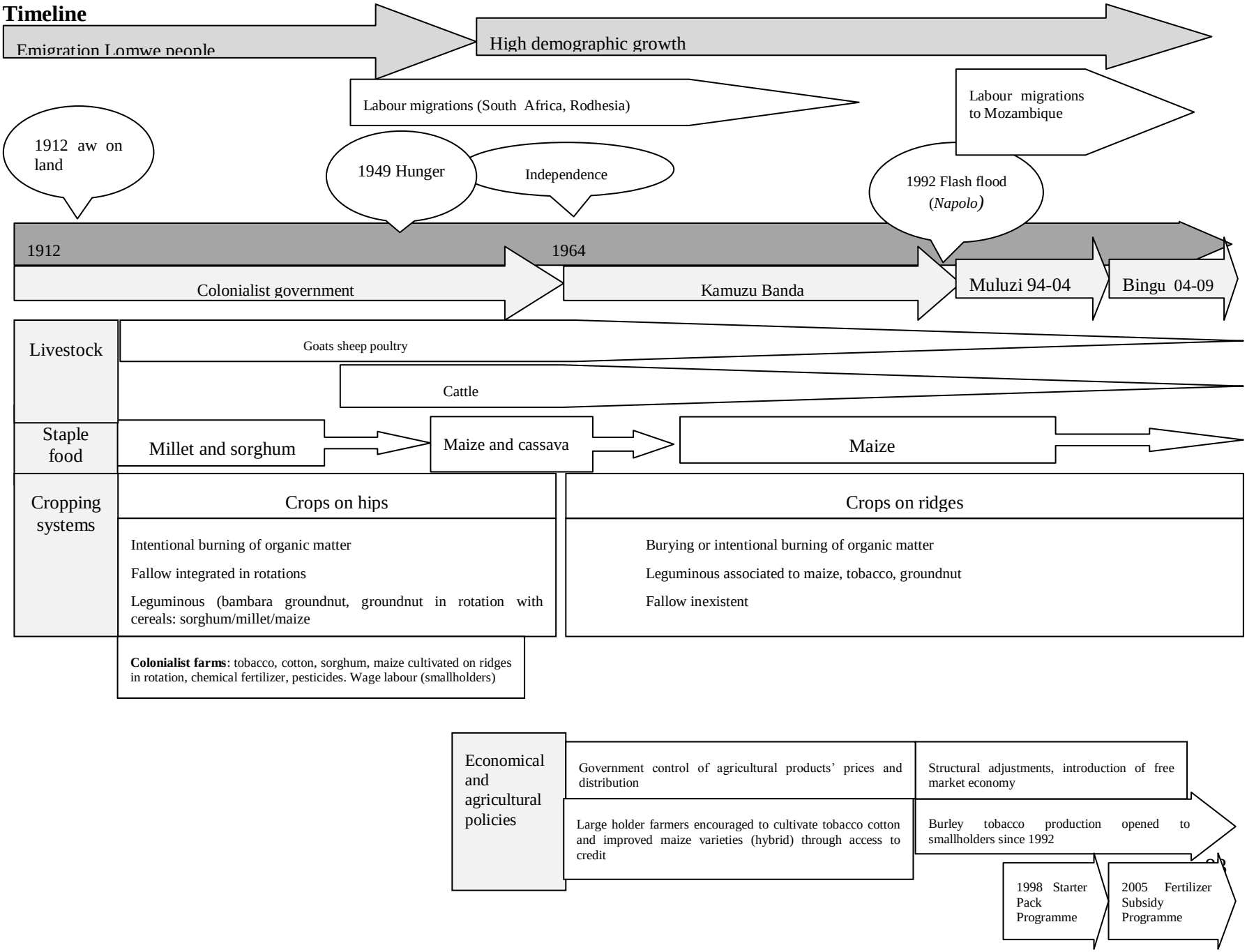
*Picture 8 : Phalombe River*

*Picture 9 : Irrigated crops in the dimba, Phalombe River (zone 6)*

*Picture 10 Tobacco shelter*

*Picture 11 Local maize*

## 7.7. Timeline


Emigration Lomwe people
High demographic growth
Labour migrations (South Africa, Rodhesia)
Labour migrations to Mozambique
1912 aw on land
1949 Hunger
Independence
1992 Flash flood (Napolo)
1912
1964
Colonialist government
Kamuzu Banda
Muluzi 94-04
Bingu 04-09
Livestock
Goats sheep poultry
Cattle
Staple food
Millet and sorghum
Maize and cassava
Maize
Cropping systems
Crops on hips
Intentional burning of organic matter
Fallow integrated in rotations
Leguminous (bambara groundnut, groundnut in rotation with cereals: sorghum/millet/maize
Crops on ridges
Burying or intentional burning of organic matter
Leguminous associated to maize, tobacco, groundnut
Fallow inexistent
Colonialist farms: tobacco, cotton, sorghum, maize cultivated on ridges in rotation, chemical fertilizer, pesticides. Wage labour (smallholders)
Economical and agricultural policies
Government control of agricultural products' prices and distribution
Structural adjustments, introduction of free market economy
Large holder farmers encouraged to cultivate tobacco cotton and improved maize varieties (hybrid) through access to credit
Burley tobacco production opened to smallholders since 1992
1998 Starter Pack Programme
2005 Fertilizer Subsidy Programme

### 7.8. *Ganyu*

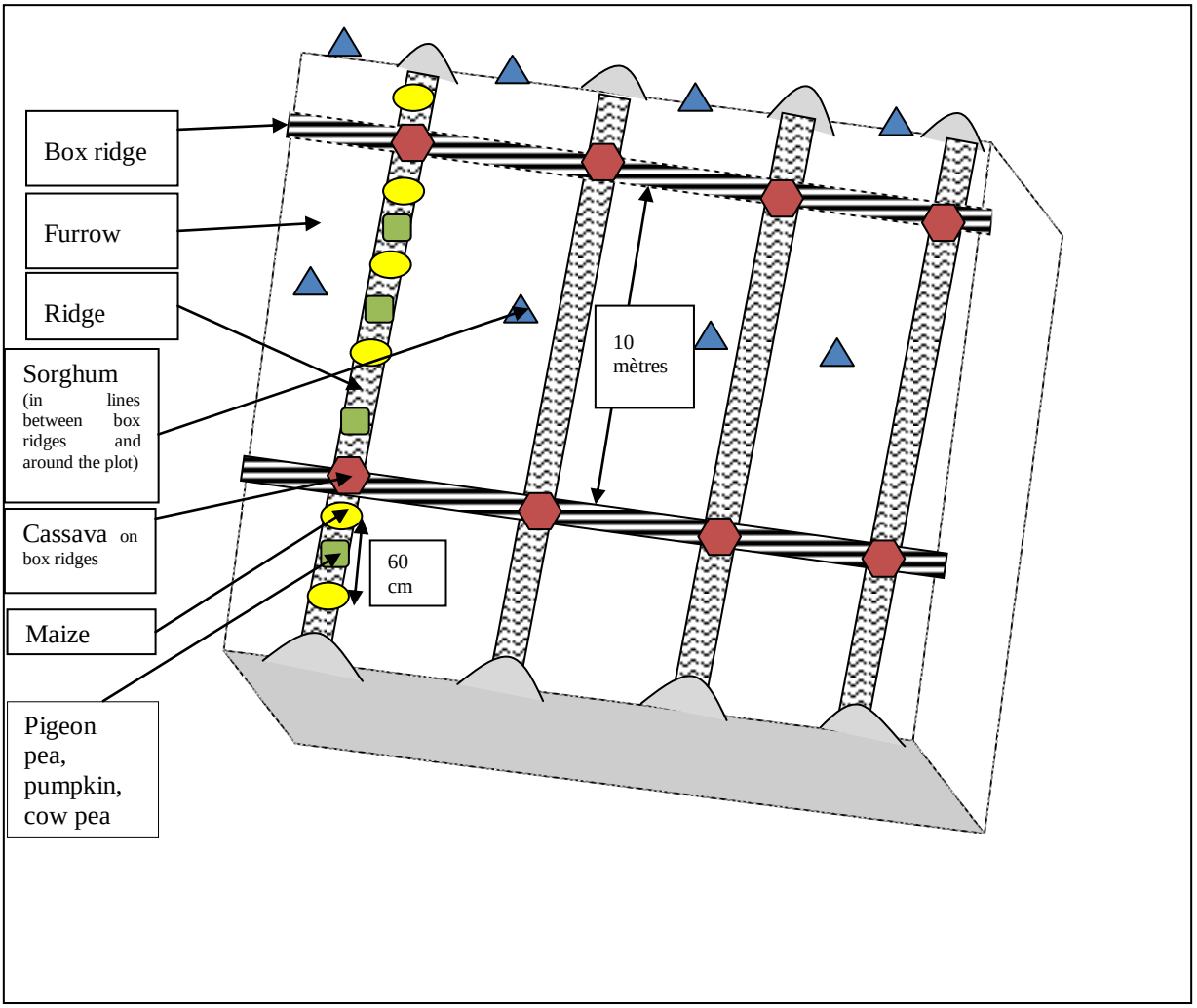
**The term ganyu covers a wide range of activities** that were identified through field interviews.

- ***The original form***: neighbours or relatives take turns to work as a group on each others' fields. A meal was cooked or beer brewed to reward the workers. It is free mutual assistance. The work could be agricultural or not, such as constructing a house. This type of *ganyu* is declining since the years 1970, but sometimes still used in planting and harvesting; among relatives mostly.
- ***Ganyu on less poor farm***. It is observed throughout the year, it involves preparing the land, ridging, weeding, banking, harvesting, and processing products. Payment is typically made on a piecework basis (planting station) and may be in cash, kind or a combination. *Ganyu* labourers travel daily.
- ***"Contract" ganyu lasting from a few weeks to* an agricultural season**. In the surveyed area, medium and large holder farmers hire contract *ganyu* to prepare the land in the dry season. A few farmers among the largest holders employ workers for an agricultural season, for tobacco cultivation mainly, and maize fields.
- ***Ganyu as a coping mechanism***: at times of peak food shortage (from December to February), the least food secure farmers move around trying to exchange labour for food. Providing food for work is a social obligation for those with food (even if the farm work could be done without hiring *ganyu*). One family (including two adults and three children under 10 years old) needs four "5 litres basins" of maize per week, which corresponds to 16 KG per week. The two adults need to work two days a week each to get the required food.
- ***Ganyu on commercial estates:*** this may involve travelling daily, or require staying for the work period on the estate. Tobacco estates are the largest employers of *ganyu* (in Lumpi, Kasungu areas). Workers hired by estates tend to be allocated to tenants on a credit arrangement and paid for the labour hired at the end of the year.
- ***Non-agricultural ganyu****:* making bricks, building houses, digging wells. These jobs tend to be done in the dry season and conflict less with own-farm production. Fishing *ganyu* at Lake Chilwa (helping pull in the nets, often for a share of the catch) is important as well.
- ***Ganyu by children*** is done by both sexes though particularly by young men. It is a way of getting pocket money and the children are generally allowed to use the cash earned for themselves.
- ***Cross-border ganyu:*** the border between southern Malawi and Mozambique is characterised by a large difference in population density, with much higher densities on the Malawian side, but few ethnic differences. On the Malawian side of the border the main constraints are lack of land and food, while on the Mozambican side lack of labour predominates. The labourer lives with and is fed by the employer. Since 2004 migrations have reduced. Men only travel during the food shortage period in January to February, if they have no other choice. Others migrate in September and October for several weeks as it corresponds to a labour peak period in Mozambique. A contract to work on 1 acre in Mozambique is paid 3000 to 4000 Mk against 1000 Mk in the surveyed area. The price of maize is halved in Mozambique.

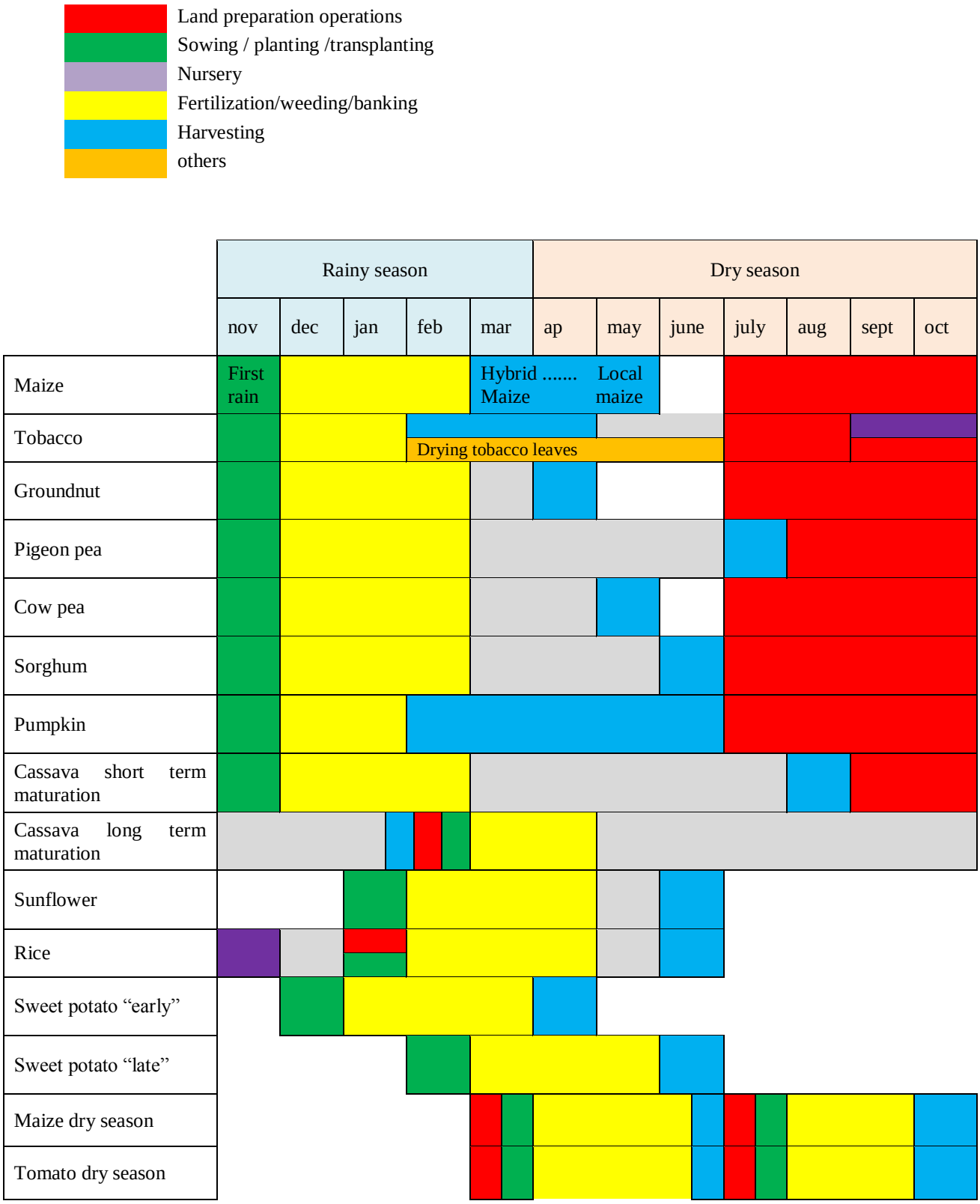
### 7.9. Important facts about ganyu:

- The number of workers hired per farmer ranges from two to twenty. The frequency of an individual performing *ganyu* tasks varies from once in the year to every day, but typically is one to three times a week for one to several months of the year. The most accurate way to estimate the importance of *ganyu* is to look at when households ran out of their own food, with the implication that the deficit is made up by doing *ganyu.*
- Men can leave the village more easily than women, so they have access to a wider range of ganyu types, whereas women are confined to *ganyu* relatively close to their homes. Having men away has implications for the workload of the women, for decision making and work on the home farm.
- Women living alone (with children or grandchildren) are given *ganyu*, in exchange of food. Traditionally, older people should not do *ganyu*, but be cared by younger family members, but this is not the case in practice.
- Going to *ganyu* can be stigmatized as it is an admission of poverty. For this reason people needing *ganyu* sometimes travel to a village where they are not known.
- The transfer of money or kind among relatives or neighbours has to be disguised to avoid the social stigma, by eating together for example. There seem to be preferential rates given to relatives or neighbours especially in hunger months in poor years when ganyu is hard to find
- Ganyu is not only a contractual relationship: it may be seen as a "safety net" for poorer farmers, by linking them to wealthier one. This safety net consists in gifts of seeds, giving food on credit, and selling products on cheaper prices, preferential hiring for *ganyu* in times it is difficult to find, lending livestock.... Undertaking *ganyu* helps maintaining this long term safety net and is not only a response to an emergency situation.
- Nevertheless, the main source of safety net seems to be assistance between relatives: feeding parents, sharing cooked food with married brothers and sisters, sending children to eat at the grand-parents'...
- The need to do *ganyu* to obtain immediate cash or food conflicts with own farm production. The time theoretically left after *ganyu* is not necessarily available for own cultivation. The children able to help in the fields may go to school, people may be sick or need to go to funerals, and women spend a considerable time on childcare and drowning water. Female headed household especially can work on a smaller surface compared to men headed households.

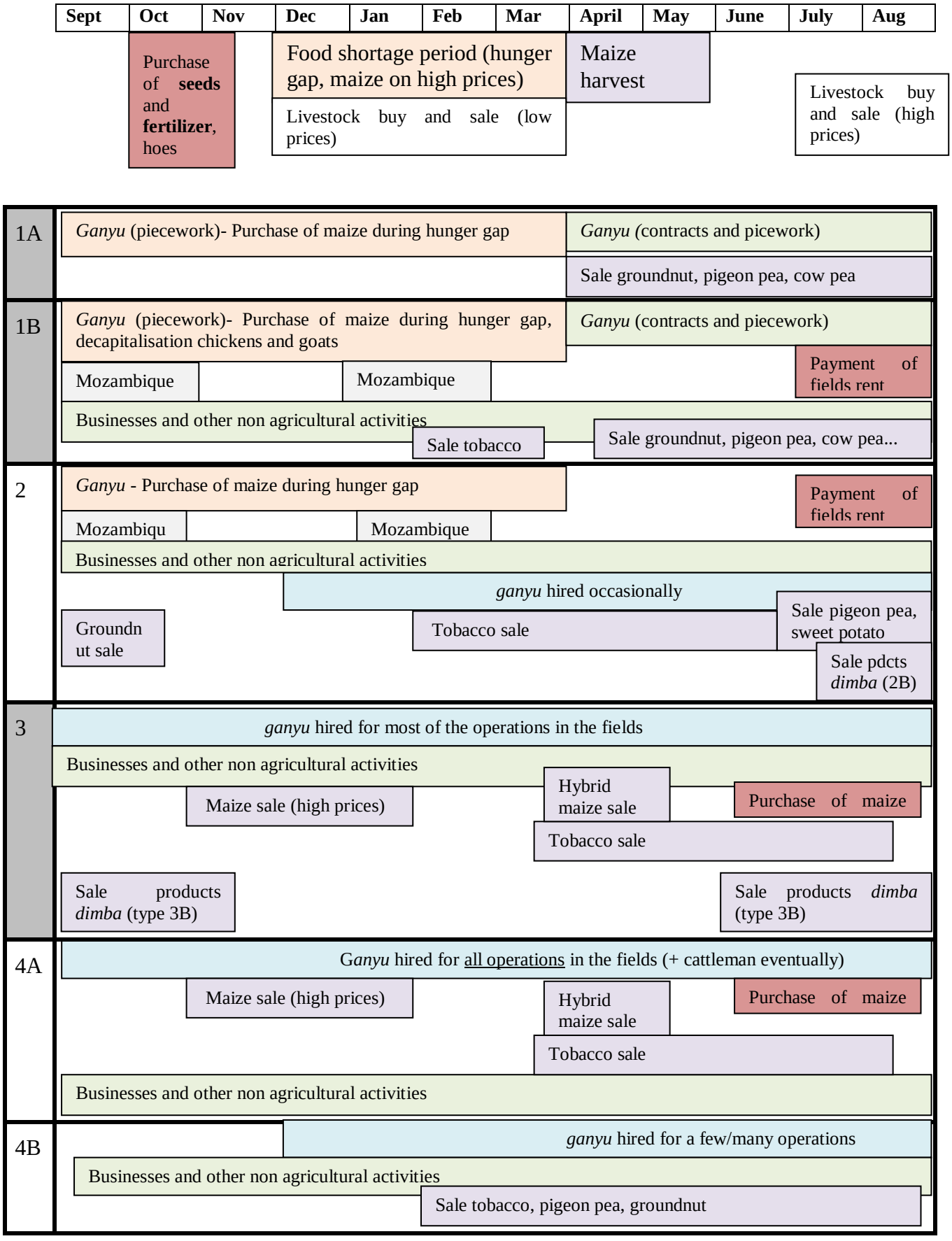
## 7.10. Ridging and sowing



## 7.11. Crop calendar of the main crops cultivated in the area



## 7.12. Cash flow management for each type of exploitations



## 7.13. Economical calculation details

**Gross Added Value**
**GAV = Gross Product – Operational Costs**
GP for cropping systems = harvest (whatever the use: household consumption, sale, seeds, remuneration of external labour force....) and crops residues.
OC for cropping systems = seeds, fertilizers, pesticides
GP for breeding systems = young animals, old animals, eggs...
OC for breeding systems = feeding, veterinary expenses...

**Net Added Value**
**NAV = GAV – Depreciations** (amortisation of capital: watering cane, bags, sacks, baskets, bags, shelter, plastic sheet used only for the cropping or breeding system concerned...)
**Depreciation** of capital = purchase price / number of years utilization

**Agricultural Familial Income**
**AFI = NAV – depreciations - S +/- L + subsidies**
**NAV =** net added value for all cropping and breeding systems practiced on the farm
**Depreciations**: tools common to all cropping or breeding system on the farm (hoes, bicycle(s), winnowers, basket, mat ... and their maintenance)
S = external labour salaries, in kind (maize bags...) and cash (*ganyu* wage per day or contract)
L= rent of the land (in kind or cash)
**Subsidies** = "coupons" for subsidized fertilizer, subsidized seeds, aktelik...

**Agricultural income per family worker:**
Agricultural family income/ number of active persons
A child of 10 to 14 years old was estimated to be equivalent to 0.16 active people; implication of older teenagers was estimated for each interview between 0.16 to 1 active people.

**Total Family Income**
**TFI = AFI + External incomes**

**External income**: incomes from the sale of the labour force (such as *ganyu*), and non-agricultural incomes (business...)

**Minimum urban salary**: 72 000 Mk (360 Euros per year) = builder wage in the construction sector in Zomba town.

**Minimum living income**: 37000 Mk (185 Euros per year) = this is the income that an active people has to earn is one year in order to be able to feed himself and the inactive people of the household (old people, children, people with long term disease...). Given the fact that the average size of a household is 5 (2 adults, 3 children), it was estimated that each active people has to sustain the life of 0.75 inactive people. Each active people has to earn 37 000 in order to sustain the life of 1.75 people (himself and 0.75 inactive people). Detail of the calculation are exposed next page.

| Details of calculation of minimum living income | |
|---|---|
| Main posts of expenses | detail |
| Maize | maize grains (average price of 44 Mk/KG)<br>maize mill expenses |
| Other food expenses | **Relish** : dried fish (1 to 2 times a week, the whole year); tomato; leaf vegetables (purchased and collected in the fields); beans (*niemba*), Groundnut, cassava, sweet potato, sorghum<br>Salt<br>Cooking oil<br>Eggs<br>Chicken (twice a year) |
| Hygiene goods | Soap<br>Cream<br>others |
| Household goods | Matches<br>Paraffin<br>Cooking pot<br>Plates<br>Winnower<br>Sieve for water<br>Basin |
| School stuff | (hardcover, pencils...) |
| Miscellaneous | |

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## 7.15. List of abbreviations

| | |
|---|---|
| mk | malawi kwacha 1 euro = 200 Mk |
| cm | centimeter |
| m | meter |
| km | kilometer |
| ha | hectare |
| NSO | National Statistical Office |