REVOLUTIONARY GOVERNMENT OF ZANZIBAR

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

# ASSESSMENT OF POST HARVEST LOSSES OF MAJOR FOOD CROPS AND FISH IN ZANZIBAR






Zanzibar, July 2012

United Nations TANZANIA

REVOLUTIONARY GOVERNMENT OF ZANZIBAR

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES

# ASSESSMENT OF POST HARVEST LOSSES OF MAJOR FOOD CROPS AND FISH IN ZANZIBAR

Zanzibar, July 2012

United Nations TANZANIA

FAO FIAT PANIS

## Estimated Post Harvest Losses of Various Crops in Zanzibar

| Cereals | % |
|---|---|
| Rice | 13.0 |
| Maize | 22.0 |
| Sorghum | 8.0 |
| Millet | 7.0 |
| **Roots and Tubers** | |
| Cassava | 26.0 |
| Sweet potatoes | 14.5 |
| Yams | 12.0 |
| Tania | 15.0 |
| Leguminous Crops | |
| Cow peas | 16.0 |
| Green gram | 32.0 |
| Pigeon peas | 16.0 |
| Dry beans | 24.0 |
| Groundnuts | 26.0 |
| Fruit | |
| Bananas | 22.0 |
| Mango | 49.0 |
| Pineapples | 33.5 |
| Oranges | 34.0 |
| **Vegetables** | |
| Tomatoes | 42.0 |
| Fish | 25.0 |

# Contents

# Acknowledgements

This study presents an assessment of post harvest losses in Zanzibar for major agricultural commodities (including fish), that was conducted in 2009 under the technical support of the Food and Agriculture Organization of the United Nations (FAO) through UN Joint Programme 5 (Capacity Building Support to Zanzibar) in the context of the One Un Delivering as One (DaO). The study results provided significant input and key recommendations in the formulation of the Zanzibar Agricultural Marketing Policy (ZAMP) and its subsequent Strategy. The Ministry of Agriculture and Natural Resources is grateful to FAO for funding and technical assistance that facilitated the exercise.

The Ministry of Agriculture and Natural Resources (MANR) is indebted to the study consultants, Ms. Betty Mlingi (FAO consultant) and Ms. Khadija Rajab (Consultant, Ministry of Agriculture and Natural Resources - Zanzibar); and to Dr. Suffyan Koroma of the FAO Trade and Markets Division for his invaluable support throughout the study, and also in guiding the ZAMP formulation team during the development of the ZAMP and Strategy documents.

Specific thanks to Ms. Louise Setshwaelo, former FAO Representative to the United Republic of Tanzania who provided overall guidance and insights. In addition, our gratitude goes to staff members at the FAO office in Dar-es-Salaam and in particular Susanne Boetekees (former APO, food security) for her technical and administrative support during the initial stages of this activity. Special thanks also go to Maarten Immink, FAO consultant, for his insights and guidance.

Special thanks are also extended to fishers and farmers as well as market vendors for taking their time to participate in discussions that provided the basis for the outcome of the study. The Ministry further expresses its profound appreciation to staff of different public institutions and the private sector who contributed in making the study a success.

Affan Othman Maalim
Principal Secretary
Ministry of Agriculture and Natural Resources
Zanzibar

# List of abbreviations and Acronyms

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ANGOZA | Association of Non Governmental Organizations in Zanzibar |
| BNPL | Basic Needs Poverty Line |
| CBOs | Community Based Organizations |
| DADO | District Agricultural Development Officer |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| FSN | Food Security and Nutrition |
| Ha | Hectare |
| HBS | Household Budget Survey |
| HEA | Household Economic Assessment |
| MACEMP | Marine Conservation and Environmental Management Programme |
| MALE[1] | Ministry of Agriculture, Livestock and Environment |
| MDGs | Millennium Development Goals |
| MSMEs | Micro, Small and Medium Enterprises |
| MKEKIZA | Mtandao wa Kuendeleza Elimu ya Kilimo Zanzibar (Network for Farmer Education in Zanzibar) |
| MKUZA | Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Zanzibar |
| MT | Metric Tone |
| NGOs | Non-Governmental Organizations |
| PADEP | Participatory Agricultural Development and Empowerment Project |
| SMEs | Small and Medium Enterprises |
| SACCOS | Savings and Credit Cooperative Society |
| RGoZ | Revolutionary Government of Zanzibar |
| TASAF | Tanzania Social Action Fund |
| Tsh | Tanzania Shilling |
| UNIDO | United Nations Industrial Development Organization |
| URT | United Republic of Tanzania |
| USD | United States Dollar |
| UWAMWIMA | Umoja wa Wakulima wa Mboga mboga Wilaya ya Magharibi (West District Vegetable Farmers Association) |
| VCA | Value Chain Analysis |
| VCD | Value Chain Development |
| ZAFFIDE | Zanzibar Association of Farmers and Fishers Development |
| ZAFICO | Zanzibar Fish Cooperation |
| ZAMP | Zanzibar Agricultural Marketing Policy |
| ZATI | Zanzibar Association of Tourist Investors |
| ZAYEDESA | Zanzibar Youth Environment Development Support Association |
| ZAZOSO | Zanzibar Zoological Society |
| ZFSN | Zanzibar Food Security and Nutrition |
| ZFSNP&P | Zanzibar Food Security and Nutrition Policy and Planning |
| ZIPA | Zanzibar Investment Promotion Agency |
| ZNCCIA | Zanzibar National Chamber of Commerce, Industry and Agriculture |
| ZPRP | The Zanzibar Poverty Reduction Plan |
| ZSGRP | Zanzibar Strategy For Growth and Reduction of Poverty |

[1] Currently Ministry of Agriculture and natural Resources. (MANR)

# Chapter 1 -

## Introduction

## 1.1 Background

In a country where 41 percent of basic food items like rice, sugar and wheat flour are imported to meet domestic shortfalls, the problem of post harvest food losses becomes of special concern because these losses predispose the country to greater risk of food insecurity and to continuing dependence on imports. There is therefore need to control post harvest losses of food in Zanzibar notably of the dominant food items like cereals, as well as root crops like cassava and sweet potatoes, key fruit and vegetables and of chief protein sources like fish. This is because if left unchecked, the losses could silently deplete household income, and hinder the achievement of the expected outcomes of the Zanzibar Strategy for Growth and Reduction of Poverty (ZSGRP), also popularly known in Kiswahili as the *Mkakati wa Kukuza Uchumi na Kupunguza Umaskini* (MKUZA).

The realization of the outcomes of MKUZA is intricately linked in a symbiotic manner to the achievement of food security and good nutrition. The outcomes of MKUZA are: i) the achievement of pro-poor growth and reduction of income poverty; ii) improved social well being; and iii) promotion of good governance. These are impossible to achieve in a state of household food insecurity or where a segment of the population is malnourished[1]. It is important to note that the (RGoZ) recognizes these relationships and has made significant efforts to reduce poverty and ensure food security and good nutrition for the population. Among these efforts is the launching of the Zanzibar Development Vision 2020 in the year 2000, with the aspiration to eliminate absolute poverty and attain sustainable development in the long term. The MKUZA, launched by the RGoZ in 2007 provides the strategic framework for achieving the objectives of the Vision 2020 in the medium term and to meeting the Millennium Development Goals. In addition, the formulation of the Zanzibar Food and Nutrition Policy (April 2008) provides the directives of how to achieve food security and nutrition in the context of the MKUZA. The RGoZ also developed the Zanzibar Food Security and Nutrition Programme (April 2008) highlighting priority areas for resource allocation to strengthen national capacity to increase food production, control of food losses and achieve food security and nutrition in the medium term.

The above-mentioned initiatives are being implemented alongside other development policies which have the objective of increasing household income and reducing poverty and improving food security and nutrition. Among these policies are:

i) *The Zanzibar Agricultural Sector Policy (2002*) which was formulated with the primary aim of promoting increased production and productivity in the agricultural sector and strengthening capacity to achieve household food security.
ii) *The Zanzibar Health Policy (2002*) which has the objective of promoting good health for all in Zanzibar by ensuring access to adequate health and medical services in rural and urban areas.
iii) *The National Water Policy (2004*) which is targeting access to adequate and safe water by rural and urban households. This will ensure reduction of waterborne diseases; will promote irrigation activities.
iv) *The Zanzibar Tourism Development Policy (2004*) which aims to increase income earning opportunities in the tourism sector through prudent use of natural resources and by strengthening partnerships between local communities and investors to ensure mutual benefits in a sustainable industry.
v) *The Zanzibar Investment Policy (2005*) which aims to promote local and foreign investments in sectors of competitive advantage like the tourism and agricultural industries as a way of opening up new and expanding income earning opportunities in rural areas and for the unemployed in urban areas to make meaningful contributions towards growth and poverty reduction.
vi) *The Zanzibar Information Policy (2005*) which aims to promote timely dissemination of information to the people to enable them to make informed decisions about matters that affect social, economic and cultural aspects of

1 *This relationship has been addressed in great detail in the Zanzibar Food Security and Nutrition Policy (April 2008) and will therefore not be dealt with in detail here*

their lives. The directives of this policy have a strong influence on people's access to crop prices and market information.

vii) *The Small and Medium Enterprise (SME) Policy (2006*) which aims to create conditions that encourage people to grow profit-making businesses at least the SMEs that have the potential to generate income and create employment in rural and urban areas of Zanzibar. The Household Budget Survey (HBS) showed that people engaged in business, however small, were more likely to be above the food poverty line and also likely to be above the basic needs poverty line (BNPL).

viii) *The Zanzibar Trade Policy (2006*) which has the objective of increasing trading activities of goods and services and of promoting efficiency in trade locally and internationally.

ix) *The Zanzibar Industrial Policy (1998*) which aims to promote local and foreign direct investments in key sectors of competitive advantage in Zanzibar notably tourism, agriculture, forestry, and fisheries to generate income and create employment.

The above-mentioned policies aim to provide a favorable environment for the people of Zanzibar to increase earning opportunities that will fuel growth, reduce poverty and improve standards of living. The attainment of food security and nutrition is an objective addressed explicitly and or implicitly by all development policies in Zanzibar. However, despite the efforts so far made at national, regional, district and household level, a large proportion of households in Zanzibar are food insecure and malnutrition is still a problem to many.

The HBS of 2004/05 found about 13 percent of all households in Zanzibar are unable to meet the minimum 2200 calories required per adult equivalent per day and were classified as food poor. Food poverty is considered the worst kind of poverty as it could lead to wasting and even starvation if the situation is prolonged. Also, the 2004/05 Demographic Health Survey (DHS) indicated that 23 percent of children in Zanzibar below the age of 5 years were stunted due to prolonged deprivation of adequate food; 19 percent were underweight and 6 percent were wasted as a result of extremely low levels of food intake. These figures indicate that many households in Zanzibar are struggling to meet basic food needs and indicate also that any post harvest food losses especially within poor households would certainly aggravate the problem of food insecurity and malnutrition.

## 1.2 Purpose of the report

This report presents findings of assessment of post harvest losses of major food items produced in Zanzibar including cereals, legumes, roots and tubers, fruit and vegetables and fish. The findings are a result of information gathered from review of literature and from interviews with key informants as well as from stakeholder consultations conducted with officers of various Government Ministries and Departments as well as with operators, managers and consumers at market centers; fishers at fish auction centers and fish markets; farmers' at production and selling centers and discussions held with heads of households at household level.

The aims of the assessment are threefold:

i) To identify magnitudes and causes of post harvest losses of food that occur in post harvest handling, transportation, packaging, storage, quality control/standardization and marketing and consumption and to derive inferences on the potential impacts on achieving sustainable food security and good nutrition;

ii) To identify specific areas along the commodity value chain that is especially vulnerable to post harvest losses and therefore determine appropriate measures for mitigation

iii) To use the information to arrive at policy solutions that would inform the formulation of the Zanzibar Agricultural Marketing Policy (ZAMP). The ZAMP is aimed at establishing an improved agricultural marketing system and is expected to put in place a framework that will ensure efficient marketing of agricultural commodities along the commodity value chain; that

is, addressing the needs of producers, transporters, distributors, traders and consumers in a manner that will reduce losses and enhance income generation in the sector. It is also expected that the comprehensive approach to be adopted by ZAMP will create linkages that will foster increased production and productivity as well as increased capabilities of the people of Zanzibar to exploit opportunities offered by domestic and export markets with greater efficiency and thereby curbing post harvest losses and generating more income in line with MKUZA.

## 1.3 Methodology

### *1.3.1 Approach*

- After the initial review of literature the framework for the assessment was shared with a team of experts responsible for the formulation of the Zanzibar Agricultural Marketing Policy (ZAMP Team) in a brain-storming session to highlight priority areas for in-depth assessment of post harvest food losses.
- Thereafter simple tools were developed to guide the stakeholder consultations that followed in both the islands of Unguja and Pemba and these tools are shown as Annexes 1 and 2.
- Field work included site visits to locations known to produce large quantities of the various food items that were included in the assessment including markets as well as households in rural and urban areas

The assessment was done in three steps as follows:

i) Step one involved discussions and interviews with Government Officials and private sector organizations. It also included key informant interviews at Darajani and Mwanakwerekwe markets as well as focus group discussions with producers, wholesalers, retailers and consumers in Unguja alone. Views and opinions were gathered about the size of post harvest losses, the loss of income due to the post harvest losses and what should be the most appropriate interventions. The results of the initial assessment were shared with the ZAMP Team and the comments and suggestions were incorporated in step two assessments that followed.

ii) Step two involved discussions and interviews with fisher and farmer villages selected in Northern, Central, East, West and Southern Unguja. Key informant interviews and focus group discussions were held with producers and sellers of various food items to find out how big the problem of post harvest losses is to farmers, fishers and traders. The assessment also included information from 20 households selected from low, middle and high income areas of Zanzibar.

iii) Step three of the assessment focused on post harvest losses of key food items in Pemba Island. Villages covered in Pemba were selected from Central, East to West and from North to South of the Island to ensure as comprehensive a coverage of the island as possible Also, household level information was gathered from housewives and from key informants about food losses that occur at micro level.

### *1.3.2 Method of estimation*

Estimation of post harvest losses was done through a mix of techniques including what is known as "the rule of thumb". Post harvest estimates were made by building on initial information gathered about the main areas that produce various types of food crops as well as location of main markets; market supply patterns in relation to farmers' proximity to crop selling centers; cropping patterns and months during the calendar year when the markets are flooded with certain food items; types of technologies and varieties used in crop production and in post harvest handling and processing; the estimated harvests per holding; the extent to which the household consumes the crop and the estimated proportion that is sold; proportion of the crop that is preserved or stored; and the market demand for the product. The assessment also included

information on fish losses from the fishing sites to the landing sites including direct observations of losses at key fish markets as well as at points of storage, preparation and consumption.

Farmers and fishers were asked to estimate in a systematic manner the amount of loss due to damage from the point of harvest to the point of consumption and in storage**.** Common measures used locally like *polos, pishi, susu, fungu* were used to estimate amount of loss at different stages of post harvest handling.

The magnitude of losses and the main causes were identified in group meetings, through key informants and by heads of households. Consultants made visits to farms to see the average size of holdings per household.

The following were the main activities of the assessment:

- extensive group discussions with farmers and fishers about their experiences with shelf life of various food items from harvesting, marketing and storage to consumption;
- focus group discussions with farmers about how long they store crops after harvesting and the treatment that is usually rendered to the crop for preservation;
- direct examination of household food stores to see the methods and conditions of storage
- visits to grain milling areas to find out the level of extraction that is done in milling processes as is often demanded by farmers in order to make grain products white or refined;
- inspection of the condition of food items at wholesale and retail markets to estimate the proportion of food items that is damaged on a weekly and monthly basis;
- taking samples of the various food items to inspect the conditions of the food items that were on sale;
- asking farmers and traders to estimate the proportion of loss at various stages after harvesting and, based on their experiences, to explain why losses occur;
- asking farmers, fishers and traders to state the proportion that is sold at peak harvest periods when the prices are at the lowest and to calculate earnings lost due to low price alone;
- asking farmers, fishers and traders to estimate the amount of income lost due to crop damage and the amount of earnings lost due to depressed prices at the peak harvest period;
- asking farmers, fishers and traders to estimate the average loss of household income per week, per month and per year and to the extent possible to estimate the average loss of volume of food items per day, week, and year.

### *1.3.3 Geographical areas covered*

The assessment covered both islands of Unguja and Pemba. Villages where selected in areas where fishing and production of main food crops were highest as shown in Table 1.1 which also shows the areas that were visited in Unguja and Pemba during the assessment.

### *1.3.4 Analytical framework*

The information gathered on post harvest losses of the main food items was analyzed in terms of loss of volume, loss of value, loss of income at national and household level and the potential impacts on household FSN.

### *1.3.5 Method of analysis*

Basic calculations of average losses per stage of value chain were carried out to arrive at an annual average for the particular crop. The percentage of post-harvest loss was used to calculate loss of volume and loss of value for the crop per year.

Table 1.1
Sites visited

| SITES COVERED IN UNGUJA | RELEVANCE OF VISIT |
|---|---|
| Mwanakwerekwe Market | Main whole sale market for food items |
| Darajani Market | Main retail market for all food items |
| Malindi Fish Market | One of the main landing sites in Zanzibar |
| Zanzibar Harbor | Key export portal for Zanzibar |
| Zanzibar Beach Resort | Consumers of fresh produce and fish |
| Mtoni Marine Hotel | Consumers of fresh produce and fish |
| Bavuai Restaurant | Consumers of fresh produce and fish |
| Mbaruak Restaurant | Consumers of fresh produce and fish |
| Shangani Hotel | Consumers of fresh produce and fish |
| **VILLAGES** | |
| Tazari village | One of the main banana growing areas |
| Kitope village | One of the main banana and cassava growing areas |
| Mahoda village | Main cassava growing area |
| Kiboge village | Main tomato and cassava growing area |
| Donge Vijibweni village | One of the main pineapple producing areas |
| Matemwe village | Main tomato growing area |
| Malindi Fish Market | Wholesale and retail fish market |
| Nungwi village | One of the key fish markets |
| Mkokotoni village | One of the main fish and tomato producing areas |
| Chwaka Village | One of the main fishing areas |
| Makunduchi village | One of the main fishing areas |
| Kizimkazi – Mkunguni village | One of the main fishing areas |
| Kinyasini village | One of the main rice producing areas |
| Kilombero, Pangeni | Rice producing area |
| Kibokwa village | One of the main rice producing areas |
| Cheju-Jendele | One of the three major rice producing areas in Zanzibar |
| Jang'ombe Urusi | Low income neighborhood in Zanzibar town |
| Mombasa, Kiembe Samaki | Middle income neighborhood, Zanzibar town |
| Jang'ombe Mtundani | Low income neighborhood in Zanzibar town |
| Kizimbani Agricultural Research Station | Government institution doing research on various crops |
| Marine Conservation and Environmental Management (MACEMP) Office, Zanzibar | General information about post harvest crop losses |
| Zanzibar National Chamber of Commerce, Industry and Agriculture (ZNCCIA) Office, Zanzibar | General information about post harvest crop losses |
| Ministry of Agriculture, Livestock and Environment (MALE), Zanzibar | General information about post harvest crop losses |
| Zanzibar Association of Farmers and Fishers Development (ZAFFIDE) Office, Zanzibar | General information about post harvest crop losses |

| Sites Covered In Pemba | |
|---|---|
| ChakeChake Town Market | Wholesale and retail market |
| Kangagani Village | One of the major tomato growing areas in Wete district |
| Ole Village | One of the main rice growing areas in Wete district |
| Mkoani Fish market | Wholesale and retail fish market in Mkoani, Pemba |
| Mwambe village | One of the main cereal and fruit producing areas |
| Macho-Manne Chake Chake | Fishing area as well as tomato and banana growing area |
| Konde Market | Wholesale and retail markets for legumes and cereals |
| Vumawimbi fishing center | Fishing area in Micheweni district |
| Makangale village | One of the main sweet potato and cassava growing areas, |
| Matangatuani Agricultural Research Station | Research on a variety of crops |
| Gando, Junguni | Cassava growing areas |
| Tumbe Harbour | Fish market |
| Kinyikani | Tomato and cassava growing areas |
| Kiuyu Village | Rice growing area |
| Pujini Agricultural Research Station | Research on rice, maize and root crops |
| CARE International Office | Working on Sustainable Livelihoods in Zanzibar |
| Action Aid Office | Working on Ending Hunger in the context of MDGs |

# Chapter 2 -

## Findings on post-harvest losses of cereals

## 2.1 Introduction

Zanzibar produces a variety of cereals including paddy, maize, sorghum, bulrush millet and small amounts of finger millet. The 2002/03 Sample Census of Agriculture found that the total area under cereals was 25,106 ha and production was 13,938 tonnes. Area under paddy production was 21,614 ha and production amounted to 10,359 tonnes or 74 percent of total cereal production; maize (23 percent); sorghum 2 percent; and millet 1 percent.

It is estimated that the yields of cereals in Zanzibar is less than half of the potential harvest. This means that with improved crop husbandry alone Zanzibar could double its output from existing acreage. Thus, the loss of harvest due to poor yields caused by poor soils and bad weather as well as pests and diseases is high and is a major cause of loss of income as well as a major cause of food insecurity in Zanzibar. This coupled with post harvest losses could account for great losses of food in Zanzibar. An in-depth assessment of post harvest losses of cereals is examined for each type of main cereal as shown next.

## 2.2 Rice

### *2.2.1 Production of rice in Zanzibar*

Rice is the most widely grown cereal in Zanzibar and is grown mostly during the long rainy season. Only a few households plant the crop during the short rainy season and most of these households are located in areas where the few irrigation schemes are operating. The 2002/03 Sample Census of Agriculture found only 2 percent of the rice harvested was planted during the short rains and 98 percent was planted during the long rainy season. The Census found rice yields in Zanzibar to be very low averaging only 0.48 tonnes / ha. Much of the rice produced in Zanzibar is upland rice that is rain fed. Only a small proportion is from irrigated rice. This explains, in part, the fluctuations in the output shown in Table 2.2. Under improved farming practices, farmers could get even up to twice the current yield of upland rice. However, in most parts of Zanzibar, diseases, pests and poor weather contribute significantly to dismal output as shown in the production figures shown below.

**Table 2.1**
**Cereal Production in Zanzibar 2000-2007 (in tonnes)**

| Year | Paddy | Maize | Sorghum | Millet | Total Cereals |
|---|---|---|---|---|---|
| 2002 | 17,725 | 1,584 | 91 | 77 | 19,477 |
| 2003 | 23,534 | 1,605 | 158 | 80 | 25,377 |
| 2004 | 20,405 | 2,515 | 145 | 80 | 23,145 |
| 2005 | 15,935 | 1,419 | 459 | NA | 17,813 |
| 2006 | 24,730 | 3,927 | 409 | NA | 29,066 |
| 2007 | 20,038 | 1,931 | 794 | NA | 22,763 |

Source: MALE, 2009

**Table 2.2**
**Rice Production in Zanzibar, 2000 – 2007 (in tonnes)**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Production (in tonnes) | 17,622 | 18,452 | 17,725 | 23,534 | 20,405 | 16,039 | 24,730 | 20,038 |

Source: MALE, Zanzibar

In some of the fertile low land areas of Zanzibar, rain fed rice yields are about tow times higher than the upland rice and are estimated at 0.8 tonnes /ha. However this is about one third of the potential yields of potential yields of 2.4 tonnes /ha. This means that 66.7 percent of yields of rain fed rice even in the fertile low lands are lost due to vagaries of weather. There are only three large scale rice irrigation projects in Zanzibar and yields in these farms average 4 tonnes t/ha compared to a potential of 4.8 tonnes /ha. In these areas farmers are able to capture 83.3 percent of potential yields but still incur losses of up to 16.7 percent. Thus, pre harvest losses are high for rain fed and for irrigated rice in Zanzibar but losses continue even after harvesting.

Post harvest losses caused by pests, damage in storage, poor handling at various stages of the value chain lead to considerable additional losses of rice. These losses have implications for income generation and for poverty reduction and more specifically for food security and nutrition.

### *2.2.2 Estimated post harvest losses of rice*

#### *Losses at harvest sites*

In many rice fields the Consultants were able to see brown paddy that should have been harvested some time back but which was still in the fields. At Kizimbani Agricultural Research Station it was learned that it is an old practice used by some farmers to store the crop in the field. However, once the paddy is dry and brown it is more susceptible to shattering and to losing part of the harvest as the farmer cuts and carries the sheaths from one place to another. In some farms it is not possible to collect each and every sheath and that inevitably some sheaths are lost in the farm during the harvesting time. Farmers estimated that losses at harvest site averages 3 percent.

- ***Losses in transit from the farm to the market***

Once harvested paddy is packed into *polos* and the polos are carefully stitched to prevent losses. Farmers and traders alike agree that very little of the crop is lost in transit once properly dry. There could be some loss if the p*olos* are placed on a wet surface or mishandled. On average only 0.5 percent of the crop is lost at this stage.

- ***Losses at wholesale markets***

Losses of paddy and clean rice at wholesale markets and shops can be very small if paddy is stored when properly dry. On the other hand losses could be very extensive if not dry. Loss also depends on whether the crop is stored in dark damp rooms or in airy dry and fumigated warehouses. In the wholesale stores that were visited, rice is stored in airy warehouses which are frequently fumigated. In one of these large storehouses in Zanzibar town the owner has hired a resident fumigation expert to ensure that mice and other pests are kept outside the warehouse. In other areas large shop owners complained of rice turning gray due to infestation by fungi. Among the 17 shops that were inspected in Unguja and Pemba 2 were selling rice that showed signs of fungi (gray color). Overall, the average loss of paddy and rice at wholesale stage was estimated at an average of 2 percent per year.

- ***Losses at retail markets***

Most retail shops said that they stock only enough to sell within a short period. However, some retailers face losses caused by pests and in weighing and measuring. At times rice weevils attack rice even if the storage period is short. On average loss at retail level is estimated at 2 percent per year.

- ***Losses in processing and packaging/branding, preservation and storage***

The only processing that takes place for paddy is threshing, milling and winnowing. Most farmers said that they do not harvest enough to be stored for prolonged periods. At Kinyasini (North A District in Unguja) farmers said that they harvest only an average of 20 *polos* per acre (about 1,000 kgs) and that most of it is consumed by the household during the harvest period. The stock is usually finished at the end of the harvest period. Thus, very little of the harvest is stored. However, it was said that even in short periods of storage mice are the greatest pests and that unless controlled, they can destroy up to one *polo* of paddy (50 kgs) within two days. There were no special storage structures seen at any of the villages or homes visited during the assessment. It was said that whenever there is paddy to be stored it is kept in secure areas where mice can not enter. Efforts to use mice poison have failed because people avoid the

poison for fear that the mice might spread it around the home or contaminate other food items.

In Cheju village, where there is a large scale rice irrigation project, farmers are able to harvest up to 100 *polos* per acre and harvest enough rice to feed the family and still have surplus for sale. Farmers in this area said they are able to store paddy from one harvest to the next. Mice were identified as the main pests but special secure rooms have been constructed in homes to hold paddy stocks.

Farmers said that losses in storage, threshing, milling and winnowing can be controlled by drying paddy properly. Information gathered from grain millers in various areas of Unguja and Pemba indicates that many farmers dry paddy before storage or milling. Millers confirmed that very little rice is lost partly because the milling machines provided under the PADEP are very good. Overall, it was estimated that post harvest losses due to fungal and mice attacks, threshing, milling and winnowing averages 5 percent per year.

- ***Losses at consumption stage***

Rice is a preferred staple and is consumed in many varied ways. Discussions held with heads of households, operators of restaurants and hotels revealed that they prepare only enough for the particular meal and loss is kept at a minimum. Products like rice cakes and *vitumbua* are made by food vendors and for home consumption. However, amounts are carefully determined to avoid losses. Only enough of these products are made for the day and fresh batches are made the following day. On average it was estimated that only 0.5 percent is lost at consumption level.

- ***Use of byproducts***

The main byproduct of rice is bran from milling activities and is used as chicken feed in most parts that grow rice. The actual loss of rice in the form of byproducts could not be established during the assessment because records the rice content in bran are not kept by farmers or millers or those who feed bran to chicken.

### *2.2.3 Implications of the post-harvest losses of rice for income generation*

***Implications for income generation at national level***

Table 2.3 presents the calculations of losses of volume and value as shown in the shaded columns, (b), (d) and (e) at the annual average loss of 13 percent. The results show that since 2002, loss of 13 percent per annum of the marketed output exceeds 2,000 tonnes of paddy each year.

The value of the losses in Tshs ranges from a low of TZS 460,850,000 in 2002 to TZS 1,015,950,000 (over a billion) in 2006. If this loss could be controlled the volume and value would increase national income. Loss of rice at post harvest level must also be seen in the context of deficits in domestic production. The thousands of mt of rice lost at post harvest can only serve to aggravate the existing gaps in the domestic supply of rice. In some years e.g. 2004, deficits reached 81 percent of domestic production. As rice accounts for over 50 percent of calories consumed in Zanzibar much of the shortfalls in supplies are made up of imports either from the mainland or from other countries to satisfy the local preference for rice as a staple.

**Box 2.1**
**Baseline summary of the estimated average annual post harvest losses of rice**

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of rice from the harvest stage to consumption is as follows:

- at harvest sites: 3 percent
- in transit to markets and to warehouses: 0.5 percent
- at wholesale point: 2 percent
- at retail market points: 2 percent
- at processing/packaging and in storage: 5 percent
- at consumption stage: 0.5 percent

***Therefore post harvest losses of rice are estimated at an average of 13 percent per year***

**Table 2.3:**
**Volume and Value of Paddy Produced In Zanzibar 2002 – 2007**

| | (a) | (b) | (c) | (d) | (e) |
|---|---|---|---|---|---|
| Year | Marketed production | Post harvest loss of volume @ 13 percent per year | Value of Marketed Paddy per year | Loss of value due to post harvest loss of 13 percent per year | Loss of value due to post harvest loss of 13 percent per year |
| | (in tonnes) | (in tonnes) | (in million TZS) | (in million TZS) | (in USD equivalent) |
| 2002 | 17,725 | 2,304.25 | 3,545 | 460.85 | 354,500 |
| 2003 | 23,534 | 3,059.42 | 4,707 | 611.91 | 470,700 |
| 2004 | 20,405 | 2,652.65 | 5,101 | 663.13 | 510,100 |
| 2005 | 15,935 | 2,071.55 | 3,555 | 462.15 | 355,500 |
| 2006 | 24,730 | 3,214.90 | 7,815 | 1,015.95 | 781,500 |
| 2007 | 20,038 | 2,604.94 | 6,332 | 823.16 | 633,200 |
| | Cumulative loss of volume @ 13 percent | **15,907.71** | Cumulative loss of value @13 percent | **4,037.15** | **3,105,500** |

Source: Based on Data extracted from RGoZ, Zanzibar Statistical Abstracts, May, 2008

***Implications for income generation at household level***

Rice producers save money they would otherwise use to buy rice for the household. A loss of 13 percent for households producing 100 *polos* of paddy would mean that 390 kgs of rice (at a conversion rate of 60 percent of paddy to rice) would be lost. At TZS 1500/kg of rice the loss would represent a loss of TZS 585,000 or about 10 times the minimum monthly wage in Zanzibar. A farmer producing 15 polos per acre, as was the case in Pujini, the loss of 13 percent would represent a loss 58.5 kgs of rice worth TZS 87,750. In order to make up for the loss the household would have to sell an equivalent of about 5 *polos* of cassava or 20 big bunches of bananas to be able to raise enough money to buy the same amount of rice as that lost after harvest. As rice is important as a staple, especially in rice producing areas, these transactions do take place to ensure that rice is available. Thus, the loss of rice after harvest leads to loss of income in many ways at household level.

***Implications of post-harvest losses of rice for food prices, FSN***

Rice is the most preferred staple that accounts for 50 percent of calorie intake in Zanzibar. Post harvest losses of rice inevitably cause deeper shortfalls in domestic production and necessitate more rice imports. Rice produced in households' own farms is less expensive compared to that sold on the market and therefore the poor can access home grown rice more readily and in amounts desired by the household. Post harvest losses push households into dependence on the market away from the self-reliance objective that drives farmers to producing own rice. This has implications for food security among the poor who are least able to access supplies on the market.

The Zanzibar market has two types of rice; the locally produced rice, the *super variety* (mostly imported from the Mainland) and other types of rice (*like Jasmine, kitumbo, VIP etc*) imported from other countries. The local rice is preferred for its aroma and stickiness and sells at TZS 1500/- per kilogramme. The other types of rice sell at TZS 800/- about half the price but it does not have the qualities preferred by the people. Retailers said that restaurants and institutions buy this rice as well as many of the poor. Many of the farmers consulted at Cheju village said they would like to eat the rice from their own farms because in their own words, "it is of the best quality".

**Table 2.4:**
**Potential for the Control of Post Harvest Losses along the Rice Value Chain**

| Stage of the Rice Value Chains | Area of concentration | Status of the Rice Value Chain |
|---|---|---|
| Stage 1 | Production | 1. Zanzibar produces mostly rain fed rice on small holdings.<br>2. There are three large rice irrigation projects located in Unguja<br>3. Improved varieties and local varieties are mixed in same small holdings<br>4. Limited supply of inputs especially herbicides, fertilizers and improved seed.<br>5. Pests and diseases are the main problems facing rice farmers especially those producing upland rice |
| Stage 2 | Harvesting | 1.Small holder use household tools for manual harvesting<br>2. Large scale irrigation projects use modern harvesting machines |
| Stage 3 | Post harvest handling and storage | Smallholders produce only enough for home consumption. Only a limited number of farmers in rice irrigation projects are able to produce surplus because they have tractors and other machinery to increase acreage as well as inputs and technical support to produce rice the modern way. Other farmers cultivate only small areas using the hand hoe and rely in rainfall and therefore harvest very little rice. |
| Stage 4 | Transportation/ Distribution | Paddy is packed in 50 kilogram bags known as *polos* and transported to markets or homes by trucks, carts or passenger buses |
| Stage 5 | Transformation/ Processing | Milling pf paddy and cooking of rice are the main transformation processes |
| Stage 6 | Marketing/ Promotion | Local rice is preferred to imported rice. Demand is high for rice in rural and urban areas |
| Stage 7 | Consumption and use of byproducts | The byproducts of rice milling, mostly bran, are used as fuel for burning bricks and to a limited extent as feed for poultry |

### *2.2.4 Recommendations*

Priority Areas for Intervention:

- in areas where farmers produce large quantities of rice like Cheju, a "Rice Bank" should be established and a form of Warehouse Receipt System established to enable farmers to access loans using paddy stocks as collateral;
- there is need to provide low-interest credit to farmers to improve irrigation activities for rice through revolving funds for farmers groups along with supply of low cost technologies like water pumps and pipes etc;
- farmers should be supported to develop low cost rain water harvesting and storage and irrigation technologies for rice production;
- Provide incentives like for input suppliers to provide herbicides and fertilizers for both the low land and upland rice as a way of improving yields;
- train farmers on how to produce rice using improved practices and how to store paddy including development of storage structures.

Main Actors in the Rice Value Chain

- there is extensive research that is on-going at various research stations including Kizimbani Research Station on improved varieties;
- there are international collaborative efforts on rice research including support from the Government of Japan;
- there are Farmer Field Schools for the provision of short courses to farmers;

- there are Civil society organizations (CSOs) like ZAFFIDE, Umoja wa Wakulima wa Mboga mboga Wilaya ya Magharibi (UWAMWIMA) and others that specialize in service delivery to farmers.

## 2.3 Maize

### *2.3.1 Production of maize in Zanzibar*

Maize is the 2nd most important cereal produced in Zanzibar after rice. The 2002/03 Sample Census of Agriculture found 4,958 households grew maize during the short rains and 7,218 in the long rains. Annual production was 3,146 tonnes; 38 percent during the short rains and 62 percent during the long rains. Yields were very low and still are as shown in Table 2.5 below. The average yields of maize were 2.5 tonnes /ha compared to potential yields of 6 tonnes/ ha. Thus, only 41.7 percent of yields are realized by farmers while they lose 58.3 percent of yields in pre harvest periods. Thus, the output presented in table 2.5 could be more than doubled if the pre harvest losses were prevented through better farming practices. Maize losses become even more extensive when post harvest losses are added to the pre-harvest losses. In the following sections the extent to which maize losses occur at various stages after harvest were examined.

### *2.3.2 Estimated post-harvest losses of maize*

#### *Losses at harvest sites*

Maize is harvested either as green maize or as dry maize. Farmers who grow maize during the short rains said that they usually harvest the crop as green maize. Loss at harvest site occurs because of poor quality; at times farmers find maize is rotten while still in the cob or is infested with weevils and at times the cobs have no maize on them. Most farmers agree that most of the loss occurs before harvest in the form of small size of cobs and stalks that have no cobs at all. Because the farms are small farmers are able to harvest the crop effectively and loss of crop is kept at a minimum. It is estimated that on average about 3 percent of the crop is lost at harvest site per year.

#### *Losses in transit from the farm to the market*

Farmers in Pujini said that green maize is transported while still on the cob and packed in large *polos* of about 100 kgs each. Green maize is sold at roadsides where it is roasted or taken to the market and sold wholesale/ retail. Dry maize is also packed into *polos* while on the cob and taken home for storage. In this form farmers said very little of the maize is lost while in transit. However, farmers said that more losses occur when maize is transported already threshed into single grains or when it is ground into flour. Farmers elaborated that only small amounts of maize are produced by households and that very little is transported outside the home or the village. Thus, loss in transit is limited and averages less than 0.5 percent per year.

**Table 2.5:**
**Maize Production in Zanzibar, 2000 – 2007 (in tonnes)**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Area under cultivation in ha | 1,980.00 | 4,012.00 | 1,006.00 | 567.60 | 1,570.80 | 1,858.60 |
| Yield in kg per ha | 800.00 | 400.00 | 2,500.00 | 2,500.00 | 2,500.00 | 1,388.42 |
| Production in tonnes | 1,584.00 | 1,605.00 | 2,515.00 | 1,419.00 | 3,927.00 | 1,930.00 |

Source: MALE, Zanzibar

#### ***Losses at wholesale markets***

Most of the wholesale markets sell imported maize largely from the Mainland. None of the wholesalers said they had bought maize locally. This is partly because the assessment was done during the off season and also because farmers do not sell the little amount of maize they produce. It was said however that during the green maize season, many farmers bring *polos* of green maize on the cob to be sold. The

demand for green roasted maize is very high in urban and even in rural areas and it was said that green maize sells quickly on the wholesale and retail markets. Loss was estimated to be very small averaging 0.5 percent. Loss of dry maize and flour was higher at whole sale level. In Konde market, North Pemba, traders estimate that on average about 2 percent is lost per year due to humidity, pests and delayed sales. Similar estimates were given at Darajani market in Zanzibar town.

***Losses at retail markets***

Most retail outlets stock only limited stock of maize flour to sell for a short period. In many parts of Zanzibar the Consultants saw green maize on roadside stands where it is roasted and sold ready to eat. Some of the youth selling the maize said they hardly lose any maize and whatever is not sold is dried and ground into flour. Retailers at Darajani market said that they stock very little amounts of maize grain or flour because "they are *slow moving items*" as not many people in Zanzibar consume maize flour. Losses occur at retail level but only to a limited extent. Most retailers estimate post harvest losses to average 1 percent per year.

***Losses in processing and packaging/branding and storage***

Apart from green maize, many consumers like to subject dry maize to some extraction before milling into flour. In Kinyasini village grain milling establishments have been set up and it was said that the average extraction rate is 20 percent of the grain to get the desired white 'sembe' flour that consumers prefer. Similar extraction rates were given at one of the grain milling points in Chake Chake Pemba. Key informants at these milling stations said that only a small proportion of the harvest is dried and milled. A proportion is consumed or sold as green maize because green maize fetches a good price on the market. A conservative estimate was given by farmers and millers that the amount of maize that is subject to milling and therefore to the 20 percent extraction rate is 75 percent of the harvest. Thus, post harvest loss due to the extraction rate for the maize was estimated at 15 percent per year.

***Losses at household level***

Heads of households who were asked about post harvest losses of maize at home were of the opinion that very little of the crop is lost at home. Because the harvest is small, very small amounts of it are stored. The amounts bought are usually sufficient for one or two meals and therefore losses at home are kept at a minimum. Housewives said that even pests like mice cannot get into maize flour or any type of flour because the containers used for safekeeping have lids that are airtight. Even in cooking care is taken by housewives and restaurant owners to keep losses at a minimum. The popular dish from maize flour "ugali" is rarely wasted at household level. This dish was not found sold in any of the restaurants in Zanzibar. It was estimated that losses at consumption stage averages 0.5 percent per year.

***Use of byproducts***

The main by product of maize is bran from milling activities and fodder from the maize stocks and leaves. It was learned at the milling points that bran is fed to poultry. The use of other byproducts was not known by most farmers even by those with livestock.

***Box 2.2:***
***Baseline Summary of the Estimated Annual Average Post Harvest Losses of Maize***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of Maize from the harvest stage to consumption is as follows:

- at harvest site: 3 percent
- in transit: 0.5 percent
- at whole sale point: 2 percent
- at retail market: 1 percent
- at processing/packaging and storage: 15 percent
- at consumption stage: 0.5 percent

***Therefore post harvest losses of maize are estimated at an average of 22 percent per year***

### *2.3.3 Implications of post-harvest losses of maize for income generation*

#### *Implications of post-harvest loss of maize for income generation at national level*

Table 2.6 below presents the estimated post harvest losses at national level based on the average loss of 22 percent per year as per the findings of the assessment. The estimated losses are given in the shaded areas showing that loss of volume in column (b) and loss of earnings in column (d) and column (e).

The Results show that since 2002, loss of maize exceeds 300 tonnes of maize at any given year. Loss of earnings (value) at any given year exceeds TZS 100,000,000. These losses have been accruing while Zanzibar has been experiencing deficits of maize production year after year. In 2004 for example, the estimated post harvest losses of 553 tonnes took place at a time when there was a deficit of 76 percent in domestic production. Zanzibar imports maize mainly from the mainland to make up for the shortfalls but this means a drain on financial resources. If pre-harvest losses of 58.3 percent and post-harvest losses of 22 percent could be controlled it is most likely that Zanzibar would be importing far less maize than currently done.

*Table 2.6:*
*Post-harvest loss of volume and value of maize produced in Zanzibar 2002-2007*

| Year | (a) Marketed Maize Production in Zanzibar | (b) Loss of volume of maize @ 22 percent post harvest loss | ( c) Value of Marketed maize | (d) Loss of value of maize @ 22 percent post harvest loss | (e) Loss of value of maize @ 22 percent post harvest loss |
|---|---|---|---|---|---|
| | (in tonnes) | (in tonnes) | (in million TZS) | in Million TZS | (in USD equivalent) |
| 2002 | 1,583 | 348.26 | 475 | 104.50 | 80,384.62 |
| 2003 | 1,605 | 353.10 | 514 | 113.08 | 86,984.62 |
| 2004 | 2,515 | 553.30 | 1,068 | 234.96 | 180,738.50 |
| 2005 | 1,419 | 312.18 | 603 | 132.66 | 102,046.20 |
| 2006 | 3,927 | 863.94 | 1,669 | 367.18 | 282,446.20 |
| 2007 | 1,931 | 424.82 | 821 | 180.62 | 138,938.50 |
| | *Cumulative loss of volume @ 22%* | 2,855.6 | *Cumulative loss of value @ 22%* | 1,133.00 | 871,538.50 |

Source: Calculations based on data from the Zanzibar Statistical Abstracts, OCGS, Zanzibar, May 2008

#### *Implications of post-harvest losses of maize for household income*

Farmers said that one acre of maize can generate up to TZS 500,000 if is sold as green maize. Losses increase as the crop stays longer in the field and when harvested dry and processed into flour. Often household with families want the crop harvested dry so that they can have flour and use it for a variety of dishes. For the majority of households that harvest only 5 *polos* per season, a 22 percent post harvest loss would mean a loss of 110 kgs. At the price of TZS 800/kg, it would mean a loss TZS 88,000 or about one and half times the minimum wage. On the other hand youth in Tazari village said they find it easier to sell the crop as green maize at an agreed wholesale price and get a lump sum payment and move on to other activities. This means that the buyer harvests the entire farm and gains all the profits, bears all the costs as well as the losses that may occur.

***Implications of post-harvest losses of maize for food prices, FSN***

Maize contributes about 5 percent of the calorie intake in Zanzibar and considered the 3rd or 4th most important staple food in many urban areas where the assessment was done. Many people consume it about 3 times a week depending on availability of other staples like plantains or cassava. However, it was said that in seasons when bananas and cassava are in short supply (November to February) maize flour becomes a very popular staple substitute and is consumed even five times a week. Post harvest losses of 22 percent could aggravate maize prices at this time of shortage of key staples. This could reduce household access to food because the price of maize flour is already high at TZS 800/kg. Thus, it is important that households produce maize and control losses of the crop at all stages.

***Table 2.7***
***Potential for the control of post-harvest losses along the maize value chain***

| Stage of the maize value chains | Area of concentration | Status of the maize value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Production is small holder dominated in the substance and traditional sector<br>2. Production is done with insufficient inputs and technical support<br>3. Area under production is relatively small compared to that which is under rice production. |
| Stage 2 | Harvesting | 1. Increasingly harvested as green maize that has high demand in urban areas.<br>2. Dominated by traditional low technology methods of harvesting |
| Stage 3 | Post harvest handling and storage | 1. Very limited storage due to limited supply<br>2. Warehouses are available mostly in urban and semi urban areas |
| Stage 4 | Transportation/ Distribution | 1. Highly localized due to the small amounts that are produced<br>2. Retail outlets abound in urban and rural neighborhoods |
| Stage 5 | Transformation/ Processing | Mostly processed into flour and into the common food "*Ugali*" |
| Stage 6 | Marketing/ Promotion | Very limited promotion done on maize sales locally |
| Stage 7 | Consumption and use of by products | Consumption of maize is increasing in Zanzibar |

***2.3.4 Recommendations***

Priority Areas for Intervention

- promote production of maize in high potential areas using improved varieties;
- lessons learned by youth in selling green maize could be shared and youth groups could be supported to produce the short duration varieties to be sold as green maize as part of "*farming as a business*". This Could be done on irrigated plots to ensure that green maize is available all year round;
- deliberate efforts should be taken to address the problem of low yields of maize and provide the necessary inputs to assist farmers produce maize in an improved environment;
- farmers should be assisted to develop skills in maize production and efforts should be made to organize farmers into areas of specialization e.g into green maize producers of Zanzibar or organic maize producers of Tazari etc.

Main Actors along the Maize Value Chain

- Ministry of Agriculture, Livestock and environment, to provide policy development, administration and legislation
- Commission of Agriculture Research and Extension to promote research and extension activities
- Plant Protection Department to provide research and monitoring of crop pests and diseases
- colleges like the Kizimbani Agricultural College, to provide training to farmers and to civil society organizations working in the agricultural sector;
- research stations like the Kizimbani Research Station on improved varieties;
- there are Farmer Field Schools for the provision of short courses to farmers;
- there are Civil society organizations like ZAFFIDE, UWAMWIMA and others that are specialize in service delivery to farmers.

## 2.4 Sorghum

### *2.4.1 Production of sorghum in Zanzibar*

Sorghum is produced in both Unguja and Pemba and is grown is some of the semi arid areas of Zanzibar. The 2002/03 Sample Census of Agriculture found about 541 ha were planted with the crop. Micheweni district in Northern Pemba accounted for 59 percent of the area under cultivation followed by North "A" district in Unguja, 27 percent. As shown in Table 2.8 there has been some modest increase in production of sorghum since the undertaking of the 2002/03 Sample Census. However, in many parts of Unguja, the consultants found that some farmers in the South and West districts had abandoned the crop and were growing cassava and yams instead. The main reason given for abandoning the crop was that it does not pay to cultivate the crop in the area. It was best said in Kiswahili as "*mtama haulipi*".

**Table 2.8:**
**Production of Sorghum in Zanzibar, 2002 – 2007 (in mt)**

| Years | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Production in tonnes | 91.00 | 158.00 | 145.00 | 459.00 | 409.00 | 794.00 |

Source: Unpublished statistics, MALE, Zanzibar

### *2.4.2 Estimated post harvest losses of sorghum in Zanzibar*

#### *Losses at harvest sites*

Farmers who grow sorghum said they harvest between 7 and13 *polos* per acre or about (350 to 650 kgs per acre). Most fields seen during the assessment showed that the tall variety is grown on very small holdings. Some farmers said they cultivate only one quarter of an acre. It is grown as a secondary staple and most often it is used to prepare weaning foods for children. Farmers in Kizimkazi and Nungwi in Unguja and Micheweni in Pemba said that because plot sizes are small and yields are low harvesting is done comprehensively and very little is left in the fields. On average about 2 percent of the crop is lost in threshing and winnowing.

#### *Losses in transit from the farm to the market*

Farmers said that very little of the crop is transported for sale. Most of the local production is consumed at household level. A very small proportion of the crop is sold. Sorghum is transported in sealed 50 and 100 kgs bags and loss is kept to a minimum. Farmers in Micheweni Pemba estimate that about 0.5 percent is lost in transit per year.

#### *Losses at wholesale markets*

Discussions held with operators of wholesale shops in Unguja and Pemba revealed that sorghum should be very dry before storing and this helps prevent attacks from weevils and other pests. They said that they stock only small amounts because sorghum is not as popular as rice but it is widely consumed in Zanzibar.

At Konde market in Micheweni district, Pemba dealers in sorghum said about 0.5 percent is lost at wholesale point. In some of the shops at Darajani market in Zanzibar town, we came across sorghum that was attacked by weevils. The broken pieces would be washed away during the cleaning processes that precede milling of the grain into flour. The overall assessment led to the conclusion that post harvest losses of sorghum at wholesale points was about 1 percent per year.

***Losses at retail markets***

Operators of retail shops said that there is a growing market for sorghum and sales are good. They said however that at times they receive sorghum that has been in stores for long periods of time and once the bags are open the grain starts to deteriorate. It was estimated that on average sorghum that is lost at retail points averages 2 percent per year.

***Losses in processing and packaging/branding, preservation and storage***

Sorghum from retail shops must be sorted and cleaned and dried before taking to milling machines to process into flour. Usually sorghum is milled as whole grain or cleaned and boil the grains as they do for rice. In some cases it is mixed with roasted groundnuts to make a nutritious weaning food that is popular among mothers in Zanzibar. The process of sorting and cleaning with water causes some loss of grain. It is estimated that as much as 2 percent of the grain is lost at the stage of processing.

***Losses at consumption stage***

Consumption in restaurants is limited and in tourist hotels even more limited. Heads of households who were interviewed said that there is very little loss of sorghum at household level and averages 0.5 percent

***Use of byproducts***

There are no known uses of byproducts of sorghum in Zanzibar.

**Box 2.3: Baseline summary of the estimated average annual post-harvest losses of sorghum**

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of sorghum from the harvest stage to consumption is as follows:

- at harvest site: 2 percent
- in transit: 0.5 percent
- at whole sale point: 1 percent
- at retail market: 2 percent
- at processing/packaging and storage: 2 percent
- at consumption stage: 0.5 percent

***Therefore post-harvest losses of sorghum are estimated at an average of 8 percent per year***

## *2.4.3 Implications of post-harvest losses of sorghum on income generation*

***Implications of post harvest losses of sorghum on income generation at national level***

As shown in Table 2.9 below, the estimated post harvest loss of 8 percent has been applied to the marketed production of sorghum. In column (a) the marketed production of sorghum is shown and in column (b) the value is shown. In column (c) the 8 percent annual post harvest loss has been applied to marketed output to calculate the annual loss of volume and in column (d) the 8 percent has been applied to the value to determine loss of value annually in TZS. In column (e) the estimated loss of value is presented in USD equivalent per annum.

The results show that in 2007, over 63 tonnes of sorghum may have been lost after harvest. The value of this loss in 2007 is estimated at TZS 28,240,000.

It should be noted that the post harvest losses are in addition to a large pre harvest loss attributed to low yields. The average yields of 2 tonnes/ha are only 40 percent of potential yields of 5 tonnes/ha. Thus, 60 percent of the potential harvest is lost before harvest. The combined pre and post harvest losses deprive the nation of food and of income that could be generated from sorghum.

**Table 2.9**
**Loss of volume and value of sorghum 2002 – 2007**

| | (a) | (b) | (c) | (d) | (e) |
|---|---|---|---|---|---|
| Year | Marketed sorghum production | Value of marketed sorghum | Loss of volume @ 8% per annum | Loss of value @ 8 % per annum | Loss of value of sorghum @ 8% per annum |
| | (in tonnes) | (in million TZS) | (in tonnes) | (in Million TZS) | (in USD equivalent) |
| 2002 | 91 | 11,000,000 | 7.28 | 880,000 | 676.92 |
| 2003 | 158 | 19,000,000 | 12.64 | 1,520,000 | 1,169.23 |
| 2004 | 145 | 29,000,000 | 11.60 | 2,320,000 | 1,784.61 |
| 2005 | 459 | 92,000,000 | 36.72 | 7,360,000 | 5,661.54 |
| 2006 | 409 | 182,000,000 | 32.72 | 14,560,000 | 11,200.00 |
| 2007 | 794 | 353,000,000 | 63.52 | 28,240,000 | 21,723.08 |
| | | ***Cumulative loss of 8%*** | ***164.48*** | ***54,880,000*** | ***42,215.38*** |

Source: RGoZ, Zanzibar Statistical Abstracts, OCGS, Zanzibar, May 2008

***Implications of post-harvest losses of sorghum for household income***

Sorghum is grown in semi arid areas of Zanzibar where food production is limited. Yields in these areas are very low averaging 8 *polos* per acre or about 400 kg. Post harvest losses of 8 percent would mean a loss of about 32 kgs per acre.

At TZS 1,000 retail price/kg the loss per acre is about half the minimum wage in Zanzibar. For those who harvest more *polos* the loss would be bigger.

***Impacts of post-harvest losses of sorghum on food prices, FSN***

Sorghum is used as a buffer crop against hunger because it grows in areas that are less suitable for other cereals like rice or maize. Post-harvest losses of sorghum deprive households of this important crop and predispose producing communities to food insecurity. Sorghum is also used extensively as a weaning food and many women have learned how to prepare sorghum mixed with legumes, especially groundnuts and ground into composite flour used to feed young children. Losses of this crop reduce household resources for ensuring good nutrition for adults and children.

**Table 2.10**
**Potential for control of post -harvest losses along the sorghum value chain**

| Stage of the sorghum value chains | Area of concentration | Status of the sorghum value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Production is mostly on small scale with little use of improved farming practices<br>2. The traditional variety that is grown takes along time to mature<br>3. Farmers have little exposure to extension services<br>4. There are not any large scale producers of the crop in Zanzibar |
| Stage 2 | Harvesting | 1. Pests and disease as well as poor farming practices have reduced yields by 60 percent.<br>2. Harvesting is mostly done by family labor |
| Stage 3 | Post harvest handling and storage | Very little of the sorghum produced is stored. Most is sued during the period of harvest because of the small harvests |
| Stage 4 | Transportation/ Distribution | Crops are transported from fields on ox-drawn carts or by bicycles. |
| Stage 5 | Transformation/ Processing | There is little if any known commercial processing of sorghum taking place in Zanzibar |
| Stage 6 | Marketing/ Promotion | Little promotion as sales are mostly done at local level. |

### *2.4.4 Recommendations*

Priority Areas for Intervention

- most producers have not been exposed to improved methods of sorghum production and therefore do not know how to improve yields. Farmers should be trained through farmer field schools and through demonstration plots to improve sorghum production;
- the hand hoe was mentioned as one of the greatest bottleneck to expanding acreage. Framers are in need of technologies like power tillers, which can be paid for by farmer groups through credit arrangements. Opportunities for availing power tillers to producers should be sought and where possible a special programme for small scale agricultural mechanization should be established in sorghum producing areas;
- most farmers have no working capital that they can use to expand acreage or to buy inputs. There is need to seek opportunities to form farmers' associations through which to establish credit schemes to support increased sorghum production.

Main actors along the chain

- Ministry of Agriculture, Livestock and Environment, to provide policy development, administration and legislation;
- Commission of Agriculture Research and Extension to promote research and extension activities;
- Plant Protection Division to provide research and monitoring of crop pests and diseases;
- colleges like the Kizimbani Agricultural Collage, to provide training to farmers and to civil society organizations working in the agricultural sector;

- research stations like the Kizimbani Research Station on improved varieties;
- there are Farmer Field Schools for the provision of short courses to farmers;
- there are Civil society organizations like ZAFFIDE, UWAMWIMA and others that are specializing in service delivery to farmers.

## 2.5 Bulrush millet

Bulrush millet is a very important cereal in North "A", Wete, Micheweni, and Mkoani districts. In 2002/03, the Sample Census of Agriculture found production was 151 tonnes, 41 percent produced in the short rains and 59 percent produced in the long rains. Average annual yields was only 0.48 tonnes/ha. Micheweni district accounted for 81 percent of the total annual production and 75 percent of the total area under cultivation.

### 2.5.1 Production of bulrush millet in Zanzibar

As shown in Table 2.11 production of millet has been stagnant for some years and production is low. A large proportion of the millet that is consumed in Zanzibar is from the Mainland.

Table 2.11: Production of Bulrush Millet in Zanzibar 2002- 2007 (in tonnes)

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Production (in tonnes) | 77.25 | 79.57 | 79.57 | NA | NA | NA |

Source: Various Reports, MALE, 2009

### 2.5.2 Estimated post-harvest losses of bulrush millet

*Loss of bulrush millet at harvest site*

The assessment of post-harvest loss of bulrush millet at harvest site was carried out among a limited number of farmers in Micheweni, Pemba. Thus, comparisons were made of the percentages given of the estimated losses. However, the acceptance of the estimates was done after a long discussion about how the losses occur. It was estimated that at harvest site about 2 percent of the crop is lost at threshing, winnowing and cleaning.

*Loss of bulrush millet in transit from the farm to the market*

Given that only small amounts of millet are produced only small amounts are transported to the market. However these are often sealed in bags before packing into carts or trucks and loss is minimal. It was estimated that only 10 percent of the harvest is sold and that of this amount only 0.5 percent is lost in transit.

*Loss of bulrush millet at whole sale markets*

There were only a limited number of wholesale shops selling millet and most of these were at Darajani market in Zanzibar town. Shop operators said that they stock only small amounts at a time to ensure that the stock does not get damaged in store. Estimated loss at wholesale point was 1 percent per year.

*Loss of bulrush millet at retail markets*

Retail shops at Konde market in Micheweni district, Pemba and at Darajani market in Zanzibar town estimate that on average 1 percent of the crop is lost at retail level

*Loss of bulrush millet in processing and packaging/ branding, preservation and storage*

Bulrush millet is cleaned, washed and dried before it is milled into flour. It is estimated that losses at this stage average 2 percent per year.

***- Loss of bulrush millet at consumption stage***

Assessment of consumption practices showed that bulrush millet is rarely used in restaurants or in the hotel industry. Most of the crop is consumed by producers and local communities. Loss at consumption stage averages 0.5 percent per year.

***Box 2.4: Baseline summary of the estimated average annual post harvest losses of bulrush millet***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post-harvest loss of bulrush millet from the harvest stage to consumption is as follows:

- at harvest site: 2 percent
- in transit: 1 percent
- at whole sale point: 0.5 percent
- at retail market: 1 percent
- at processing/packaging and storage: 2 percent
- at consumption stage: 0.5 percent

***Therefore post harvest losses of bulrush millet are estimated at an average of 7 percent per year***

**Table 2.12: Potential for control of post-harvest losses of bulrush millet value chain**

| Stage of the Bulrush millet Value Chains | Area of concentration | Status of the Bulrush Millet Value Chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Bulrush millet is produced primarily by smallholders<br>2. Some farmers have adopted the short improved variety<br>3. Most farmers expressed need for education and skills training on how to produce and process bulrush millet<br>4. Many farmers are seeking access to improved seed but can not find it in input shops<br>5. Many farmers do not have access to fertilizers or pesticides |
| Stage 2 | Harvesting | Harvesting is done when the crop is dry and is mostly done by family labor |
| Stage 3 | Post harvest handling and storage | 1. Very limited storage due to limited supply.<br>2. Warehouses are available mostly in urban and semi-urban areas. |
| Stage 4 | Transportation/ Distribution | Bicycles and ox-drawn carts are the main means of transport. Only small volumes available for distribution outside the local community |
| Stage 5 | Transformation/ Processing | Processing is done mostly in the form of milling the grain into flour |
| Stage 6 | Marketing/ Promotion | Marketing is done locally and the crop is sold mostly to low income consumers in the neighborhood |
| Stage 7 | Consumption and use of by-products | Used as a staple in the key producing areas. |

# Chapter 3:

## Findings on post-harvest losses of legumes

## 3.1 Introduction

Production of leguminous crops is still very low in Zanzibar as seen in table 3.1 below. Cow peas dominate the production of pulses. Green gram is produced in the northern part of Unguja. There is also production of groundnuts in many parts of Pemba and Unguja.

**Table 3.1: Production of main legumes in Zanzibar (in tonnes)**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Cowpeas | 156.00 | 228.00 | 695.00 | 1,346.00 | 474.00 | 972.90 | 960.00 | 1,029.20 |
| Green gram | 129.00 | 132.87 | 348.00 | 348.00 | 62.00 | - | - | - |
| Pigeon peas | 387.00 | 398.61 | 90.00 | 117.00 | 266.00 | - | - | - |
| Groundnuts | 101.00 | 90.00 | 295.00 | 295.00 | 105.00 | 310.80 | 1,800.00 | 75.80 |
| Beans Dried | 49.00 | 49.00 | 49.00 | 49.00 | 49.00 | - | - | - |
| Total | 822.00 | 898.48 | 1,477.00 | 2,155.00 | 956.00 | 1,283.70 | 2,760.00 | 1,105.00 |

Source: Zanzibar Statistical Abstracts, OCGS, May 2008

Estimates of post harvest losses were made based on consultations with only a limited number of farmers and from visits to shops and stores. In many shops that were visited, samples were taken and proportions of damaged crop estimated. These were used to come up with the averages presented in Table 5.2. The results are presented in Table 3.2 below.

**Table 3.2 Baseline Summary of the Estimated Average Annual Post Harvest Losses of Key Leguminous Crops**

| Location of post-harvest loss | Cow peas (%) | Dry beans (%) | Green gram (%) | Pigeon peas (%) | Groundnuts (%) |
|---|---|---|---|---|---|
| Harvest site | 5 | 5 | 7 | 5 | 2 |
| In transit | 1 | 1 | 1 | 1 | 1 |
| At whole sale point: | 2 | 2 | 3 | 2 | 5 |
| At retail market | 5 | 10 | 10 | 5 | 10 |
| Processing/packaging/storage | 2 | 5 | 10 | 3 | 5 |
| At consumption stage | 1 | 1 | 1 | 1 | 3 |
| **Total post-harvest loss** | **16** | **24** | **32** | **16** | **26** |

The losses are said to be due to lack of proper storage structures, attacks by weevils, and limited availability of pesticides. Most farmers do not know what pesticides to use for storing various crops.

# Chapter 4:

## Findings on post-harvest losses of roots and tubers

## 4.1 Introduction

Roots and tubers, notably cassava, sweet potatoes, yams and tania (coco yams) are the main annual subsistence crops produced in Zanzibar. The production and yield of these crops especially cassava is higher compared to all cereals combined. Root crops can grow even in areas of low soil fertility. The 2002/03 National Sample Census of Agriculture found that of the 53 percent of the areas planted with annual crops was occupied with root crops. Cassava accounted for 81 percent of the 41,765 ha that were planted with roots and tubers. Table 4.1 shows cassava is produced in larger amounts than any other root crop followed by sweet potatoes.

Table 4.1: Marketed production of main roots and tubers in Zanzibar (in tonnes)

| Year | Cassava | Sweet Potatoes | Yams | Tania | Total Main Roots and Tubers |
|---|---|---|---|---|---|
| 2002 | 162,006 | 19,652 | 1,052 | 7,166 | 189,876 |
| 2003 | 158,898 | 21,500 | 3,164 | 1,400 | 184,962 |
| 2004 | 166,106 | 36,018 | 3,691 | 3,227 | 209,042 |
| 2005 | 102,886 | 13,211 | 2,394 | 7,542 | 126,033 |
| 2006 | 190,266 | 63,949 | 5,100 | 8,408 | 267,723 |
| 2007 | 187,213 | 45,620 | 8,192 | 4,191 | 245,216 |

Source: Various Reports, MALE, 2009

## 4. 2 Cassava

### *4.2.1 Production of cassava in Zanzibar*

The 2002/03 Sample Census of Agriculture found cassava accounted for 86 percent of all root crops produced in Zanzibar and that about 63,785 households planted cassava and these represented 66 percent of households with crop holdings. Cassava is grown in mono or mixed cropping with other annual or perennial crops. In 2002/03 the highest production was found in Mkoani district in Pemba which produced 22 percent of the total harvest, followed by Micheweni, 15 percent; Wete, 13 percent; and the South district of Unguja accounted for only 3 percent; West 9 percent; Central, and North A, 7 percent each. On average a cassava growing household cultivates about 0.58 ha.

Table 4.2 Cassava productions in Zanzibar, 2000-2007 (in tones)

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Area Harvested (ha). | 12,274.6 | 12,848.8 | 10,800 | 10,593.2 | 11,1073 | 6,859 | 12,684.4 | 12,480.87 |
| Yield in kg/ha | 10,000 | 10,000 | 15,000 | 15,000 | 15,000.99 | 15,000.15 | 15,000 | 15,000 |
| Production (in tonnes.) | 122,746 | 128,488 | 162,006 | 158,898 | 166,106 | 102,886 | 190,266 | 187,213 |

Source: Various Reports, MALE, Zanzibar

### 4.2.2 Estimated post-harvest losses of cassava

#### Losses at harvest site

Cassava farmers were asked to estimate the amount of the harvest that is lost at various stages from the farm to the table and to calculate the value of the loss based on their own experiences. The results were as follows.

i) in Mahonda and Kitope two of the main cassava growing villages in central Unguja, it was said that delayed harvesting of some varieties causes the tuber to become hard and rubbery and unsuitable for consumption. This has happened to some farmers who have planted cassava in stony (coral rag) areas where, at times, the temperatures get very hot thereby causing overheating of the tuber while still in the ground. These farmers said that in one particular year they lost 100 percent of the crop as a result.

ii) in parts of Pemba like Gando village, some farmers are increasingly harvesting cassava that is small and fibrous and to a large extent unsuitable for consumption. One farmer said he has lost 90 percent of his crop as a result of planting the wrong (highly fibrous) variety. Another farmer in the same village said that he has often harvested bitter cassava from his 5 acre farm when he actually thought he planted the sweet variety. He has been unable to sell the crop even though he cultivated it as a cash crop and the yields are said to be good.

iii) most farmers in key cassava growing areas estimate that as much as 5 percent of the crop is damaged by the use of poor harvesting tools alone. In order to avoid breaking the tubers some farmers wait until the rainy season when the soil is softer and easier to pull the plant from the ground. However, during this season farmers in Mahonda said wild animals, notably monkeys and wild hogs also find it easy to dig up the crop and cause just as much a loss to the farmer as with the poor tools. Overall, it was estimated that loss of cassava at harvest sites averages 5 percent per year.

#### Losses in transit from the farm to the market

*Exposure to salt water:* When salt water comes into direct contact with the tuber, it is known to cause rapid and complete deterioration of the crop. However, it was said that often cassava is brought into Unguja from Pemba, Tanga or Bagamoyo in open boats and under poor packaging conditions. This allows salt water to get to the crop and many traders have lost entire consignments this way. Stories told at Mwanakwerekwe market indicated that there have been many traders who have lost cassava due to contact with salt water including of investors who ended up giving up his business after an encounter with salt water flooding in a boat, which destroyed a large consignment of cassava that was destined for the Unguja market. It is estimated that the average loss due to damage of the crop while in transit averages about 5 percent per year.

*Delayed arrival at destined markets:* In Unguja it is possible to harvest and get the crop to the market on the same day because of proximity to the main markets. However, for farmers and traders coming from Pemba or from the Mainland, delays could last up to two or three days. Longer delays are said to cause discoloration of the tuber. Discolored cassava is not discarded but processed into flour and eaten as *Ugali*. However, once discolored it is sold at a fraction

of the price sometimes at 20 percent of the price. This causes loss of income to the farmer or trader such that to those involved with large consignments the price offered is said to cover only the transport costs. It is estimated that the amount of cassava that is processed into flour due to discoloration averages 3 percent of the crop sold per year.

### *Losses at wholesale markets*

Mwanakwerekwe is the only wholesale market for cassava in Unguja. Cassava is brought into the market and sold as is in *polos* during the early morning auctions. There are not any quality control measures to safeguard quality and buyers are expected to sort the crop after buying it. Traders said that cassava is brought into the wholesale market without any labeling to show when it was harvested. Based on meetings and discussions with traders and brokers at Mwanakwerekwe market most of the cassava that is brought into the market is sold the same day regardless of how much has been brought in that day. Farmers who bring the crop late after the main auction has taken place are the ones who remain with the crop for the day or until the next day's auction. Thus, loss of the crop at wholesale level is minimal and is estimated at between 3 percent and 5 percent. In Pemba information gathered based on visits to markets in Wete, Chake Chake and Mkoani indicates that cassava losses at wholesale points average 2 percent. Overall, it is estimated that loss of cassava at wholesale points in Zanzibar averages 3 percent per year.

### *Losses at retail points*

The greatest post-harvest loss of cassava takes place at retail level especially when the market is flooded with the crop at particular seasons like the Holy Month of Ramadhan or when there is an influx of imported cassava from the Mainland. It was said that the greatest losses at retail level occur due to the following reasons:

i) retailers can not easily tell when the crop was harvested because the crop is sold still covered with the soil from the field and there are no sanitary regulations to guide or enforce how the crop should be presented for sale. It is after the retailers have taken the crop to the retail outlets that they realize that the cassava is yellowing or rotting and discover then that the crop had been harvested days before sale.

ii) consumers demand that they break parts of the crop and taste it to see if it is fresh and not bitter. The broken pieces are thrown away at a loss to the retailer.

iii) poor vending environments at open markets or where the crop is exposed to the sun and or rain leads to rapid deterioration as well as damage by rats and other pests.

However, it was said that the losses increase and decrease depending on season. During the season of plenty, September to December losses increase because retailers stock large volumes of cassava taking advantage of the lower prices that often prevail at the time. On average, it was estimated that 10 percent of the crop is lost at retail level annually

### *Losses in processing and packaging/branding, preservation and storage*

Cassava processing and packaging is still very underdeveloped in Zanzibar. Farmers said they process cassava into flour at home but only when they find the tuber is discolored or when they come across the bitter variety. Only about 3 percent of the cassava brought into the market is processed into flour. Farmers and traders estimate that the amount of loss in processing this small amount of cassava averages 1 percent per year.

### *Losses at household level*

When cassava is needed for food at home, most farmers harvest only what they need and leave the remaining crop safe in the ground. Whenever there is surplus at home it is peeled, dried and pound into flour. Most traders and farmers are of the opinion that the crop is discarded only when it is rotten and estimate that only a small amount of the crop is lost at household level due to a number of factors including:

i) Cassava that is broken in the field and some of the small broken pieces are removed in preparation.

ii) Failure to recognize poor quality cassava at the market, which becomes unpalatable once prepared and must be discarded.

iii) On average 2 percent of cassava is lost at consumption stage.

**Box 4.1**
**A household of 15 people missed the main meal due to bitter cassava from the market**

The Consultants met Mgeni Nahodha on 29th May 2009, at her home at around noon. She was sitting outside her house holding her head in her hands. We greeted her and she welcomed us into her home at Jang'ombe Urusi, one of the low income areas of Zanzibar Town. We explained the purpose of our visit and requested some information about post harvest food losses she has experienced at her home. She told us we came at the right time. She took us to where she had left a pile of brown peels of cassava. She explained that she bought the cassava for TZS 4,000, the entire food budget for the day.

I have never failed to tell good cassava from the bad but today I do not know what happened. I buy cassava from the same trader every day. I trust him but today all has changed, she said. She paused for a moment and asked us again what we wanted to know. On the side of the house two of her younger children were sorting fresh sardines (dagaa) but now she must think fast about what will be served for lunch now that the cassava can no longer be used. She said, there are 15 people in my house and now I have to organize something for them especially the children.

We asked her if she would be willing to return the remaining cassava to the trader. She said she peeled it all trying to see if any of it was good and found none. She stressed that it is important to ask the trader to cut a small piece of cassava for tasting before buying and not to trust the outside appearance of the crop. She said she was in a hurry and did not taste the cassava that day and that was the main reason she took home the bad lot.

Asked if that sort of experience was common, she said it does not happen often. It happens only every once in a while perhaps two times in a year families experience that kind of loss.

***Use of cassava by-products***

The main use of cassava byproducts is the stalk as planting material and the leaves that are used as a popular green vegetable in many households. Other uses of cassava byproducts like the peel is used as livestock feed but only to a very limited extent because livestock keepers are few compared to the amount of cassava peel generated and also because only a few farmers are aware that the peels can be used as fodder.

***Box 4.2 Baseline summary of the estimated average annual post-harvest losses of cassava***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post-harvest loss of cassava from the harvest stage to consumption is as follows:

- at harvest site: 5 percent
- in transit: 5 percent
- at whole sale point: 3 percent
- at retail market: 10 percent
- at processing/packaging and storage: 1 percent
- at consumption stage: 2 percent

***Therefore post harvest-losses of cassava are estimated at an average of 26 percent per year***

### 4.2.3 Potential economic and social impacts of post-harvest losses of cassava

- ***Loss of income due to post-harvest losses at national level***

Cassava is the most dominant food crop grown in Zanzibar and a staple for the majority of the poor in rural areas. Although cassava is the third most preferred staple next to rice and plantains, it is the food most often consumed as a national buffer crop that safeguards the people from hunger and to many farm households it is also a source of cash. Cassava generates more revenues for farmers than that generated from rice, maize, sorghum, yams or sweet potatoes.

Table 4.3 below shows post-harvest losses of revenue based on 26 percent loss. In column (a) the marketed output of cassava is shown and in column (b) the estimated loss at 26 percent of average annual post-harvest loss. In column (c) the value of the market annual output is shown and in column (d) the estimated loss of value in Tanzania shillings at the average loss of 26 percent per annum. In column (e) the annual loss of value is presented in United States Dollar equivalent.

As shown in the Table the losses are shown in the shaded areas (*in volume and in value for Tanzanian Shillings and United States Dollar equivalents*).

The results of the calculations show that since 2002 losses as a result of the 26 percent post harvest loss of volume of cassava exceed 25,000 tonnes per annum at any given year and loss of value exceed TZS 1.75 billion at any given year.

**Table 4.3: Value of cassava and cassava produced in Zanzibar, 2002 – 2007 in million Tanzanian Shillings**

| | (a) | (b) | (c ) | (d) | (e) |
|---|---|---|---|---|---|
| **Year** | Marketed cassava production | Loss of volume @ 26 percent post harvest loss | Value of marketed cassava produced in Zanzibar | Loss of value @ 26 % post- harvest loss | Loss of value @ 26 % post harvest loss |
| | (in tonnes) | (in tonnes) | (in Million TZS) | (in Million TZS) | (In USD equivalent) |
| 2002 | 162,006 | 42,121.56 | 6,966 | 1,811.16 | 1,393,200 |
| 2003 | 158,898 | 41,313.48 | 6,833 | 1,776.58 | 1,366,600 |
| 2004 | 166106 | 43,187.56 | 10,974 | 2,853.24 | 2,194,800 |
| 2005 | 102,886 | 26,750.36 | 6,790 | 1,765.40 | 1,358,000 |
| 2006 | 190,266 | 49,469.16 | 21,881 | 5,689.06 | 4,376,200 |
| 2007 | 187,213 | 48,675.38 | 21,529 | 5,597.54 | 4,305,800 |
| | ***Cumulative estimate of loss @ 26 %t*** | **251,517.5** | ***Cumulative estimate of loss @ 26 percent*** | **19,492.98** | **14,994,600** |

Source: RGoZ, Zanzibar Statistical Abstracts, 2007

***Implications of post-harvest losses for food prices, FSN***

Retailers of cassava said when they incur post harvest losses they raise prices to try to break even. Thus, the costs of post harvest losses are born by the consumer. In a poor country an increase in food prices has implications for household food access and is often reflected in the quality of the household food basket. This, in turn, has implications for nutrition; the poorer the quality of food the less likely it is that the household will be able to meet all its nutritional needs.

In Zanzibar the cost of basic food items is relatively high considering the low incomes of the majority of the people. For example, it costs about TZS 500 to buy enough fresh cassava for one person and about TZS 1,000 to buy one fish for one person. One kilogram of tomatoes cost TZS 1,200 and an average household of 5 people would use about half a kilogram of tomatoes per day at an estimated cost of TZS 500. In a household of 5 adults, it would cost TZS 2,500 for the starchy portion of the meal alone. In households where cassava is consumed two times a day this would mean a daily expenditure of TZS 5000 for cassava alone. This would amount to TZS 150,000 per month or about two and half times the minimum wage in Zanzibar.

### Box 4.3 Household earnings from cassava

Small scale farmers in Unguja said on average, a household cultivates between 0.5 and 3 acres of cassava often intercropped with bananas, yams, vegetables and fruit trees. Over 95% of farmers said they produce cassava primarily for own consumption. However, almost all said that they sell whatever surplus they produce to generate cash. Harvests are estimated in medium sized container bags popularly known as *polos*. When filled with cassava each *polo* weighs between 40 and 50 kgs. On average, farmers harvest about 50 to 100 *polos* per acre. Thus, one acre yields between 1,600 and 5,000 kgs of cassava. Most farmers sell cassava either at the local market or to neighbors and they say the demand is always high. During the low season a *polo of 50* kilogramms could sell for TZS 30,000. In seasons of glut the same *polo* could sell for as low as TZS 5,000. Farmers agree that the season of glut does not last long and is often during the Holy Month of Ramadhan when most farmers release the crop for sale.

Based on the yield estimates provided above a farmer could earn as much as TZS 1,500,000 per acre during the season of high demand. Farmers estimate that the cost of cultivating one acre could be as high as TZS 200,000. Thus, the profit that farmers could get from one acre could be as high as TZS 1,300,000 or about 2 two times the annual size of minimum wage in Zanzibar of TZS 60,000 per month (or TZS 720,000 per year). For those who cultivate 3 acres cash earnings could be as high as TZS 4,500,000 per season. The profit could be TZS 3,900,000 or more than 5 times the annual minimum wage. Farmers who are using the improved varieties which take only 6 months to mature could earn this amount twice a year. Post harvest losses deprive farmers of these potential earnings.

***Implications of post harvest losses for household income***

Loss of cassava leads to loss of food security at home and leads also to loss of cash income for the household. The loss of 26 percent would happen only to a person who is involved in all the stages of the commodity chain of losses as elaborated in Section 4.2. Often a farmer would lose at harvesting site and at household level during food preparation at home. Other actors would incur some of the losses along the chain. In the end the losses affect many households according to level and area of involvement.

Cassava is relatively more expensive to buy as a staple food compared to rice. A kilogram of locally produced rice costs TZS 1,500 and this would be enough to feed a family of five. However, it would cost about TZS 2,500 to feed the same family of five with cassava. Therefore the loss of cassava at home would necessitate even higher imports of rice to feed the population. This would lead to further draining of the scarce foreign exchange resources. The loss of cassava also means loss of an important buffer crop and increased reliance on food purchases to sustain households. Increased losses would most likely push households to abandon farming and seek wage employment to be able to access food on the market. This would also mean increased acquisition of cassava from the Mainland but the cost would probably be too high to be accessible to poor families.

### Table 4.4: Potential for control of post harvest losses along the cassava value chain

| Stage of the cassava value chain | Area of concentration | Status of the cassava value chain |
|---|---|---|
| Stage 1 | Production | 1. Production is done mainly done on small holdings averaging 0.5 to 3 acres per household.<br>2. Traditional varieties are mostly used with very low yields of only 20 percent of the potential yields. Only a limited number of farmers have adopted improved varieties. Production is dominated by traditional methods with limited investments in technology.<br>3. A Cassava Improvement Initiative is on-going with a focus on development and distribution of improved varieties.<br>4. Some farmers at Kizimkazi have already adopted the new varieties<br>5. Additional research on Cassava improvement is on-going at Matangatuani in Wete Pemba. |
| Stage 2 | Harvesting | 1. Poor harvesting tools and practices are used that damage tubers and cause rapid deterioration of the crop.<br>2. Loss of planting material and vegetables when plant dries up after harvest |
| Stage 3 | Post harvest handling and storage | 1. Poor market infrastructure for cassava<br>2. There is only one wholesale market, Mwnakwerekwe and retail markets in various locations of Unguja and Pemba |
| Stage 4 | Transportation/ Distribution | 1. Crop haulage is done mostly using animal drawn carts, or bicycles.<br>2. At times farmers unite to hire a small pick up to carry the crop to the whole sale market.<br>3. Passenger busses are sometimes used to transport the crop to the market |
| Stage 5 | Transformation/ Processing | 1. Very limited processing or packaging done.<br>2. The RGoZ with support from the Government of South Korea plans to build a factory that will be able to process cassava for increased value addition at Kizimbani |
| Stage 6 | Marketing/ Promotion | 1. Traditional marketing practices dominate the cassava industry<br>2. Very low demand for cassava in the tourism industry<br>3. The local producer is also the biggest buyer of cassava and village neighborhoods are the main retail outlets |
| Stage 7 | Consumption and use of by products | 1. Most of the crop produced in Zanzibar is consumed locally.<br>2. Little is know about the use of by products for animal feed or for the manufacture of other products. A large proportion of the peel is wasted. |

### 4.2.5 Recommendations

Priority areas for intervention

- there is need to raise awareness of the post harvest losses that are taking place along the commodity chain and the cost of the losses to the nation;
- there is need for increased farmer training opportunities through FFS to learn about improved farming practices for cassava;
- there is need to increase farmer access to improved cassava varieties through the Cassava Improvement Initiative;
- there is need for a deliberate effort to control cassava diseases and pests in Zanzibar through a special programme that either builds on the Cassava Improvement Initiative or stands on its own;
- there is need to reconsider budgetary resources for extension services and human resources to improve extension support to cassava farmers
- there will be a need to initiate a cassava processing initiative at Kizimbani as soon as the planned processing plant is constructed to demonstrate what could be achieved commercially in cassava processing and this could draw lessons from other African countries like Ghana and Nigeria;
- there is need to train a cadre of food processing specialists to support aspiring entrepreneurs in food processing using cassava as a raw material.
- there is need for training of key personnel in government, private sector and CSOs working on cassava development to fully understand the cassava value chain and its analysis and how to tap into it for value addition.

Main stakeholders in the cassava value chain

- the Cassava Improvement Initiative could be tapped to lead the way for the development of solutions for the post harvest losses;
- research stations at Matangatuani and Kizimbani could provide technical support towards the development of lasting solutions;
- CSOs like ZAFFIDE could partner with the public sector to provide extension services to end post harvest losses of cassava;
- ZNCCIA could advocate for increased cassava processing and marketing or promote the development of an organic cassava brand from Zanzibar

## 4.3 Sweet potatoes

The 2002/03 Sample Census of Agriculture found sweet potato production in Zanzibar to be the 2nd most important root crop. The area under production was 5,231 ha and production was 21,500 tonnes. Most of the crop was produced in the central district, 26 percent, followed by North "B", 22 percent, Micheweni, 18 percent, Chake Chake, Mkoani and South districts each accounted for 1 percent . Overall annual yield was 1.58 tonnes/ha.

### 4.3.1 Production of sweet potatoes in Zanzibar

Table 4.5 shows production of sweet potatoes has been fluctuating mainly due to changes in area under cultivation, poor farming practices and heavy reliance on rainfall.

**Table 4.5: Production of sweet potatoes in Zanzibar, 2000-2007, (in tonnes)**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Production (tonnes) | 37,894 | 29,740 | 19,656 | 21,500 | 36,018 | NA | 63,949 | 45,620 |

Source: Various Reports, MALE, 2009

### 4.3.2 Estimated post-harvest losses of sweet potatoes

***Losses at harvest sites***

Sweet potatoes are harvested from September to December. In key producing areas sweet potatoes are a food as well as a cash crop. Farmers in Micheweni district said that loss of sweet potatoes at post-harvest starts while it is in the ground. Farmers said that due to diseases they lose about 80 percent of the yields. At harvest sites some potatoes are thrown away because of blemishes and diseases and these amount to about 5 percent of the harvest.

***Losses in transit from the farm to the market***

Potatoes are packed into *polos* and transported to markets. Farmers estimate that loss in transit is minimal and averages 0.5 percent per year.

***Losses at wholesale markets***

Once potatoes arrive at wholesale points they are auctioned while still packed in the *polos*. Farmers claim that sweet potatoes can last even a week in the *polos* and still remain fresh and estimated that loss at whole sale points averages 1 percent per year.

***Losses at retail markets***

Losses occur at retail points when sales are slow like during the months of September when there is an influx of sweet potato supply from various areas of Zanzibar. Losses at retail during the year average 5 percent per year.

***Losses in processing and packaging/branding, preservation and storage***

There are few if any processing activities for sweet potatoes in Zanzibar. Storage is often done in the ground to minimize loss. Farmers said that very little is known about sweet potato preservation or processing. The most common processing carried out is peeling of the potato before boiling in coconut milk. The peeling is estimated to cause a loss of about 1 percent and other losses to pests could account for another 1 percent. Thus the average loss at this stage was estimated at 2 percent per year.

***Losses at consumption stage***

Farmers estimate that only about 1 percent of potatoes are lost at consumption stage.

***Box 4.4: Summary estimated average post harvest losses of sweet potatoes***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of sweet potatoes from the harvest stage to consumption is as follows:

- At harvest site: 5 percent
- in transit: 0.5 percent
- at whole sale point: 1 percent
- at retail market: 5 percent
- at processing/packaging and storage: 2 percent
- at consumption stage: 1 percent

***Therefore post-harvest losses of sweet potatoes are estimated at an average of 14.5 percent per year***

### 4.3.3 Implications of post-harvest losses of sweet potato losses for income generation

***Implications for income generation at national level***

Table 4.6 shows the calculations of post-harvest losses of volume and value of sweet potatoes at an average loss of 14.5 percent per year. In column (a) the quantities of marked sweet potatoes are shown and in column (b) the value of the marketed volume is shown in million Tanzanian Shillings. Column (c) presents the calculated loss in volume and column (d) the loss in million Tanzanian Shillings and in column (e) the loss is presented in United States Dollar equivalent.

The results in Table 4.6 show that at 14.5 percent post harvest loss, Zanzibar has been losing at least 2,500 tonnes of the crop at any given year since 2002 and losses increase as volume of output increases. Losses in value exceed TZS 100 million in any given year. These are significant losses that drain scarce food resources in a food deficit country. The impacts are felt at household level especially among communities where the cop is a major cash and food crop.

**Table 4.6: Post harvest loss of volume and value of sweet potatoes, 2002 – 2007**

| | (a) | (b) | (c) | (d) | (e) |
|---|---|---|---|---|---|
| **Year** | **Marketed sweet potatoes production** | **Value of sweet marketed potatoes** | **Post-harvest loss of volume @ 14.5 %** | **estimated post-harvest loss of value @ 14.5 %** | **estimated post-harvest loss of value @ 14.5 %** |
| | **(in tonnes)** | **(in million TZS)** | **(in tonnes)** | **(in Million TZS)** | **(in USD equivalent)** |
| 2002 | 19,652 | 786 | 2,849.54 | 113.97 | 87,669.23 |
| 2003 | 21,500 | 860 | 3,117.50 | 124.70 | 95,923.08 |
| 2004 | 36,018 | 1,981 | 5,222.61 | 287.25 | 220,957.70 |
| 2005 | 60,330 | - | 8,747.85 | -- | - |
| 2006 | 63,949 | 4,987 | 9,272.615 | 723.12 | 556,242.30 |
| 2007 | 45,949 | 3,558 | 6,662.615 | 515.91 | 396,853.80 |
| | | ***Cumulative loss @14.5 %*** | ***3,5872.71*** | **1,764.94** | **1,357,646.00** |

Source: RGoZ, Zanzibar Statistical Abstracts, 2007

***Implications for income generation at household level***

Farmers are able to harvest up to 80 *polos* of sweet potatoes from one acre. Each *polo* sells for TZS 10,000 when there is scarcity. At this time a farmer can generate up to TZS 800,000 from one acre. In high potential areas farmers cultivate an average of 3 acres. Assuming that one acre is reserved for own consumption the remaining two acres can generate up to TZS 1,600,000 per season. A loss of 14.5 percent means a loss of about TZS 232,000 or about 4 times the monthly minimum wage.

***Implications of post-harvest losses for food prices, FSN***

Post-harvest loss of sweet potatoes is, in fact, a loss of a cash crop, a food crop and a buffer crop, which could lead to decreased access to food on the market, lower food consumption at home and poor nutrition. In areas like Micheweni in Pemba the crop plays a very important role in preventing hunger and ensuring food security. Any loss of the crop in areas like these and in any area for that matter deprives households of income earning opportunities and poses a risk to household food security.

### Table 4.7 Potential for control of post-harvest losses along the sweet potato value chain

| Stage of the Sweet Potato Value Chain | Area of concentration | Status of sweet potato value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Production is mostly small scale using traditional cultivars that are low yielding<br>2. Almost all farmers consulted were not using any type of fertilizer but almost all were concerned about leached soils |
| Stage 2 | Harvesting | Harvesting is done from September to December |
| Stage 3 | Post harvest handling and storage | Sweet potatoes are either consumed or taken to market son after harvesting |
| Stage 4 | Transportation/ Distribution | Sweet potatoes are distributed locally but during the harvest season buyers from urban areas approach h farmers to buy the crop on site |
| Stage 5 | Transformation/ Processing | The crop is used mostly in its fresh state as a staple |
| Stage 6 | Marketing/Promotion | Marketing is done locally and the main customers come from the communities and nearby villages |
| Stage 7 | Consumption and use of by products | Mostly consumed at household level. Some limited use in local restaurants. Very limited use in tourist hotels |

### 4.3.5 Recommendations

Priority Areas for Intervention

- the importance of the sweet potato as a cash crop should be promoted through awareness campaigns.
- a programme to provide power tillers to farmer groups should be initiated to expand acreage for potatoes.
- a sweet potato improvement initiative should be established to promote the use of improved cultivars, increase research on pests and disease control and to train more farmers on improved farming practices.

Main actors in the sweet potato value chain

- MALE , provides policy and strategic direction for production of sweet potatoes and other crops including matters of environmental protection and preservation;
- the Commission of Agriculture, Research and Extension, which networks at district and Shehia level and working with RADOs, DADOs and field extension workers.
- Pride Tanzania, provides financial services in Zanzibar and some farmers had been able to secure loans.
- civil society organizations like ZAFFIDE, MKEKIZA, UWAMWIMA, and THE Zanzibar Zoological Society (ZAZOSO) could provide extension support to sweet potato growers.


RICE


PHARMA

# Chapter 5:

## Findings on post-harvest losses of fruit

## 5.1 Introduction

Zanzibar's tropical climate provides ideal conditions for the production of many types of tropical fruit. These include bananas, mangoes, oranges, limes, lemons and mandarins and tangerines, pineapples, pomelos, grapefruit, papayas, guavas, jackfruit, breadfruit, Malay apple, star fruit, passion fruit, durians, Averrhoa *(Bilimbi)* rambutans and avocados. Some fruit like bananas (plantains) and breadfruit are used as substitutes for starch staples in many parts of Zanzibar. In this section an in-depth assessment of post-harvest losses of bananas, oranges, mangoes and pineapples is presented because these are cultivated by many households in Unguja and Pemba and are marketed in large quantities in both islands. These were among the crops that many farmers, traders and consumers were most concerned about post-harvest losses.

Table 5.1 shows that there has been a steady increase in the production of the major fruit crops in Zanzibar and bananas were by far the largest marketed production in quantities. Most of the fruit is sold as seasonal cash crops locally and some exported to international markets. The tonnage shows that Zanzibar has capacity for fruit production even in small holdings. Most of the fruit produced in Zanzibar is organic.

**Table 5.1: Production of Main Fruit in Zanzibar (in tonnes)**

| Year | Bananas | Oranges | Mangoes | Pineapples | Jackfruit | Bread fruit | Papaya |
|---|---|---|---|---|---|---|---|
| 2002 | 32,541.00 | 8,585.00 | 11,868.76 | 14,390.00 | 580.00 | 1,200.00 | 1,157.00 |
| 2003 | 35,250.00 | 8,836.00 | 12,462.20 | 14,390.00 | 580.00 | 1,200.00 | 1,191.71 |
| 2004 | 37,998.00 | 9,094.00 | 12,836.06 | 14,821.70 | 597.00 | 1,236.00 | 1,227.46 |
| 2005 | 22,984.00 | 9,365.00 | 13,221.14 | 15,266.35 | 615.00 | 1,273.00 | 1,264.29 |
| 2006 | 88,438.00 | 9,640.00 | 13,617.78 | 15,724.34 | 634.00 | 1,311.00 | 1,302.21 |
| 2007 | 93,641.00 | 9,921.00 | 14,026.31 | 16,196.07 | 653.00 | 1,351.00 | 1,341.28 |

Source: Various Statistics, MALE, Zanzibar, 2009

## 5.2 Bananas

### 5.2.1 Production of bananas in Zanzibar

Bananas are cultivated in all the districts and occupy an area bigger than any other permanent crop. The 2002/03 Census found the district with the highest production was Mkoani in Pemba which accounted for 18 percent of annual output followed by North "B" and West districts producing 14 percent of the crop each. The crop was cultivated on 13,572 ha and total production was 43,792 tonnes**.** As shown in Table 5.1 production has been steadily increasing but at a very slow rate. Farmers in Tazari village in the northern part of Unguja, who produce substantial amounts of bananas, said that they could produce more if they knew how.

### 5.2.2 Estimated post-harvest losses of bananas

- ***Losses at harvest sites***

Farmers say that usually care is taken at harvesting time to ensure that bananas are not damaged at harvest time and that bananas are harvested for three reasons: to be ripened if they are the desert type; to be peeled and cooked as a starchy staple in the case of plantains; or to be sold on the market for both types of bananas. In most cases bananas are cut while still green and

when the potential for damage is low. They said that only on very limited occasions do bananas ripen and rot in the field and this happens only to farmers who cultivate big plots and are often absent from the farm for a long time. They estimated that on average they lose about 2 percent of the crop due to poor handling while harvesting.

***Losses in transit from the farm to the market***

It was said that much damage occurs to bananas while being loaded on to trucks and picks and when being transported to market. Whole bunches of bananas are thrown into lorries and packed in a hurry without consideration for bruises and loss of quality caused to the fruit. It was said that at least 5 percent of the crop is damaged in transit to the market.

- ***Losses at wholesale markets***

Brokers at Mwanakwerekwe wholesale market in Unguja said that most of the banana crop that comes in for the day is usually sold unless the farmer is too late to catch the auction. Even if the farmer is late for one day, there are chances that he/she will sell during the early morning auctions of the next day. Loss of produce at retail market is minimal in terms of rotting or theft of damage by rats because of the rapid sales of produce once it arrives. It is estimated that only about 1 percent of bananas are lost due to sampling by retailers and sorting that could at times be required by brokers.

- ***Losses at retail markets***

At Darajani retail market in Unguja the Consultants were able to see a variety of bananas on sale showing many of the bruised areas dried and blackened. Even when the banana ripens, the bruised areas remain dry, black and unattractive. Once this happens, the retailer knows that most of the tourist hotels and high income customers will avoid the product. Other consumers who chose to buy the product know that the bruised areas must be thrown away and therefore negotiates a lower price for the crop. Retailers said often sales of bruised bananas are slow. For that reason they reduce the price by 50 percent to attract customers.

Retailers in Macho-Manne, Chake Chake said that they shoulder much of the loss resulting from poor handling of bananas while packing, unpacking and on transit from the farm to the market. Damage to green bananas is limited and many retailers said that green bananas can last up to one week on the market and still remain fresh. Dessert bananas are the ones that are susceptible to damage and to rapid deterioration once they ripen. On average, retailers estimate that about 10 percent of dessert bananas are lost at retail level per year. At Wete district market it was said that at times green bananas stay for long periods on the market and ripen. When this happens customers do not buy them because they are no longer useful as green bananas at home. Retailers said that there are losses that occur in sales of green bananas and that these average 5 percent per year. Green bananas account for 70 percent of all bananas produced in Zanzibar and dessert bananas 30 percent. The average post harvest loss for dessert and green bananas at retail level was estimated at 10 percent per year.

- ***Losses in processing and packaging/branding, preservation and storage***

A small proportion of bananas produced in Zanzibar are exported mostly to the Gulf States. There are rules and regulations about packaging and labeling products destined for the export market. Discussions were held with key personnel at the Zanzibar harbor about export regulations and the extent to which exporters of goods like bananas are able to comply with and meet the standards. It was said that most exporters are fully informed of the regulations and try to the extent possible to comply.

Conventional fresh banana packaging does not exist at the Zanzibar harbor. Exporters make the best of traditional small scale packing and transportation, and trying to keep storage times prior to shipment to the absolute minimum. There are routine checks and inspections of various products including bananas according to international standard specifications. Only on very rare occasions do exporters fail to meet the standards. However, delayed shipment or delayed

arrival of bananas at the desired destination could cause up to 100 percent post-harvest loss. On average though, it was estimated that about 2 percent of all bananas are lost in packaging, sorting and labeling and in short term storage.

***Losses at consumption stage***

Most heads of households are in agreement that there is limited wastage of green bananas at household level. Loss occurs from broken bananas resulting from the impact of touching the ground when harvested. It was said that household take only what is needed for cooking for the day and leave the rest of the bananas intact. However, a proportion of dessert bananas is wasted. Some are over ripe or have ripened unevenly. Other dessert bananas have been forced to ripen by fire and while they look attractive on the outside they are unripe on the inside. It is estimated that on average, 5 percent of dessert bananas are lost at consumption stage but only 1 percent of green bananas are lost at this stage. Dessert bananas comprise 30 percent of total banana production in Zanzibar. Thus, overall post harvest loss for all bananas at consumption stage is estimated at an average of 2 percent

**Box 5.1:**
**Post-harvest loss due to forced ripening of dessert bananas in Zanzibar**

Forced ripening of bananas is a practice that has become common with some farmers as well as with wholesalers and retailers. They burry the bananas in pits and smoke them. This causes the dessert bananas to have a bright yellow skin while the inside, i.e. the banana itself, is unripe. Such bananas are unpalatable and are therefore wasted.

***Use of banana byproducts***

During the assessment the Consultants did not come across any group of farmers using banana byproducts like the peel for animal feed or for making compost as is done in many other parts of Tanzania where bananas are widely grown.

**Box 5.2: baseline summary of the estimated average annual post-harvest losses of bananas**

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of bananas from the harvest stage to consumption is as follows:

- at harvest site: 2 percent
- in transit: 5 percent
- at whole sale point: 1 percent
- at retail market: 10 percent
- at processing/packaging and storage: 2 percent
- at consumption stage: 2 percent

***Therefore post harvest losses of bananas are estimated at an average of 22 percent per year***

### 5.2.3 Implications of post-harvest losses of banana for income generation

***Implications for income generation at national level***

Table 5.2 shows the calculated post-harvest losses of bananas using the average loss of 22 percent per year. In column (a) the marked production of bananas is presented and in column (b) the calculated loss of volume per year due to 22 percent post harvest loss is presented. In column (c) the value of the marketed output is shown and in column (d) the calculated loss of value in million Tanzanian Shillings due to the 22 percent post-harvest loss is shown. In column (e) the loss of value is presented in United States Dollar equivalent.

The results shown in the Table indicate that thousands of tonnes of bananas are lost after harvest each year and that these losses are worth billions of Tanzanian Shillings if they were to be controlled. Bananas are a major cash crop in areas where spices are not grown. Even where spices like cloves are grown bananas supplement household income and provide all year round source of cash and food and therefore it is a crop that fuels growth in the agricultural sector.

**Table 5.2: Volume and value of bananas produced in Zanzibar 2002 – 2007**

| | (a) | (b) | ( c) | (d) | (e) |
|---|---|---|---|---|---|
| Year | Marketed bananas production | Loss of volume @ 22 % post harvest loss | Value of marketed bananas | loss of value @ 22% post harvest loss | Loss of value @ 22 percent post harvest loss |
| | (in tonnes) | (in tonnes) | (in million TZS | (in million TZS) | (in USD equivalent) |
| 2002 | 32,541 | 7,159.02 | 4,690 | 1,031.80 | 793,692.3 |
| 2003 | 35,250 | 7,755.00 | 5,799 | 1,275.78 | 981,369.2 |
| 2004 | 37,998 | 8,359.56 | 8,930 | 1,964.60 | 1,511,231.0 |
| 2005 | 22,984 | 5,056.48 | 5,401 | 1,188.22 | 914,015.4 |
| 2006 | 88,438 | 19,456.36 | 22,552 | 4,961.44 | 3,816,492.0 |
| 2007 | 93,641 | 20,601.02 | 23,878 | 5,253.16 | 4,040,892.0 |
| | **Cumulative total loss of 22 %** | **68,387.44** | **Cumulative loss of value 22 %** | **15,675.00** | **12,057,692** |

Source: Based on crop data extracted from RGoZ, Zanzibar Statistical Abstracts, OCGS, May 2008

***Implications for income generation at household level***

Farmers in Tazari, in the northern part of Unguja said on average they earn at least TZS 5,000 per day from sale of bananas. During the long rains bananas are in plentiful and a farmer can sell up to 10 bananas worth about TZS 50,000 per day depending on size and type. On a monthly basis a farmer earns at least TZS 150,000 or two and a half times the minimum wage and this is after deducting the cost of transport to the market. A post harvest loss of 22 percent means that they lose TZS 33,000 every month or more than 50 percent of the minimum wage in Zanzibar.

***Implications for Food Prices, FSN***

Bananas are the second most preferred staple after rice. A loss of 22 percent of bananas translated into reduction of household food supplies. Loss of bananas also means that people will turn to rice more often and this will in turn mean more expenditure on purchased food. In fishing communities like Nungwi in the northern part of Unguja, fishers said that a large portion of their earnings goes to buy basic food stuffs and rice was most frequently mentioned.

In Tazari however, also in the northern part of Unguja, where fishing and banana production is done, it was said that having bananas at home helps reduce the food budget. Since majority are fishers they can readily provide fish from the daily catch so that the money they earn from banana and fish sales is spent on limited food items like edible oil, sugar, flour etc. This enables these households to save some of the income to finance other needs of the households like children's education. Thus, if the 22 percent post harvest loss of bananas could be controlled, it is likely that households would be better off financially.

Table 5.3: Potential for control of post harvest losses of banana along the value chain

| Stage of the Banana Value Chains | Area of concentration | Status of the banana value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Production is mostly by small holders with few large scale farmers.<br>2. Small scale farmers rarely use any fertilizers.<br>3. There is heavy reliance on rainfall for production.<br>4. Most of the crop is organically produced.<br>5. 5. Bananas are a cash and food crop for most producing households. |
| Stage 2 | Harvesting | 1. Family labor dominates the activity<br>2. Household tools are used to harvest in small farms |
| Stage 3 | Post harvest handling and storage | 1. Some bananas are exported and therefore packaged and shipped as per international standards and specifications.<br>2. Only short shelf life for both dessert and green bananas and therefore storage times are kept at minimum. |
| Stage 4 | Transportation/ Distribution | 1. On trucks and ox-drawn carts.<br>2. There is only one whole sale market, Mwanakwerekwe, in Zanzibar town. |
| Stage 5 | Transformation/ Processing | There is little if any processing done in Zanzibar apart from the cooking that is done for green bananas. |
| Stage 6 | Marketing/Promotion | Bananas are in high demand locally and internationally. There is high demand for dessert bananas in the tourist hotel industry. |
| Stage 7 | Consumption and use of by products | Consumption is mostly at local level. Only a small proportion of Zanzibar bananas are exported. |

### 5.2.5 Recommendations

Priority Areas for Intervention

- there is need to develop an organic identity for Zanzibar bananas since over 95 percent are produced organically,
- as bananas are a main cash crop to many households, extension support should be provided to increase output on exiting plots. Low yields are primarily due to poor husbandry as was seen across the two islands of Unguja and Pemba. There are too many suckers growing at one stand creating a forest of banana trees many without fruit. Reducing the number of suckers to a maximum of three per stand would greatly improve yields.
- the Commission of Agriculture, Research and Extension should target building capacity of civil society organizations like ZAFFIDE, ZAYEDESA, MKEKIZA and UWAMWIMA to provide extension services to farmers across the country in the areas of banana improvement

- a banana improvement programme should be established to focus on this important food and cash crop for Zanzibar

Main Actors in the value chain

- MALE provides policy and strategic direction for production of banana and other crops including matters of environmental protection and preservation;
- the Commission of Agriculture, Research and Extension, which networks at district and shehia level and working with RADOs, DADOs and field extension workers.
- Pride Tanzania, provides financial services in Zanzibar and some farmers had been able to secure loans.
- Civil society organizations like ZAFFIDE, MKEKIZA, UWAMWIMA, and ZAZOSO could provide extension support to banana growers.

## 5.3 Pineapples

### 5.3.1 Pineapple production in Zanzibar

Many farmers have adopted the production of pineapples as a cash crop especially in the central part of Unguja. Production has been increasing steadily during the past 5 years as shown inn Table 5.4 below.

**Table 5.4 Production of pineapples in Zanzibar, 2002 - 2007**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Production (in tonnes) | 14,390.00 | 14,390.00 | 14,821.70 | 15,266.35 | 15,724.34 | 16,196.07 |

Source: Various Reports, MALE, 2009

### 5.3.2 Estimated post-harvest losses of pineapples

***Losses at harvest sites***

The main harvest season for pineapples is from November to end of December for most parts of Zanzibar. This is also the season when mangoes are in season and fruit is in plentiful supply on the market. Farmers in Donge Vijibweni in the central part of Unguja estimate that they lose much of the crop in reduced yields. At harvest time loss is incurred for fruit that is unevenly ripened or that which has been damaged by birds. They estimate on average for every 100 pineapples harvested 5 will be discarded, i.e. 5 percent of the crop. Loss occurs to farmers who sell the whole field to wholesale buyers at a pre-arranged price. Unless the farmer is knowledgeable about market trends, they are likely to sell the whole crop at 50 percent of the market price.

***Losses in transit from the farm to the market***

Farmers in Donge said that there is very little loss in transit from the farm to the main wholesale market at Mwanakwerekwe. Some fruit may be bruised during packing but this does not happen often. On average a farmer loses about 0.5 percent on transit.

***Losses at wholesale markets***

Pineapples are auctioned as soon as they arrive at the market and it is estimated that loss is minimal to the farmer. On average about 5 percent of the crop is lost at whole sale points.

***Losses at retail markets***

Some retailers said that during the pineapple season they lose up to 30 percent of the crop because there are not enough customers. However, during the off season losses average 5 percent. Overall, the estimated post harvest loss was 15 percent per year.

***Losses in processing and packaging/branding, preservation and storage***

Only a small proportion of the crop is processed and only a limited amount is exported. Losses in processing and storage is estimated at 5 percent per year.

***Losses at consumption points***

It is estimated that about 3 percent of the fruit is lost due to uneven ripening or to over ripening.

***Use of by-products***

The main by-product of pineapple harvest is planting material. Very little is known about other use of byproducts for making compost or for other industrial uses like biogas.

***Box 5.3: Baseline summary of the estimated average annual post-harvest losses of pineapples***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of pineapples from the harvest stage to consumption is as follows:

- at harvest site: 5 percent
- in transit: 0.5 percent
- at whole sale point: 10 percent
- at retail market: 15 percent
- at processing/packaging and storage: 5 percent
- at consumption stage: 3 percent

***Therefore post-harvest losses of pineapples are estimated at an average of 33.5 percent per year***

### 5.3.3 Implications of pineapple losses for income generation

***Implications for income generation at national level***

The loss of tonnage is high at 33.5 percent post-harvest loss as shown in Table 5.5. The lowest tonnage of loss was 4,820.65 in 2002 and this has increased with increasing production to reach a high of 5,425.68 tonnes lost in 2007.

**Table 5.5: Post-harvest loss of pineapples produced in Zanzibar 2002 – 2007**

| Year | Production of pineapples (in tonnes) | Loss of volume due to post harvest losses @ 33.5% |
|---|---|---|
| 2002 | 14,390.00 | 4,820.65 |
| 2003 | 14,390.00 | 4,820.65 |
| 2004 | 14,821.70 | 4,965.27 |
| 2005 | 15,266.35 | 5,114.23 |
| 2006 | 15,724.34 | 5,267.65 |
| 2007 | 16,196.07 | 5,425.68 |
| | **Cumulative loss of 33%** | **30,414.13** |

Source: RGoZ, Zanzibar Statistical Abstracts, 2007

***Implications for income generation at household level***

Households that produce pineapples cultivate on average 6 acres each. Each acre can provide up to 5,000 pineapples. Thus farmers said they produce up to 30,000 pineapples each season. In the village of Donge alone, they estimated that there were more than 500 producers each aiming at the same market. Each pineapple sells for about TZS 300 each. A five acre farmer can get up to TZS, 900,000 each season. This is good money for rural communities and in their own words, "*health comes to us during the pineapple harvesting season and disappears as soon as the pineapple season ends*", Focus group discussion at Donge village revealed how good farmers feel about cash crops when the price is right. The main problem they face is lack of a sure market, lack of inputs and inadequate technical assistance to produce and market in accordance with international standards. Many farmers said they do not know how to work with brokers and other operators at the market but they do what they can to sell the crop.

**Table 5.6: Potential for control of post harvest losses along the pineapple value chain**

| Stage of the Pineapples Value Chain | Area of concentration | Status of the pineapple value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Production is on small holdings but acreage is larger averaging 5 acres<br>2. Production is organic with little or no use of any chemical fertilizers or pesticides<br>3. Yields average 5,000 pineapples per acre |
| Stage 2 | Harvesting | The Main harvest season is November and December the mango season. there is high competition for customers |
| Stage 3 | Post harvest handling and storage | Mostly sold for consumption as table fruit |
| Stage 4 | Transportation/ Distribution | Lorries are the main means of haulage due to the large volumes of the crop |
| Stage 5 | Transformation/ Processing | Little if any commercial processing or branding |
| Stage 6 | Marketing/Promotion | The local market is the main target for the fruit. The market is unstable and flooded during the season and there is need for outside markets |
| Stage 7 | Consumption and use of by products | There is high demand in rural and urban areas |

### 5.3.5 Recommendations

Priority areas for intervention

- pineapple growers expressed need for a processing plant to assure them of a stable price and a reliable market;
- there is need to organize pineapple growers into Savings and Credit Cooperative Society (SACCOS) to be able to access credit for more production and expansion of acreage and to be able to buy inputs;
- farmers expressed need to be trained on pineapple marketing and how to deal with market operators from outside the village including how to enter into contractual agreements for sale of crops.

Main actors in the pineapple value chain

- MALE provides policy and strategic direction for production of pineapple production other crops including matters of environmental protection and preservation;
- The Commission of Agriculture, Research and Extension, which networks at district and Shehia level and working with RADOs, DADOs and field extension workers.
- Pride Tanzania, provides financial services in Zanzibar and some farmers had been able to secure loans.
- Civil society organizations like ZAFFIDE, MKEKIZA, UWAMWIMA, and ZAZOSO could provide extension support to pineapple growers.

## 5.4 Mangoes

### 5.4.1 Production of mangoes in Zanzibar

It is believed that there are over 150 locally named mango varieties grown in Unguja and Pemba. Most mangoes are grown by households, which have between 1 and 10 or more trees depending on location and size of land owned. It is estimated that mangoes are the third in volume of the fruit produced in Zanzibar next to bananas and pineapples. Production is mainly for local consumption but in recent years Zanzibar has been exporting mangoes to the Gulf States. Mangoes that meet the export standards are the *Boribo muyuni, Boribo mviringo and Dodo* varieties. Table 5.7 shows mango production in Zanzibar has been steady with only marginal increases since 2002. This is probably because of the reliance on old mango trees.

**Table 5.7: Production of mangoes in Zanzibar, 2000 – 2007 (in tonnes)**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Production (in tonnes) | 10,761.31 | 11,303.58 | 11,868.76 | 12,462.20 | 12,836.06 | 13,221.14 | 13,617.78 | 14,026.31 |

Source: Zanzibar Statistical abstracts, various volumes

### 5.4.2 Estimated post-harvest losses of mangoes

The consultants visited markets, households and saw small holder farms with mango trees growing but scattered around the farm while others were growing as shade trees around the homes of some households and yet some mango trees were growing along the road. The main observation that was made during the visits is that there were not any mango farms seen in any of the villages. Discussions about post harvest losses of mangos revealed the following.

***Loss of mangoes at harvest site***

It was said that one mango tree could produce even more than 10,000 mangoes if planted in good soil. However, at harvest time, as many as 1,000 mangoes (10 percent) could be found rotting on the ground under the mango tree because the cost of harvesting and transporting it to market is higher than the price offered at the harvest season. To avoid this loss households that have many mango trees sell the mangoes at wholesale to a buyer who harvests the entire tree at his/her own costs and sells the fruit wherever he/she pleases. Villagers said that the price offered by these wholesale buyers is usually very low but they accept it to avoid total loss of the harvest.

***Loss of mangoes in transit from the farm to the market***

Once mangoes have been harvested, they are counted and put into *polos* of 100 kgs and stitched before transporting to the wholesale market. Most times mangoes destined for the wholesale market are selected to exclude the very ripe ones. This reduces the risk of damage to the fruit while on transit. The ripe ones are sold at the village for local consumption usually at a very low price or given as part of the wages for those assisting with the harvesting and packaging, etc.

One of the wholesalers who participated in the discussions said that on average very little of the fruit is damaged in transit because within Unguja it takes only hours to reach the wholesale market. Some damage does occur for mangoes that are shipped from Pemba to Unguja by boat mostly in the form of bruising that is seen as black marks on the skin of the fruit. The average loss of fruit while in transit was estimated to be about 1 percent per year.

***Loss of mangoes at wholesale markets***

Generally, the fruit does not stay long at wholesale markets and therefore loss is minimal. However, in some cases, during the period of glut, some few sellers wishing to wait for a better price have kept the mangoes long enough at the wholesale market to a point where some begin to rot. It was estimated that on average about 5 percent of the fruit gets damaged at the wholesale point.

***Loss of Mangoes at Retail Markets***

Fruit vendors at various markets said that most loss of mangoes takes place at retail outlets. It was estimated that out of *100 polos* of mangoes 20 *polos* (20 percent) are wasted as a result of over-ripening and rotting. Even those who sell in small allotments said that out of 10 allotments, 2 are discarded due to rotting.

***Loss of Mangoes in Processing and Packaging/ Branding, Preservation and Storage***

Apart from home processing and preparation of various mango products, there is little processing of mangoes in Zanzibar on a commercial scale. Sales of mango juice in various hotels and restaurants in Zanzibar are widespread but this is done mostly on small scale by each establishment according to need. There is considerable loss of mangoes for those who ripen the fruit in dark places where it develops spots and ripens unevenly. It is estimated that loss of mangoes at this stage averages about 3 percent per year.

***Loss of Mangoes at Consumption Stage***

Loss of mangoes at consumption stage is considerable especially after the recent infestation of mangoes with the fruit fly. Mangoes that look wholesome are found with the larva of the fruit fly when cut ready for consumption. Most of the people we talked to said that they frequently come across the infested mangoes. At least 1 in every 10 mangoes has the fruit fly (10 percent).

***Box 5.4:***
***Baseline summary of the estimated average annual post-harvest losses of mangoes***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of mangoes from the harvest stage to consumption is as follows:

- *at harvest site: 10 percent*
- *in transit: 1 percent*
- *at whole sale point: 5 percent*
- *at retail market: 20 percent*
- *at processing/packaging and storage: 3 percent*
- *at consumption stage: 10 percent*

***Therefore post harvest losses of mangoes are estimated at an average of 49 percent per year***

### 5.4.3 Implications of the post harvest losses of mangoes on income generation

The estimated post harvest loss of mangoes at an annual average of 49 percent has implications for income generation at national and household level. The loss in volume alone is enormous as shown in Table 5.8 below. In column (a) the marketed production of mangoes is shown and in column (b) the calculated loss of volume based on the post harvest loss of 49 percent is presented.

The results show that since the year 2000, post-harvest losses of mangoes have exceeded 5,000 tonnes at any given year. The cumulative loss over the years exceeds 49,000 tonnes.

### Table 5.8: Post Harvest Losses of Mangoes, 2000 - 2007 (in mt)

| | (a) | (b) |
|---|---|---|
| **Year** | **Marketed production of mangoes** | **Loss of volume of mangoes calculated based on 49 percent post harvest loss per annum** |
| | (in tonnes) | (in tonnes) |
| 2000 | 10,761.31 | 5,273.04 |
| 2001 | 11,303.58 | 5,538.75 |
| 2002 | 11,868.76 | 5,815.69 |
| 2003 | 12,462.20 | 6,106.48 |
| 2004 | 12,836.06 | 6,289.67 |
| 2005 | 13,221.14 | 6,478.36 |
| 2006 | 13,617.78 | 6,672.71 |
| 2007 | 14,026.31 | 6,872.89 |
| | **Cumulative loss of volume @ 49 percent post-harvest loss per annum** | **49,047.60** |

Source: Zanzibar Statistical Abstracts, Various Volumes

***Implications of post-harvest losses of mangoes for income generation at household level***

Most households have at least one mango tree giving an average yield of about 5,000 mangoes per season. In all areas visited the lowest price for one mango was TZS 50. Assuming that a household is able to sell 51 percent of the crop at TZS 50 each, it would mean earnings of about TZS 127,500 per season or more than two times the minimum wage in Zanzibar. For those with more trees with higher productivity of up to 10,000 mangoes per tree the earnings would be even higher.

***Implications of post-harvest losses of mangoes for food prices, FSN***

The mango is an attractive palatable fruit that is liked by adults and children and it is also a good source of micro-nutrients. Consumption of mangoes is high during the mango season and this increases intake of carotene. In many parts of Pemba and Unguja the main mango season of November to mid-February coincides with the hungry season when food supplies are low for many households. During these times mangoes are eaten frequently to keep hunger at bay.

**Box 5.5:**
**Zanzibar experiences post-harvest loss of income as mangoes from are denied entry into one of the Gulf States**

During the assessment it was learned that one of the Gulf States had rejected imports of mangoes from Zanzibar because the mangoes were found to be infested with the fruit fly. The ban is expected to last until there is adequate assurance that mangoes from Zanzibar are free from the fruit fly. Efforts are being made by the RGoZ to ensure that the problem is under control. In the meanwhile many of the exporters of mangoes to the said Gulf State have lost an opportunity to earn foreign exchange because of post-harvest problems affecting the mango crop.

### Table 5.9:
### Potential for Control of Post Harvest Losses along the Mango Value Chain

| Stage of the mango value chains | Area of concentration | Status of the mango value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Land under mango production is small ranging from 1 to 10 trees per household. There was not any systematic farming system observed for mangoes. In other words there were no mango farms, but just mango trees growing amidst other crops.<br>2. Some export varieties of mangoes are being developed at Kizimbani Research Station like the Boribo and Dodo types<br>3. Pemba produces more and better mango varieties than Unguja |
| Stage 2 | Harvesting | 1. The main harvesting period for mangoes is from November to Mid February. Harvesting is done by hand by members of households or by traders who buy mangos on wholesale basis.<br>2. Traders sort and sell mangoes by varieties and prices differ. The most highly priced is the Dodo variety followed by the Boribo varieties. |
| Stage 3 | Post harvest handling and storage | 1. Most traders harvest and transport the fruit still unripe to prevent damage and store the fruit in special areas to ripen.<br>2. Storage is done in open spaces to prevent over-ripening of the fruit |
| Stage 4 | Transportation/ Distribution | 1. The main distribution point is the Mwanakwerekwe wholesale market.<br>2. Mangoes from Pemba are transported by boat to Darajani market in Zanzibar town or to the wholesale point at Mwanakwerekwe.<br>3. Some mangoes from the Mainland, notably from Tanga are also sold in Zanzibar in large quantities |
| Stage 5 | Transformation/ Processing | 1. There is very little commercial processing of mangoes.<br>2. There is a fruit and cassava processing plant earmarked for development in the near future at Kizimbani with support from the Republic of South Korea that will be able to process mangoes |
| Stage 6 | Marketing/ Promotion | 1. Marketing is done at local level but exports of mangoes is increasing for as long as pests and diseases are controlled.<br>2. Very little marketing promotion is done of mangoes.<br>3. The mango season is what does most of the promotion |
| Stage 7 | Consumption and use of by products | 1. Mostly consumed locally but with some exports into the Gulf States<br>2. Very little is known about the use of mango by products |

### 5.4.4 Recommendations

Priority Areas for Intervention

- there is need to promote mango production as a plantation crop where land availability permits;
- there is also urgency for the Plant Protection Division of MALE to see to it that the problem of the fruit fly is eliminated and that exports of mangoes to the key Gulf States resumes.

Main Actors in the Mangoes Value Chain

- the Division of plant protection in MALE for the control of mango pests and disease;
- farmers should be encouraged to produce more mangos for own consumption and for sale.

## 5.5 Oranges

### 5.5.1 Production of oranges in Zanzibar

Zanzibar produces many citrus fruits and oranges are by far the largest in volume. On average households in high producing areas cultivate between 1 and 2 acres of orange trees. In low potential areas households have one or two orange trees and some have none at all. Orange production ranks 4th in the quantities of fruit produced in Pemba and Unguja. Table 5.10 shows that the quantities of oranges produced from 2002 to 2007 have been increasing only slightly from year to year.

**Table 5.10: Production of oranges in Zanzibar 2002 – 2007 (in tones)**

| Year | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| **Production (in tonnes)** | 8,585.00 | 8,836.00 | 9,094.00 | 9,365.00 | 9,640.00 | 9,921.00 |

Source: Zanzibar Statistical Abstracts, Various Volumes, OCGS, Zanzibar

### 5.5.2 Estimated post-harvest losses of oranges

The assessment of post harvest losses of oranges was done based on information gathered from villagers at Mwambe village in Pemba, Pujini Research Station in Pemba. It also included information gathered at Kiboje village in Central Unguja and at Kizimbani Research Station in Unguja

***Loss of oranges at harvest sites***

Usually farmers wait for oranges to ripen before they harvest. One of the signs that oranges have ripened enough is that some start to fall under the tree when the wind blows. It is estimated that a mature orange tree yields between 3000 and 4000 oranges for the season. Delayed harvesting causes many oranges to fall down and rot under the tree. Farmers in Mwambe village in Pemba estimate that 10 percent of oranges are discarded at harvest site.

***Loss of oranges in transit from the farm to the market***

Oranges are packed into *susus* and transported by lorry or bus to the main market. Loss is estimated to be small because the fruit is cushioned with banana leaves in the *susus*. It is estimated that loss in transit does is about 1 percent per annum.

***Loss of oranges at wholesale markets***

There are two types of wholesale markets. One is at the harvest site where a household is paid for the entire farm and the trader harvests the crop and sells as he/she wishes. The other is the Mwanakwerekwe, where traders participate in auctions. The sales at Mwanakwerekwe are said to have very limited post-harvest loss built into it. The former, where the trader harvests the fruit has a considerable loss attached to it because of possible days in harvesting, damage by birds and animals or theft. At Mwanakwerekwe the loss is estimated at 3 percent while at harvest site the wholesale loss is estimated at 10 percent. Since the loss at harvest site has already been accounted for (above) it is estimated that on average post harvest loss at wholesale point is 3 percent per year.

***Loss of oranges at retail markets***

Traders and fruit vendors said oranges can stay for up to 5 days in the open without losing freshness and can be sold at full value. Beyond five days oranges begin to soften and customers avoid such oranges. In

retail markets it was said that for every ten *susus* of oranges on sale one and half *susu* (15 percent) will be discarded. Traders said that there is so much of the fruit on sale that there are not enough customers. Delayed sales cause the fruit to become damaged.

***Loss of oranges in processing and packaging/ branding, preservation and storage***

There is very little processing of oranges in Zanzibar apart from home preparation. Most of the fruit is eaten as fresh table fruit or as a street snack. Some modest attempts have been made to process oranges into jams but this has not taken off in any significant stages to be able to estimate losses in processing or preservation. Post-harvest loss at this stage is estimated to be at an average of 2 percent per annum.

***Loss of oranges at consumption stage***

Once selection of oranges at retail level has been done properly, loss at consumption stage is reduced. On some occasions consumers said that they encounter oranges that are of a variety that is like sponge with little or no juice and which are unpalatable. These oranges are often mixed with good oranges and cannot be distinguished by visual inspection alone. It is when they are cut ready to eat that the consumer realizes that they are of the poor variety. It is estimated that these oranges account for about 3 percent on the market.

### 5.5.3 Implications of the post harvest losses of oranges on income generation

The post harvest loss of oranges since 2002 is shown in Table 5.11. Column (a) shows the marked production and column (b) the calculated values of loss based on the 34 percent post harvest loss estimated through the assessment.

The results show that losses of oranges at any given year exceed 2,900 tonnes. Loss of oranges in 2007 was more than 3,373 tonnes.

***Box 5.6: Baseline summary of the estimated average annual post-harvest losses of oranges***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of oranges from the harvest stage to consumption is as follows:

- at harvest site: 10 percent;
- in transit: 1 percent;
- at whole sale point: 3 percent;
- at retail market: 15 percent;
- at processing/packaging and storage: 2 percent;
- at consumption stage: 3 percent.

***Therefore post harvest losses of oranges are estimated at an average of 34 percent per year***

### Table 5.11: Post-harvest losses of oranges at 34 percent per annum (in tonnes)

| | (a) | (b) |
|---|---|---|
| **Year** | **Marketed production of oranges (in tones)** | **loss of oranges calculated based on 34 percent post harvest loss per annum** |
| 2002 | 8,585.00 | 2,918.90 |
| 2003 | 8,836.00 | 3,004.24 |
| 2004 | 9,094.00 | 3,091.96 |
| 2005 | 9,365.00 | 3,184.10 |
| 2006 | 9,640.00 | 3,277.60 |
| 2007 | 9,921.00 | 3,373.14 |
| | **Cumulative post harvest loss @ 34 percent post-harvest loss per annum** | **18,849.94** |

***Implications of post harvest losses on income generation at household level***

An orange farmer expects to harvest 3,000 to 4,000 oranges per tree. Farmers in Mwambe in Pemba said a farmer with one acre harvests between 15,000 and 20,000 oranges. At wholesale price the farmer gets about TZS 600,000 depending on the size and appearance of the oranges. This amount is ten times the size of the minimum wage in Zanzibar. Loss of 34 percent means loss of TZS 204,000 per season or about 3.5 times the minimum wage in Zanzibar.

Table 5.12: Potential for control of post harvest losses along the value chain for oranges

| Stage of the Oranges Value Chains | Area of concentration | Status of the Value Chain for Oranges |
|---|---|---|
| Stage 1 | Production | 1. Oranges are produced mostly by small holders on 1 to 2 acre plots.<br>2. Production is organic with no use of fertilizers or pesticides |
| Stage 2 | Harvesting | 1. The harvest season starts in July and lasts until November<br>2. Household and hired labor is used for orange harvesting |
| Stage 3 | Post harvest handling and storage | 1. Oranges are sold as soon as harvested either at the local retail market or at the main wholesale market.<br>2. Oranges are sold in the open air at all markets |
| Stage 4 | Transportation/ Distribution | Oranges are packed into bamboo baskets known as *susus* and transported to markets either by bus, lorry or animal drawn carts |
| Stage 5 | Transformation/ Processing | Commercial processing of oranges is still underdeveloped in Zanzibar but plans are under way to establish a fruit processing plant at Kizimbani in Unguja |
| Stage 6 | Marketing/ Promotion | Venders, wholesalers, brokers and farmers are the main actors promoting orange sales |
| Stage 7 | Consumption and use of by products | 1. Most oranges produced in Zanzibar are consumed locally.<br>2. There is little information about the use of orange byproducts like the making of compost or biogas. |

### 5.5.4 Recommendations

Priority areas for intervention

- farmers in high potential areas said that orange production is stagnating because the soils are leached and yields are low. There is need to promote improved varieties of oranges and to support farmers with fertilizers and extension services to increase orange production in Zanzibar.

Main actors in the oranges value chain

- the Ministry of Agriculture, Livestock and the Environment in partnership with farmers and private sector firms and organizations.

# Chapter 6:

## Findings on post-harvest losses of vegetables

## 6.1 Introduction

Zanzibar produces many vegetables including tomatoes, egg plants, green peppers, okra, chilies, and cabbages, cucumbers, spinach (*Amaranth)*, Chinese cabbage, cassava leaves, cow pea leaves and onions. Tomatoes dominate vegetable production in Zanzibar. The 2002/03 sample Census of Agriculture found tomatoes accounted for 52 percent of the area planted with fruit and vegetables. As seen in Table 6.1 tomato production dominates the vegetable industry in Zanzibar. A more in-depth look at tomato production shows that the output could be even higher if the yields were at the optimal level.

**Table 6.1: Production of main vegetables in Zanzibar (in tonnes)**

| Year | Tomatoes | Cassava leaves | Spinach (Amaranth) | Egg plant | Okra | Cucumber |
|---|---|---|---|---|---|---|
| 2002 | 5,228 | 3,726 | 1,898 | 1,465 | 401 | 909 |
| 2003 | 5,381 | 3,655 | 1,898 | 1,508 | 401 | 936 |
| 2004 | 5,538 | 3,764 | 1,995 | 1,552 | 409 | 963 |
| 2005 | 5,703 | 3,877 | 2,013 | 1,598 | 417 | 992 |
| 2006 | 5,870 | 3,994 | 2,074 | 1,645 | 426 | 1,021 |
| 2007 | 6,041 | 4,113 | 2,136 | 1,693 | 434 | 1,051 |

Source: MALE, Zanzibar, 2009

## 6.2. Tomatoes

### 6.2.1 Production of tomatoes in Zanzibar

The tomato, popularly known as *tungule* in Zanzibar is grown in many parts of Zanzibar for household's own consumption as well as for sale. The 2002/2003 National Sample Census of Agriculture found that on average, farm households cultivate about 0.41 acres of tomatoes. Area under cultivation varies by district and by location within districts. In high potential areas like Matemwe village in Northen Unguja, holdings are bigger and range from 0.5 to 5 acres per household. Most produce the local variety that is small in size but preferred for its slightly acidic flavor and soft skin. Over 95 percent of tomatoes produced in Zanzibar are of the local variety. Only in a few areas like Umbuji, in West Unguja is the local variety grown along side the improved variety. In this area, farmers irrigate and are able to produce tomatoes all year round but the quantities produced are small and only enough to supply the local communities.

The 2002/03 Census found 4,884 households planted tomatoes in the short rainy season and a slightly higher number of households, 5,846 planted them during the long rainy season. The annual total planted area was 2,370 ha and the average annual yield was only 2.27 tonnes/ha. The annual output was only 5,381 tonnes. The Census of 2002/03 found Central district cultivated 47.7 percent of the total area under tomatoes, followed by North "A" district, 19 percent.

The main harvest season for both Unguja and Pemba is July, August and September. This is the period when most markets are flooded with tomatoes and prices are at the lowest. For the remaining 9 months of the year tomatoes have to be imported mainly from the Mainland and prices are high at between TZS 800 and 2000/kg.

### Table 6.2: Main tomato producing areas of Unguja and Pemba

| Unguja | | Pemba | |
|---|---|---|---|
| **Village** | **Location** | **Village** | **Location** |
| Matemwe | North A district | Gando | Wete district |
| Umbuji | Central district | Macho Manne | Chake Ckake |
| Dimani | West district | Kangagani | Wete district |
| Kiembe-Samaki | West district | Matangatuani | Wete district |
| Mwera | West district | Mwambe Village | Mkoani district |
| ---- | ----- | Makangale | Micheweni district |

Source: Survey data

### Table 6.3: Area under cultivation, yield and output of tomatoes in Zanzibar 2000-2007

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Area Planted (ha) | 2164 | 2232 | 2303 | 2370 | NA | 2512 | 2586 | 2661 |
| Yield (kg/ha) | 2270.5 | 2270.5 | 2270.5 | 2270.5 | NA | 2270.5 | 2270.5 | 2270.5 |
| Production (tonnes) | 4,914 | 5,069 | 5,228 | 5,381 | 5,538 | 5,703 | 5,870 | 6,041 |

Source: Unpublished Crop Statistics, MALE, Zanzibar, June 2009

### 6.2.2. Estimated post-harvest losses of tomatoes in Zanzibar

***Loss of tomatoes at harvest sites***

Farmers in Matemwe village, one of the high producing areas estimate that in some years they lose between 40 and 50 percent of the crop at harvest site because they find that many of the tomatoes have disease infections and have dropped to the ground and have serious blemishes some caused by pests and diseases and in some cases by uneven ripening and black spots. The sorting that takes place at harvest site separates tomatoes that are for sale and for use by the household. The rest are usually discarded because they are too damaged to be used. Apart from the extreme cases narrated by farmers in Matemwe village in Northen Unguja and in Kangagani village in Wete, Pemba, most producers estimate that the amount of tomato that is discarded at harvest site could be about 1 out of five *susus* or about 20 percent per year

***Loss of tomatoes in transit from the farm to the market***

Poor transportation of tomatoes from the field to the market causes damage to the crop. Most of the crop is packed in bamboo baskets known as "*visusu*" and transported on top of lorries or in passenger busses

to the nearest whole sale or retail market. In some villages, like Matemwe, farmers get together and hire a lorry that transports the crop from the village to Mwanakwerekwe wholesale market in Stone town about 60 kilometers away. Even when care is taken farmers still lose some of the crop due to damage on transit. On average it was estimated that at least 5 percent of the crop is damages on transit.

***Loss of tomatoes at wholesale markets***

Tomatoes are brought to Mwanakwerekwe market early in the morning for auctions that take place routinely every day. Each farmer tries to sell off his/her crop the same day to prevent damage. This is necessary because there are not any special cool or shaded holding places for tomatoes at the market. For as long as the crop is left in the open it is susceptible to damaged by the sun or by rats or insects. Brokers said that very little of volume is lost at the wholesale point but much is lost in value due to dumping. At the peak of the tomato season farmers sell the crop at any price to prevent total loss of the crop. Farmers in Kangagani village said that often they have offered the crop to wholesale buyers at give away prices just to get rid of it.

Discussions with brokers at Mwanakwerekwe wholesale market expressed concern that some farmers harvest the crop while very ripe and transport it to the market at a time when the crop is highly susceptible to damage. The overripe crop often breaks and turns into a pulp before it reaches the market. In this state it is sold as "pasu' (which means broken or pulped) at 20 percent of the market price. Brokers estimate that a minimum of 5 percent of the wholesale crop is "*pasu*" and that retailers know that they will find some broken and pulped tomatoes in any given "*susu*". The prices offered to farmers at auctions take into account the high probability that the buyer will find *pasus* in any given *susus.* Brokers also said that tomatoes imported from the Mainland are more carefully packed in wooden boxes and that even though the shipment from the Mainland to Zanzibar could take two days to reach Mwanakwerekwe market, much of it arrives in good condition.

They estimate that even after two days transit the proportion of broken or pulped tomatoes is about half of that which occurs for the locally produced tomatoes. They added that one of the main reasons is that tomatoes from the Mainland are of the improved varieties that are less susceptible to breaking and pulping compared to the local variety, which is thin skinned and very soft when ripe. On average it was estimated that post harvest loss of the crop at wholesale point average only 3 percent because the *pasus* (also known as *masala* tomatoes because these broken and pulped tomatoes are used for making stews and soups) are not discarded but sold at reduced prices, often sold at 20 percent of the price.

***Loss of tomatoes at retail markets***

Retailers of tomatoes say that they sell tomatoes in small allotments of 4 to 8 tomatoes for TZS 500 to 1,000 each. The majority of retailers say they are able to sell between 10 and 20 of these allotments per day and on average they sell 100 allotments per week. Out of these 100, they take home about 5 allotments of *pasus* and discard another 5 of the allotments due to rotting or damage by mice etc. Overall, they lose 10 allotments out of 100 destined for sale. On average the loss of tomatoes at retail level is estimated at 10 percent per year

***Loss of tomatoes in processing, preservation and storage***

Much of the crop could be preserved for future use in the form of chutneys, tomato sauces, purees or ketchup that have great demand locally. Also sun dried tomatoes are in great demand in the EU market and the local variety would be most ideal for drying. Farmers said that they do not know how to preserve tomatoes. There have been some training on tomato processing in the areas of jam and chutney making but sufficient action has not taken place to have a significant impact on reducing the post harvest losses

during the peak harvest season. So far there are not any large processing plants to absorb the harvest that comes to the market at main harvest time. On average it was estimated that 3 percent of tomatoes are lost in home processing and preservation.

*Loss of tomatoes at consumption stage*

Most people even farmers said that they do not store tomatoes at home. The majority of households buy enough to use for the day to avoid damage. There are many kiosks *(magenge)* selling tomatoes and these kiosks are situated in residential neighborhoods and cater for those without refrigerators and provide them with fresh tomatoes everyday. It was estimated that only negligible amounts of tomatoes are lost at household level. On average 1 percent of tomatoes are lost at home

The estimation of post harvest losses of tomatoes has used the figures for marketed production of tomatoes as seen in Table 6.4. The losses exceed 2,100 tonnes at any given year since 2002. However, these results must be interpreted cautiously due to the fact that data on tonnage that is marketed is not reliable. It is likely that the losses could be much higher than the figures presented.

***Box 6.1: Baseline Summary of the estimated average annual post harvest losses of tomatoes***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post harvest loss of tomatoes from the harvest stage to consumption is as follows:

- at harvest site: 20 percent
- in transit: 5 percent
- at whole sale point: 3 percent
- at retail market: 10 percent
- at processing/packaging and storage: 3 percent
- at consumption stage: 1 percent

***Therefore post harvest losses of tomatoes are estimated at an average of 42 percent per year***

**Table 6.4: Marketed production of tomatoes, 2002 – 2007**

| Year | (a) | (b) |
|---|---|---|
| | Marketed Production of Tomatoes | Loss of Volume @ 42 % due post-harvest loss per year |
| | (in tonnes) | (in tonnes) |
| 2002 | 5,228 | 2.195.76 |
| 2003 | 5,381 | 2.260.02 |
| 2004 | 5,538 | 2.325.96 |
| 2005 | 5,703 | 2.395.26 |
| 2006 | 5,870 | 2.465.40 |
| 2007 | 6,041 | 2.537.22 |
| | Cumulative loss @ 42 per-cent per year | **14,179.62** |

Source: RGoZ, Zanzibar Statistical Abstracts, 2007

### 6.2.3 Potentials Economic and Social Impacts of Post Harvest Losses of Tomatoes

***Implications of post-harvest losses of tomatoes for loss of income at national level***

Each household spends a minimum of TZS 200 on tomatoes each day. Based on the projected number of households in Zanzibar in 2007 were 217,894. Assuming a minimum expenditure of TZS 200 per household per day approximately TZS 7,457,943 was spent every day on tomatoes alone. Assuming also that for 9 months households purchased all the tomatoes that they used and that most of the tomatoes were brought in from the Mainland or from elsewhere, the estimated expenditure for tomatoes for the year 2007 was TZS 11,766,314,717 (or about TZS 12 billion). At an annual average the exchange rate of TZS 1,100 to the United States Dollars in 2007, the dollar equivalent was USD10, 696,650 that was spent on tomatoes alone. If the pre-harvest and post-harvest losses could be contained and if production could be done all year round through simple irrigation activities this large expenditure on imported tomatoes could be spent on local tomatoes and boost the local economy.

***Implications of post-harvest losses for household income***

Some estimate that even a farmer cultivating half an acre is able to generate at least TZS 400,000 when the harvest is free from disease. Most farmers agree that tomato production is good business and that during the tomato harvest season that is when they are able to meet most household expenses. Post harvest losses reduce household income and limit the profitability of this otherwise lucrative business of many rural households and reduce the ability of households to invest into other productive activities.

***Implications of post-harvest losses for food prices, FSN***

Tomatoes are used in soups and stews that are used as accompaniments to staples. It is also eaten raw as a salad popularly known in Kiswahili as *kachumbari* also commonly eaten with rice or with potato or cassava. Since many farm households rely on this crop for cash income and for food it is an important crop for many rural households. In most parts of Zanzibar tomato farmers said that during the tomato harvest that they are able to eat well sometimes even up to four good meals a day because there is money in the household. It should be noted also that the intake of micro nutrients is limited in Zanzibar due to limited consumption of fruit and vegetables. Many fishers said that for as long as they have fish they consume little if any vegetables. Fruit is consumed as a snack when available and is not always planned for as part of the meal. Consequently, micro nutrient deficiencies are widespread in Zanzibar especially Vitamin A deficiency and anemia. The consumption of tomatoes is therefore very important to prevent the worsening of the micro-nutrient deficiency situation.

Table 6.5: Potential for the control of post-harvest losses along the tomato value chain

| Stage of the Tomato Value Chains | Area of Concentration | Status of the Tomato Value Chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. there is little input supply of tomato seed and where available farmers do not know how to grow the improved variety. Over 95 percent of tomatoes produced in Zanzibar is of the local variety that is small in size and would have little chance of a market outside Zanzibar in its fresh form;<br>2. production is done without the use of any fertilizers. Farmers move to new plots of land once the soil is leached;<br>3. over 95% of farmer rely on rainwater for production. Only in a few areas of Unguja are irrigation activities for tomato production ongoing;<br>4. there is supply of small scale irrigation equipment in Zanzibar but only a small number of farmers have been exposed to these technologies;<br>5. the supply of chemical pesticides is very limited and in most parts farmers have never used them;<br>6. most of the crop is organically produced;<br>7. tomatoes are produced on small plots ranging from 0.25 of an acre to 10 acres. there were no reports of large scale producers;<br>8. only a small proportion of farmers have trained to produce tomatoes under irrigation through the World Banks' funded PADEP;<br>9. planting of tomatoes is done in late April and early May each year |
| Stage 2 | Harvesting | 1. harvesting of tomatoes is done from July to end of September .<br>2. family labor is used to do the harvesting early in the morning and the crop is packed into bamboo baskets (susus) the same day<br>3. in areas located away from the market, farmer organize to harvest the same day an hire a truck to transport the crop to the market<br>4. young men, women and girls are hired on harvest days to sort, and pack into the susus at about TZS 2000 per day. |
| Stage 3 | Post harvest handling and storage | 1. young, men are also hired to load the susus into trucks at an agreed price per 10 susus loaded and could range from TZS 500 to TZS 1,000;<br>2. a similar payment is made by farmers by those who unload the crop at the market;<br>3. there are no special provisions for handling tomatoes at key market centers and the crop must be sold the same day to avoid loss;<br>4. the market is secure and farmers who leave stock overnight usually find it intact the next day. |
| Stage 4 | Transportation/ Distribution | 1. the main method of transport from the farm to the market is on ox drawn carts, bicycles, busses and lories;<br>2. the main distribution point is the Mwanakwerekwe wholesale market in Unguja. |
| Stage 5 | Transformation/ Processing | 1. there are no large scale processing facilities for tomatoes but plans are under way to build a processing plant at Kizimbani in Unguja. |
| Stage 6 | Marketing/ Promotion | 1. Marketing and promotion is done locally by farmers and traders. |
| Stage 7 | Consumption and use of by products | 1. The main consumers are households;<br>2. The hotels in the tourism industry prefer the larger improved variety usually imported from the Mainland. |

### 6.2. 4. Recommendations

Priority areas for intervention:

- there is need to break the heavy dependence on rain-fed one season crop of tomatoes by irrigating and producing the crop all year round as is done in the mainland;
- farmer groups especially youth groups should be formed and organized as business groups to produce tomatoes using simple irrigation technologies;
- there is need to export sun dried organic tomatoes from Zanzibar. The Zanzibar local variety would be ideal for the preparation of sun-dried tomatoes that are in high demand in the EU market;
- there is need for more extension workers to provide training to tomato farmers on how to produce tomatoes commercially;

Potential actors along the tomato chain:

**1. Government**

- Ministry of Agriculture, Livestock and Environment -
- Kizimbani Institute of Agriculture - Offers general Certificate Courses on Agriculture including horticulture
- Farmer Field Schools – provide specialized training to farmers on various aspects of agricultural development

**2. CSOs**

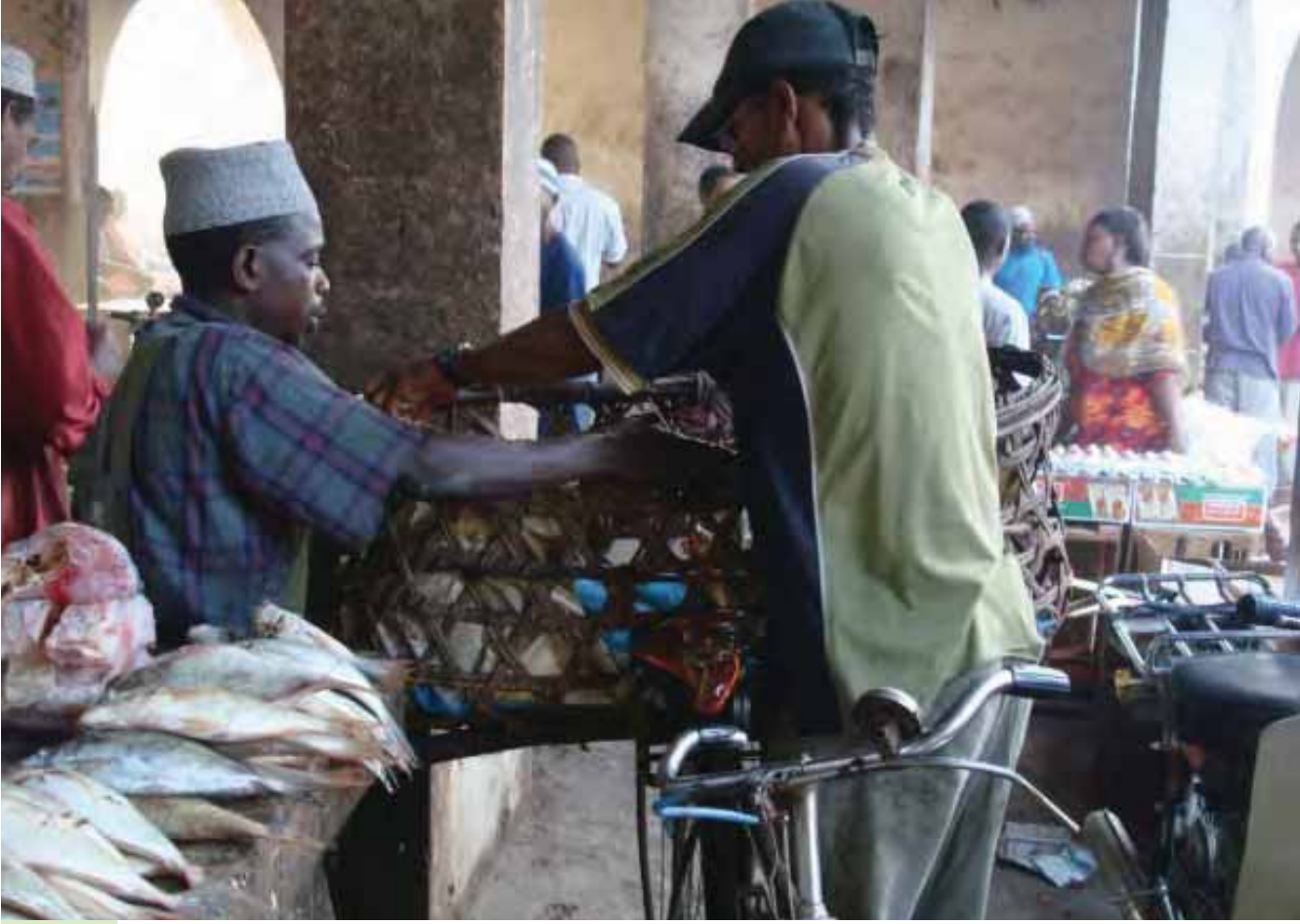
- Action Aid working to end hunger through a range of capacity building initiatives to farmers;
- Care International promoting sustainable livelihoods and investments into agriculture;
- Pride Tanzania supporting farmer groups through delivery of financial services;
- Africare is supporting farmer groups in developing organizational skills;
- ZAFFIDE - provides capacity building services to farmers and fishers in Zanzibar;
- UWAMWIMA – Network for farmer organizations linked to MVIWATA in the mainland and aimed at building farmer capacity for production and marketing;
- *Mtandao wa Kuendeleza Elimu ya Kilimo* (MKEKIZA) - Progressive farmer group and intellectuals providing training to farmers on how to produce better crops.

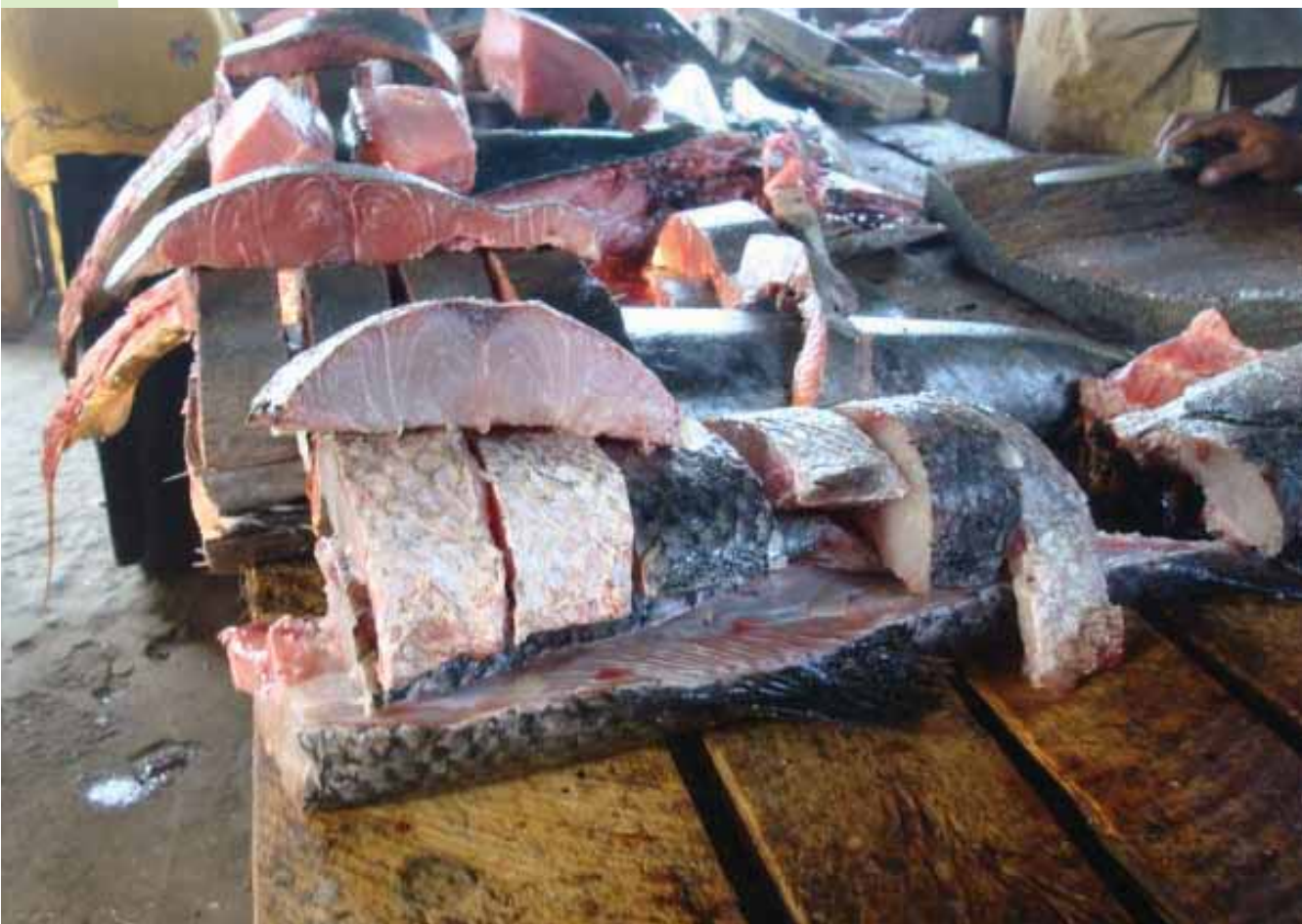
**3. Private Sector Organizations**

- ZNCCIA – Building capacity of the private sector for advocacy and for service delivery to members.

**4. Farmers**

- individual farmers are aspiring to increase tomato production;
- some farmers' business groups have been trained under PADEP.





# Chapter 7:

## Findings on post harvest losses of fish

## 7.1 Introduction

In 2007 it was estimated that Zanzibar produced about 23,582 tonnes of fish annually valued at TZS 34,639,223,000 or about USD 26,645,556 at the current exchange rate[2]. Over 96 percent of the marine catch of Zanzibar is classified as artisan fishing. The main fishing areas in Zanzibar are North "A" and Urban districts in Unguja and in Pemba the districts of Mkoani, Wete and Micheweni produce most fish. As shown in Table 7.1 Pemba produces about 44 percent of the catch while Unguja produces about 56 percent. This trend appears to have remained relatively stable over the past six years perhaps due to the fact that the artisan production of fish has not changed much over these six years despite the fact that the number of fishers has increased substantially on both islands.

**Table 7.1: Proportion of fish landed in Unguja and Pemba, 2002-2007**

| Year | Fish landed in Unguja (in tonnes) | Catch in Unguja as % of total | Fish landed in Pemba (in tonnes) | Catch in Pemba as % of total | Total Fish Landed in Zanzibar ( (in tonnes) |
|---|---|---|---|---|---|
| 2002 | 11,298 | 55.5 | 9,045 | 44.5 | 20,343 |
| 2003 | 11,676 | 56.0 | 9,192 | 44.0 | 20,868 |
| 2004 | 12,394 | 56.7 | 9,477 | 43.3 | 21,871 |
| 2005 | 13,568 | 58.3 | 9,687 | 41.7 | 23,255 |
| 2006 | 13,486 | 57.9 | 9,800 | 42.1 | 23,286 |
| 2007 | 14,633 | 62.1 | 8,949 | 37.9 | 23,582 |

**Source: Calculated from Basic Fisheries Statistics, MALE, 2007**

## 7.2 Estimated post-harvest losses fish at various stages of the fish value chain

***Loss of fish at fishing sites***

Fishers were asked to estimate the loss of fish at fishing sites and to state the main reasons why such losses occur. Most said that losses are small and occur only when fish are entangled in nets for long hours. Overall, this happens rarely and experienced fishers have learned to detect the problem early and dive down to disentangle the nets to avoid damage to the fish and to the nets. It is estimated that post harvest loss averages 1 percent at fishing sites.

***Loss of fish on transit from fishing sites to landing sites***

Small fishers who use the sail as the main method of propulsion said that they lose most fish on transit from the fishing sites to the landing sites. In calm weather it was said that it takes fishers up to 12 hours and sometimes 24 hours to move from fishing sites in off shore waters to the landing sites. In these situations and given that the small boats lack cold storage facilities all the catch rots and can no longer be sold. This problem of slow moving boats has been recognized by the Fisheries Department of Zanzibar and some training has been given to fishers about how to clean and handle fish on transit to prevent rapid

2 Current exchange rate 1USD = 1,300 Tshs

deterioration. However, fishers said when the hours of transit are prolonged the loss can be as high as 100 percent of the catch even after cleaning. It was also said that these types of incidences (i.e 100 percent loss of catch) happen rarely these days. It was said that when there is trouble at sea and the catch is big fishers use mobile telephones to call other fishers on shore to come and assist with a boat engine. On the whole the majority of fishers said they catch between 10 and 60 kgs of fish every day. The fish is estimated in the form of *mitungo* (fish threaded in strings) that may contain up to 50 kgs of different or similar fish.

During the windy weather (July to September), fishers on small boats said that they do not take the risk of using small sail boats to off shore fishing sites. It was said that some fishers have been propelled out of their destinations by strong winds and landed in the north or south depending on the direction of the winds. They said it is difficult to control the small sail boats during the strong winds and some fishers who attempt to do so end up losing the fish and or lives when the boasts capsize as they often do. During the strong afternoon winds of July to September the fishers who gain the most are those with big boats with engines who can control the time they go and the time they return to the landing sites. Fishers estimate that they lose about 5 percent of catch in transit on a regular basis due to the hot sun and poor and or lack of sanitation facilities at landing sites.

Boat engines are available for lease at most landing sites at an average cost of TZS 5,000 per day for the 15-HP engine and up to TZS 8,000 per day for the 40-HP engine. Fishers must add fuel which averages about TZS 10,000 per day. Thus, the average cost of hiring an engine is estimated at between TZS 13,000 and TZS 18,000 per day depending on horse power. Usually off-shore fishing boats are operated by 5 adults and this would mean that each person would contribute between TZS 3,000 and TZS 4,000 to hire the engine and pay for the fuel. Selling 10 kgs of the catch at TZS 1,500 would pay for the boat's rental fees and the fuel per day.

The above calculations were shared with fishers at various landing sites in Unguja and Pemba to find out why more fishers do not rent the engines as often as they should. It was learned that fishers are not assured of the catch and are reluctant to face the owners of the engines on days when they return without anything. It was said that fishers expect to return without any catch at least once a week. Some said that they average about 15 days of good catch and 15 days of poor catch every month. Most fishers said that whatever income they earn is used the same day and most do not have any cash savings. One of the main reasons for lack of cash is the fact that the majority of fishers or fish traders who were encountered during the assessment were not organized into Savings and Credit Cooperative Societies (SACCOS) to enable them to access short term loans for the days when fishers do not get any catch and none in rural areas had bank accounts or any savings in formal institutions. This is despite the relatively high daily earnings on majority of the days of the week when the catch is good.

***Loss of fish at landing sites***

Most of the fish landed in Unguja is expected to be auctioned immediately upon arrival. Most landing sites have freezers where catches landed late in the evening can be stored until the next morning. At landing sites where freezer spaces are limited there are private operators who lease freezer space at about TZS 200 kg/day. In each of the landing sites there are informal organizations that ensure that the site is well managed and freezer space accessible on equitable basis. Freezer lenders have mobile telephones and can be reached by fishers on transit from fishing sites to alert them of an incoming catch if arrival is expected to be late in the evening or late in the morning.

Losses at landing sites occur most often when there are power cuts for two to three days continuously. In some areas, some fishers have made arrangements with hotel owners who have private power generators to buy the fish at reduced prices or allow the fisher to store the fish in the cold rooms of hotels. To the extent possible, fishers try to reduce losses using all means available at their disposal. However, even with these efforts losses do occur at landing sites.

Fishers said that when there are extensive power cuts, the fish is salted and preserved. It was said that there is virtually no demand for salted fish in the tourist hotels and since many people can get fresh fish every day, even the local people avoid salted fish in favor of fresh fish. It was elaborated that when there are no customers, the fish is left to soak in the salt for many days even weeks and develops into what the local people call "*ng'onda*". Ng'onda is not sold but shared among friends as a sign of solidarity among fishers and is often used to strengthen friendships in fishing camps. However, fishers said that they would not like to be forced by power cuts to make too much *ng'onda* because it reduces revenues from fishing. It was estimated that post harvest loss of fish at landing sites could be 3 percent of catch.

***Loss of fish at retail markets***

Discussions held with individual fishers reveal that they lose some fish at least once a week. Those who buy in bulk at auctions can lose between 5 and 20 kgs of fish products per week. Observations made at many of the retail fish markets reveal that most fishers use rudimentary tools to processes fish. This takes time and in observing a fisher preparing fish fillets it was noted that much of the flesh was left on the bones because the knife was not sharp enough. In Mkoani, Pemba a fisher who had a 40 kgs fish took about three hours to cut it with a blunt knife and at the end of the work there were many small pieces of fish left on the table that could have amounted to 500g. None of the landing sites had electric saws to cut big fish. Fishers come with own tools. In Chwaka Bay, Central Unguja, fishers said that losses at retail level occur when fishers try to sell on the streets on a hot day. They suggested that the best place to sell fish is at the landing site but this must be done only at certain hours of the day. Fishers who arrive after 0900 hours in the morning can not find any body at the landing site and must wait until 1500 hours for the next round of fish auctions. Discussions with fishers in Chwaka Bay, Wete and Mkoani Pemba and those in Nungwi in North Unguja all estimate that they lose about 5 percent of the catch due to poor handling at retail points.

**Box 7.1: Competing for customers at Malindi fish market, Unguja:**

***traditional and modern fish mongers struggle to control fish losses***

The Consultants visited the fish market in the morning of the 13th of May 2009, to examine the facilities and the overall condition of the market to seek views of fishers and fish buyers about potential fish quality and safety from the sanitary point of view, and as follow-up, inquire from fishers the amount of fish losses that they incur on a regular basis. The facility was constructed with enough stalls to accommodate only 19 fishers. It has a regular supply of running water and daily cleaning services provided by the Municipal Authority. Fishers who use the facility pay a flat fee of TZS 200 per day and this fee is collected each day from those who have a catch of any size for the day.

On the day of the visit the Consultants found only 25 percent of the stalls were in use while many fish mongers continued to sell fish the traditional way in open air outside the facility with little or no provisions for sanitation. Those selling fish outside said they are able to catch the customer before he/she walks into the market they added that since they do not pay any fees to the Municipal authorities they are able to sell the fish at a lower price than those who use the stalls inside the facility. However, the consultants found that the prices inside the facility and that outside the facility were almost the same for the similar type of fish.

There is an ice making machine nearby where fishers can buy enough ice to cool 30 kgs of fish for one day at TZS 3,000. However, it was learned that many fishers who sell outside the market are always prepared to flee from the Municipal Authorities and find the ice heavy to work with. Therefore they do not buy the heavy ice but keep fish is small buckets that are easy to carry around the market

It was said that those who sell the traditional way expose the fish to the sun all day long and lose more fish due to poor handling than those who sell inside the market facility.

***Loss of fish in processing/preservation/packaging, branding and storage***

There are no large-scale commercial fish processing facilities in Zanzibar. Most of the processing is done either at retail level or at home where the fish is cleaned, gutted, cooked and eaten or sold as fried fish on the streets and markets. Most people do not buy large quantities of fish to be stored thereby risking spoilage. Even tourist hotels buy fish almost every day and keep stocks to as low as possible. Whatever amount of fish that is stored in freezers is kept for a maximum of two to three days. It was learned through discussions with hotel owners and operators in Zanzibar town that almost all tourist hotels in Unguja have back up power generators to ensure that food is kept fresh. Hotels also have back up suppliers of fish so that if one supplier fails to turn up with good fish they call another supplier who will bring fresh fish within hours' notice. Overall, it was estimated that post-harvest losses of fish in processing, preservation and notably in storage averages 10 percent per year.

***Loss of fish at consumption stage***

Fish is eaten at breakfast, lunch and dinner in Zanzibar and is prepared as fried fish, soup, or stew according to taste of individuals. Men and women interviewed said only negligible amounts of fish are lost at domestic level. Fishers estimate that apart from the byproducts of cleaning, very little of the fish is lost once it reaches the household level. Even in most tourist hotels, very little of the fish is lost at consumption stage. All hotels that were visited said they have back up power systems to ensure that food including fish is kept fresh. Some hotels empty all stocks of fish from freezers and stock with fresh ones every two to three days. Since most provide food for the employees the old stock is used for preparing food for staff while the new stock is used for hotel guests. However, it was said that even in big hotels only limited amounts of fish are stocked in freezers. It was said that very little of the fish is lost at consumption level and together with interviews collected at household level the average annual loss was estimated at about 1 percent .

***Use of fish byproducts***

There is very little information about the use of fish byproducts in Zanzibar for the manufacture of fish meal or for use in feed mills. It is assumed that over 90 percent of all fish byproducts are wasted and this was confirmed through discussions with fishers in Pemba and Unguja. It should also be noted that only a small proportion of fish is left as a byproduct as most parts are consumed. The byproducts are mostly the gills and the tails; the rest of the fish is consumed. Fishers did not put any value to these byproducts and did not consider any of the parts thrown away as valuable. Thus, they were not able to put any value to the loss of such byproducts.

***Box 7.2: Baseline summary of the estimated average post-harvest losses of fish***

Based on discussions held with farmers and traders as well as from review of literature it is estimated that on average post-harvest loss of fish from the harvest stage to consumption is as follows:

- fishing site 1 percent;
- in transit from fishing site to landing site 5 percent;
- landing site 3 percent;
- in retail sales 5 percent;
- in processing/packaging and storage: 10 percent;
- at consumption stage: 1 percent.

***Therefore pos- harvest losses of fish are estimated at an average of 25 percent per year***

As shown in Table 7.2 the 25 percent post-harvest loss of fish translates into big losses of both fish volume and value. In terms of volume, it is most likely that more than 5,000 tonnes of fish are lost every year. The loss of value from these losses in 2007 alone could have been more than TZS 8.6 billion. The cumulative estimates of the loss are staggering at 33.3 thousand tonnes of fish worth over TZS 32.5 billion (over 25 million USD) for the 7 year period.

### Table 7.2: Post-harvest losses of volume and value of fish landed in Zanzibar 2002 – 2007

| Year | (a) | (b) | (c ) | (d) | (e) |
|---|---|---|---|---|---|
| | Total fish landed | Loss of volume @ 25 % due to fish damage | Value of fish | Post-harvest loss of value @ 25% | Post harvest loss @ 25 % loss |
| | (in tonnes) | (in tonnes) | (in TZS) | (in TZS) | (in USD equivalent) |
| 2002 | 20,343 | 5,085.75 | 12,537,295,000 | 3,134,323,750 | 2,411,018 |
| 2003 | 20,868 | 5,217.00 | 13,187,683,000 | 3,296,920,750 | 2,536,093 |
| 2004 | 21,871 | 5,467.75 | 18,562,550,000 | 4,640,637,500 | 3,569,721 |
| 2005 | 23,255 | 5,813.75 | 24,671,413,000 | 6,167,853,250 | 4,744,503 |
| 2006 | 23,286 | 5,821.50 | 26,561,739,000 | 6,640,434,750 | 5,108,027 |
| 2007 | 23,582 | 5,895.50 | 34,639,223,000 | 8,659,805,750 | 6,661,389 |
| | ***Cumulative estimate of loss*** | ***33,301.25*** | ***Cumulative estimate of loss*** | ***32,539,975,750*** | ***25,030,751*** |

Source: Calculated from Annex Table 7.1 on Fisheries Statistics, OCGS, May 2008

## 7. 3 Implications of post-harvest losses of fish for income generation

*Implications for loss of income at national level*

Loss of income at national level does not only come in terms of loss of value of the catch but also in terms of revenues derived from taxes and from the multiplier effects of the fish industry. It should be recalled that fishing activities employ over 34 percent of the economically active population in Zanzibar including men, women and youth. Post-harvest losses of fish inevitably reduce income earned in the fisheries sector and cause insecurity of investments. Even among small scale fish traders, it was said that fish sales were good business because even on a bad business day they are assured of a profit of at least TZS 10,000 per day or TZS 300,000 per month. This amount of income is about 5 times the minimum wage in Zanzibar and it was said that the cash earnings were in addition to setting aside enough fish for home consumption. Mbaruk Saleh is one of the off- shore fishers in Chwaka village who averages 30 kgs of catch per day. He has two wives and sends home 6 kgs of fish every day; 3 kgs to each wife. On the day of our visit he had already earned about TZS 45,000. He said the amount fluctuates from day to day but recently catches have been good and does not recall a day when he went home without TZS 20,000. This level of income, if maintained could be a good basis for poverty reduction and for ensuring FSN.

### Box 7.3: Baseline summary of the estimated average annual post-harvest losses of fish

One net costs about TZS 250,000 and an average fisher uses about four to six nets worth between TZS 1,000,000 and TZS 1,500,000. Others invest up to TZS 3,000,000 on nets alone. It is estimated that a small fabricated boat costs TZS 8,500,000. A 40-HP engine costs TZS 4,500,000 and a 15-HP engine costs TZS 3,000,000. When the cost of nets is added the investment for a small- to medium-size fisher ranges between TZS 15,000,000 and 20,000,000.

***Implications of post-harvest fish losses for household income***

Income earned from fishing even by the smallest investor is more than double the minimum wage of TZS 60,000 in Zanzibar. As shown in Table 7.3 the fisher with only a bamboo trap could earn as much as 3 times the minimum wage even if his/her fishing is successful for only 12 days per month. This estimate is low but it takes into consideration the seasonality of fishing activities and the fact that fishers also take time out to do other work including agricultural work during the month.

**Box 7.4: Estimated returns to investments in small and medium scale fishing**

The very small scale fishers invest about TZS 20,000 to get the very basic of fishing gear like a trap or hand line as well as basic supplies for the day. On a good day the fisher could catch about 20 kgs of fish enough to return the investment plus a profit of TZS 10,000. However, on average the fisher expects to return the investment within two days. Fishers rarely experience two successive days of unsuccessful fishing and even if it occurs chances are small that the trend would repeat itself over a week or month.

A fisher investing TZS 20,000,000 and using purse seine nets would expect to catch about 250 kgs of *dagaa* per day for about 12 days per month. This would generate at least TZS 3,000,000 per month. The value of the investment could be recovered within seven months and a profit of at least TZS 15,000,000/- made within the same year assuming that fishing is done all year round.

**Table 7.3: Potential earnings from fishing assuming 12 days of successful fishing per month**

| Type of fishing gear used | No. of fishers using the type of fishing gear | Average catch per day per fisher | Potential earnings per fisher per day (in TZS) | Earnings per month per fisher assuming an average of 12 successful fishing days each month (in TZS) |
|---|---|---|---|---|
| Trap | 10,599 | 4 kgs | @ 1,500 per kg = 15,000 | 180,000 |
| Hand lines | 18,865 | 5 kgs | @ 1,500 per kg = 22,500 | 270,000 |
| Long lines | 706 | 5 kgs | @ 1,500 per kg = 22,500 | 270,000 |
| Purse seine[2] | 215 | 50 kgs | @ TZS 1,000 per kg for the small fish (dagaa) = 50,000 | 600,000 |
| Cast net | 1,046 | 30 kgs | @ 1,500 per kg = 45,000 | 540,000 |
| Scoop net | 264 | 30 kgs | @ 1,500 per kg = 45,000 | 540,000 |
| Ring net | 180 | 15 kgs | @ 1,500 per kg = 22,500 | 270,000 |
| Spears | 2,349 | 10 kgs | @ 1,500 per kg = 15,000 | 180,000 |

**Source: Calculations based on data from the Zanzibar Frame Survey 2007; personal communications with Mr. Issa Ameir Suleiman, MACEMP, Zanzibar, and discussions with fishers**

Fishers and fish mongers know that fish trade is good business and said it is the best money maker of all fresh food items sold at local markets. Overall, it was said that a fish trader could make a daily profit almost double that of his/her investment regardless of how small the investment, if the losses are controlled. Income from fishing could be earned daily and enables access to food daily. Income earning opportunities are higher for those using nets in off shore fishing. It is estimated that between 8,000 and 12,000 fishers use nets to do the fishing off-shore where the catch is better. A good days catch could amount to between 250 kgs worth a minimum of TZS 375,000.

### Table 7.4: Potential for control of post-harvest losses along the fish value chain

| Stage of the fish value chain | Area of concentration | Status of the fish value chain in Zanzibar |
|---|---|---|
| Stage 1 | Production | 1. Over 34,000 fishers are involved in what is known as artisanal fisheries, which contributes more than 96 percent of the total marine catches of Zanzibar.<br>2. The fisheries sector is technologically very underdeveloped with traditional tools and practices dominating fishing activities.<br>3. Income generation from fishing is highly seasonal due to heavy reliance on small boats propelled by winds instead of modern boats with engines and other navigational technologies. |
| Stage 2 | Harvesting | 1. Only 7,096 fishing vessels were found and 806 engines.<br>2. Fishing gears include gill net, scoop nets, hand lines, long lines, troll lines, cast nets, ring nets, movable traps, shark nets, fixed fences, spears and sticks. |
| Stage 3 | Post harvest handling and storage | • In 2007 there were 166 landing sites in Zanzibar;<br>• 51 sites out of 166 had permanent buildings;<br>• 42 out of 166 had temporary buildings;<br>• Only 2 out of 166 landing sites had cold rooms and these were in Unguja;<br>• Only one ice making facility was found in Unguja;<br>• There were a total of 67 freezers at landing sites in Zanzibar;<br>• Only 95out of 166 landing sites had running water;<br>• Only 73 had power supply;<br>• Only one landing site located in Northern Unguja had a fish kiln but not yet in operation. A visit was made to the site of the fish kiln at Nungwi landing site and it was learned that operations will soon start after completion of operational guidelines to show how it will be run and managed. |
| Stage 4 | Transportation/ Distribution | 1. Animal drawn carts, bicycles, buses and lorries from landing sites to retail markets are the main means of transporting fish.<br>2. There were not any cold storage vans seen in Zanzibar for the movement of fish from one place to another |

| | | |
|---|---|---|
| Stage 5 | Transformation/ Processing | 1. The Fisheries Sector in Zanzibar lacks commercial processing facilities. Most processing done at domestic level<br>2. There is high potential for the use of fish byproducts for the manufacture of fish meal and other animal feed products. However the industry is still underdeveloped |
| Stage 6 | Marketing/ Promotion | 1. Self-promoting sector in Zanzibar as a source of food, employment and income.<br>2. Demand for fish is high within the tourist hotels, among high income consumers as well as within middle and low income segments of the population. |
| Stage 7 | Consumption and use of by products | 1. Large quantities of fish are consumed in Zanzibar. Most of the fish landed in consumed locally with only a small proportion of specialty fish and shark fins being exported.<br>2. Very little use of fish byproducts in Zanzibar as a whole but high potential exists for use in the manufacture of animal feeds. |

## 7.4 Recommendations

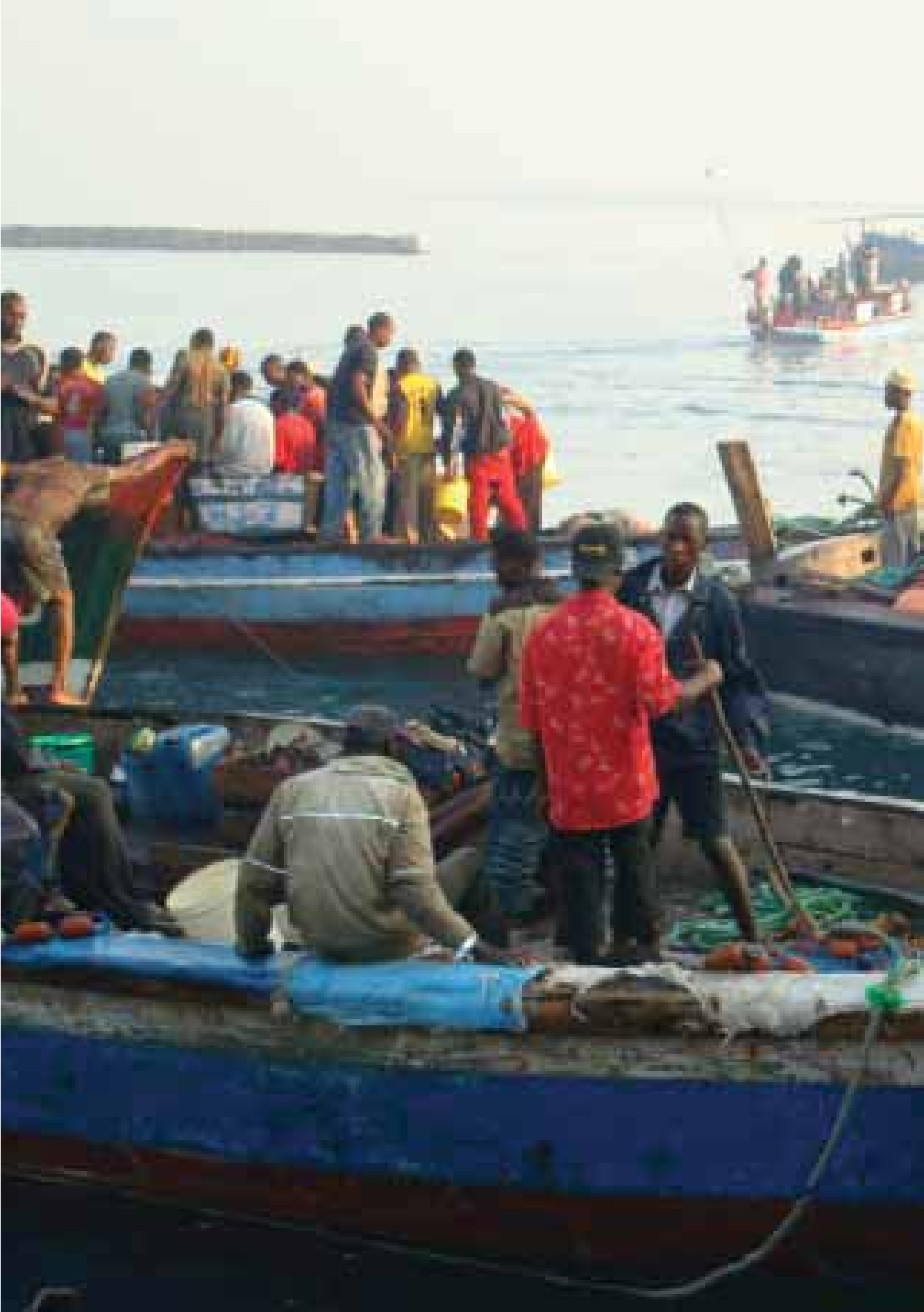
Priority areas for intervention

- fishers believe that there could be much gained from having fish processing plant at a central location where fish could be sold at any time of the day. Reliance on the poor to buy fish every day is one cause of the unstable market and the fluctuation in prices. The hotel Industry wants fish of a certain type mostly king fish, tuna, white snapper, lobsters and red snapper. They also want the fish cut in a certain way and are willing to pay for the service but fishers do not know how to respond to that demand. A processing plant in Zanzibar town for example would be able to capture fish landed in all parts of the island;
- the most frequently requested intervention by fishers is assistance (through low cost credit arrangements) to be able to access improved fishing gear notably the right fishing nets and boat engines;
- provision of technical assistance to fishers to be able to fish in a sustainable manner. (In some tourist hotels, lobsters, which are in great demand, have been rejected from fishers who bring those with eggs still in them. Some hotel operators say rejecting the lobsters is one way of sending a strong message to the fishers about the unsustainability of this type of fishing. However, more efforts have to be done to reach fishers with similar messages even those who do not sell at tourist hotels);
- each landing site should have a shelter equipped with tools and water with all necessary sanitation services. Guidelines should be developed showing how landing sites should be developed and equipped. (In Tazari village, in the northern part of Unguja, there over 300 fishers with a landing site that has no shelter or facility but handles large quantities of catch every day);
- there should rules and regulations to guide the selling of fish and these should be fully enforced by the municipal authorities;
- efforts should be made to have power generators at landing sites and enough freezers and cold

rooms should be installed at landing sites to safeguard fish that is not sold the day it is landed;
- representatives of Fisheries Department should be stationed at all major landing sites and should provide technical support to fishers about the quality of fish landed.
- fishers need to organize into viable SACCOS but do not know how. Many have learned of successful SACCOS under PADEP and would like to have similar groups. Efforts should therefore target organizing fisher groups into SACCOS.

Main Actors along the fish value chain

- the Revolutionary Government of Zanzibar Fisheries Department provides administrative and policy guidance to the fisheries sector. It has representatives at most landing sites to provide technical assistance to fishers;
- the Municipal and Town Council Authorities enforce regulations for sanitation and good practice is the fisheries sector. They provide support in the areas of staff for cleaning services, collecting fees for various services offered at landing sites including auctioning of fish and assurance of standards of measures and scales used at the landing sites.
- MACEMP has been providing technical, financial and materials support in almost all areas of fishing activities including building shelters at landing sites, providing freezers for cold storage of fish, providing modern fishing boats and engines and water supply at landing sites.
- TASAF has been organizing fishers into groups for capacity building in fishing activities including provision of fabricated boats and boat engines;
- Some members of the Zanzibar Association of Tourism Investors (ZATI) have been creating partnerships with fishers to supply fish for the hotel industry. This has opened up opportunities for more formal arrangements as well as capacity building for fishers to engage more effectively in the tourism industry.
- ZAZOSO and ZAFFIDE are civil society organizations that are working in the fisheries sector to strengthen capacity of fishers in fisheries conservation and environmental management as well as fish marketing. Private sector operators who provide freezer spaces have saved much of the fish landed in Zanzibar from damage. A more organized engagement of these service providers of cold storage could increase and improve the service. Fishers are the main actors in the fisheries industry. Technical support as well as provision of improved fishing gear would enable this group to play an even greater role in fisheries development.



# Chapter 8:

## General recommendations

## 8.1 Developing and organic brand for Zanzibar's agricultural products

The assessment found that much of the produce consumed in Zanzibar is grown organically. There is very little use of fertilizers or pesticides. However, there is little if any branding as "organic" of the products that are found in most of Zanzibar's market. There is therefore an opportunity to develop an ***organic brand*** that will have the capability to attract markets locally and internationally. Support institutions and civil society organizations working in the agricultural field are already in place in Zanzibar and these could play a big role in promoting these organic products.

## 8.2 Establish anchor processing plants

In line with the objectives of the Zanzibar Industrial Policy, anchor processing plants should be established to absorb excess produce during periods of glut. This would also help stabilize the price of perishable items like fish, cassava and vegetables like tomatoes.

- priority should be given to processing fish for export and for the domestic market especially for the growing hotel industry;
- there should be at least two big fishing vessels that are capable of going off-shore during the high winds. Even with good boat engines small boats refrain from off shore waters because of risk of capsizing. It is proposed that one of such big fishing boats should be used in Pemba and another in Unguja;
- processing of cassava into flour and other products should be done hand in hand with demonstrations on the type of products that could be made from it. "Cassava product shows" should be organized perhaps once a year to display the range of products that are commercially possible from cassava. These "shows" could be done in collaboration with other African countries like Ghana, Nigeria and others that produce and process cassava into a variety of commercial products;
- processing of tomatoes into jams and chutneys as well as the making of tomato paste and tomato juice should be given priority because of the high demand locally and also because there is a big potential market in East Africa and the international market as well;
- special efforts should be made as soon as possible to process the local tomato variety into the high standard "sun-dried-organic" product that is acceptable into the EU market. This is possible in the short- term because the main requirement is technical support for quality control and some working capital.

## 8.3 Encourage the Formation of Marketing Associations among Fishers and Farmers

Since only a few of fishers and farmers are organized into formal groups, they lack the solidarity to command the support they need. If organized into Marketing Associations they would be able to demand services as well as command better market prices for the products they offer.

- priority should be given to organizing tomato producers to produce all year round through small scale irrigation schemes so as to avoid the seasonal nature of the harvest.
- the groups should be linked with relevant financial institutions to provide loans that could be recovered through arrangements with Mwanakwerekwe wholesale market.
- since most tomato farmers grow only the local variety and through traditional farming methods, the group should be linked with an agronomist to enable farmers to learn more about how to grow improved varieties of tomatoes in addition to the local variety.
- priority for organizing fishers should be on the formation of fishers' marketing associations. the associations should be given information about the way the tourism industry operates and the types of fish that are in high demand by tourist hotels and the quality requirements. they should also learn how to work effectively in the market.

## 8.4 Encourage the formation of savings and credit cooperative societies among fishers and farmers

Since most of the fishers do not belong to any savings and credit associations, they should be encouraged to farm SACCOS. Most fisher expressed desire to unite and form associations and to be able to access credit. Priority should be given to enabling fishers to access boat engines and farmers to access inputs especially improved seed varieties. Given that many fishers and farmers do not have bank accounts or savings the formation of fisher and farmer SACCOS should also be used to inculcate a culture of savings through training on financial management and how to make investments.

## 8.5 Improve regulatory framework for the marketing of food items to ensure quality and safety

There are no regulations governing the sale of cassava, tomatoes or fish in the domestic market in terms of hygiene and sanitation.

In the fisheries sector:

- in the fisheries sector, there is need to review laws and regulations governing fishing in particular those dealing with illegal fishing along the coast of Zanzibar;
- there should be guidelines on how to establish markets and landing sites for fish to indicate the essential provisions that would minimize losses and safeguard the health of the consumer;
- the private sector should be encouraged to establish ice making plants at major landing sites and in collaboration with local private sector organizations like the Zanzibar National Chamber of Commerce, Industry and Agriculture (ZNCCIA) or the National Insurance Trust and identify and invest in modern landing sites in Zanzibar;
- there should be strict enforcement of hygiene and sanitation procedures and landing sites and at key fish markets to ensure fish safety and also to prevent losses.

For cereal crops and legumes

- there should be strict regulations to govern the use of pesticides for cereals and legumes in storage.

For the horticultural industry

- Regulations about pesticide use should be reviewed and farmers should be trained about the proper use of pesticides to reduce pre- and post-harvest losses.

## 8.6 Increasing farmer access to basic information about post-harvest handling and harvesting of food

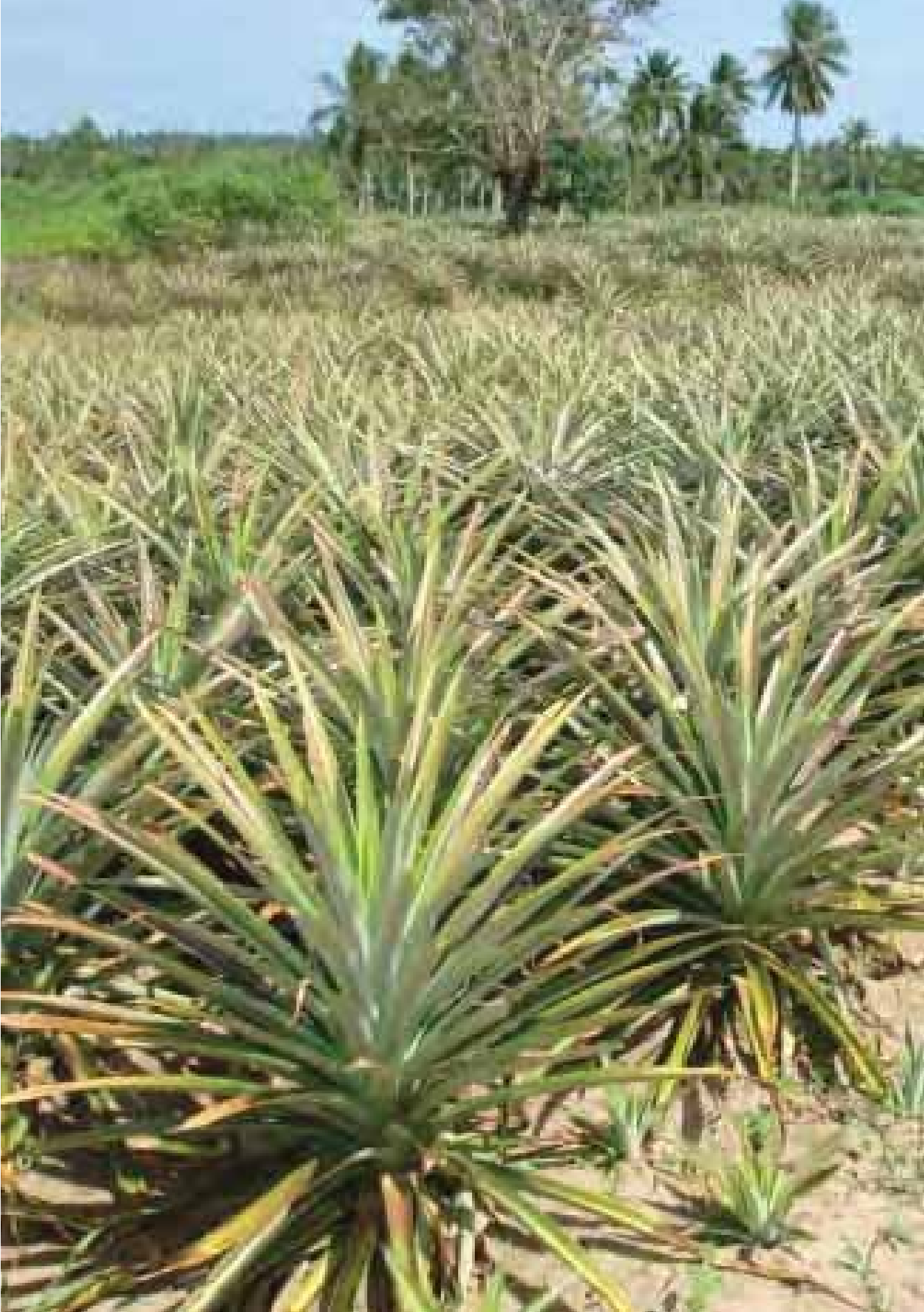
Most rural farmers are hungry for information about business and about what is taking place in other parts of the country. Many said that the mobile phone is a key link to the outside world but there should be more structured ways of disseminating information to farmers about crop prices and other developments taking place in the sector. A crop marketing information system should be developed for Zanzibar to reach rural farmers.

## 8.7. Assure producers of a reliable market by linking farmers/fishers to consumers

The problem of the unreliable market for fish and fresh produce was mentioned many times. There is a need to establish a programme to link producers with consumers locally and internationally.

## 8.8. Establish a programme to assure access to inputs and power tillers by farmer groups

Most farmers said they are able to pay for inputs and power tillers if organized and if the timing coincides with the harvest period for the major cash crops like tomatoes, pineapples, mangoes, oranges etc. Efforts should be made to supply these essential inputs that have the potential to transform the agricultural sector.



# Annex 1:

## Study tool for post-harvest food losses in zanzibar

Name: _____

Title/Designation _____

Date: _____

Address _____

- How big would rank the problem of post harvest food losses among other problems confronting household efforts to achieve food security?

  High .....
  Moderate .....
  Low .....

- To what extent have you attempted to estimate the problem of post harvest food losses in your district?

  Have not tried .....
  Have tried to a limited extent .....
  Have tried to a large extent .....

- If you have attempted to calculate the percentage, what would you say is the percentage post-harvest loss of the following food items?

**Paddy**

- In yields .....
- At harvest .....
- In Transport from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Maize**

- In yields .....
- At harvest .....
- In Transport from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Sorghum**

- In yields .....
- At harvest .....
- In Transport from home to market or from field to home .....

- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Millet**

- In yields .....
- At harvest .....
- In Transport from home to market or from fields to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Cassava**

- In yields .....
- At harvest .....
- In Transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Bananas**

- In yields .....
- At harvest .....
- In Transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Legumes (kunde, choroko etc)**

- In yields .....
- At harvest .....
- In transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Bananas**

- In yields .....
- At harvest .....
- In transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Mangoes,**

- In yields .....
- At harvest .....
- In transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Tomatoes (Tungule)**

- In yields .....
- At harvest .....
- In transit from home to market or from field to home .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

**Fish**

- In yields at fishing sites .....
- In transit from fishing site to landing sites .....
- In marketing at wholesale centers .....
- In marketing at retail markets .....
- In processing .....
- In Storage .....
- At consumption stage .....
- As by products of consumption .....

4. What would you say are the main causes of post harvest losses of the following crops?

**Paddy**

.....
.....
.....
.....
.....
.....

**Sorghum**

.....
.....
.....
.....
.....
.....

**Millet**

.....
.....
.....
.....
.....
.....

**Maize**

.....
.....
.....
.....
.....
.....

**Cassava**

.....
.....
.....
.....
.....
.....

**Bananas**

.....
.....
.....
.....
.....
.....

**Legumes (kunde, choroko etc)**

.....
.....
.....
.....
.....
.....

**Mangoes**

.....
.....
.....
.....
.....
.....

**Tomatoes (Tungule)**

.....
.....
.....
.....
.....

**Fish**

.....
.....
.....
.....
.....
.....

4. What do you suggest should be done to stop or reduce post harvest losses of food in your area?

.....
.....
.....
.....
.....
.....

5. Name some organizations or institutions in your district that you know are working n post harvest losses in your district. State what they are doing in trying to control post harvest losses

.....
.....
.....
.....
.....
.....

6 What resources are available in your district that could be used to support farmers to control post harvest losses of food?

.....
.....
.....
.....
.....

7. What would you recommend as a policy intervention to prevent post harvest losses in your area?

.....
.....
.....
.....
.....

# Annex 2:

## Guide for assessment at markets (cereals, roots and tubers)

## Mwongozo wa mazungumzo na wafanyabiashara sokoni

1. Jina la Muuzaji.....

2. Jinsia .....

3. Eneo la Biashara.....

4. Aina ya Biashara: a) Rejareja b) Jumla c) Jumla na rejareja

5. (Bila kuuliza swali andika aina na kiasi cha chakula anachouza)

.....
.....
.....
.....

6. Uliza kama hii biashara kwa siku ya leo ni ya kawaida au kuna mabadiliko yoyote na aeleze mabadiliko hayo ni yepi katika biashara yake

.....
.....
.....
.....

7 Je biashara hii umeifanya kwa muda gani na kwa nini ulichagua biashara hii?

.....
.....
.....
.....

8. Wewe unapata wapi mali yako unayouza? (Eleza kama unaletewa, unavuna shambani kwako au unafuata mwenyewe kununua kwa wauzaji wa jumla)

.....
.....
.....
.....

9. Kwa wastani unauza kiasi gani kwa siku? (Taja mafungu au kgs na thamani yake)

.....
.....
.....
.....

10. Ni mara ngapi kwa wiki na mwezi uliopita uliwahi kukosa wateja na chakula kuharibika?

Ulipata hasara ya kiasi gani?

.....
.....
.....
.....

11. Ni tahadhari gani unachukua ili usipate uharibifu wa mali yako na ili uweze kuepuka hasara katika biashara yako?

.....
.....
.....
.....

12. Kwa maoni yako ni kitu gani kinasababisha uharibifu mkubwa zaidi wa mazao unayouza?

.....
.....
.....
.....

13. Unapendekeza kitu gani kifanyike ili kuzuia uharibifu wa mazao unayouza? .....

.....
.....
.....
.....

14.Je umekwisha kupata mafunzo yo yote kuhusu jinsi ya kuhifadhi mazao unayouza?

.....
.....
.....
.....

15. Je unafahamu njia za asili za kuhifadhi mazao unayouza?

.....
.....
.....
.....

16. Unaweza kusema uharibifu wa mazao unakupunguzia kipato kwa kiasi gani kila siku au kila wiki?.

.....

.....

.....

.....

17. Je mazao yanapoharibika inakubidi kupandisha bei ili kufidia gharama zako?

.....

.....

.....

.....

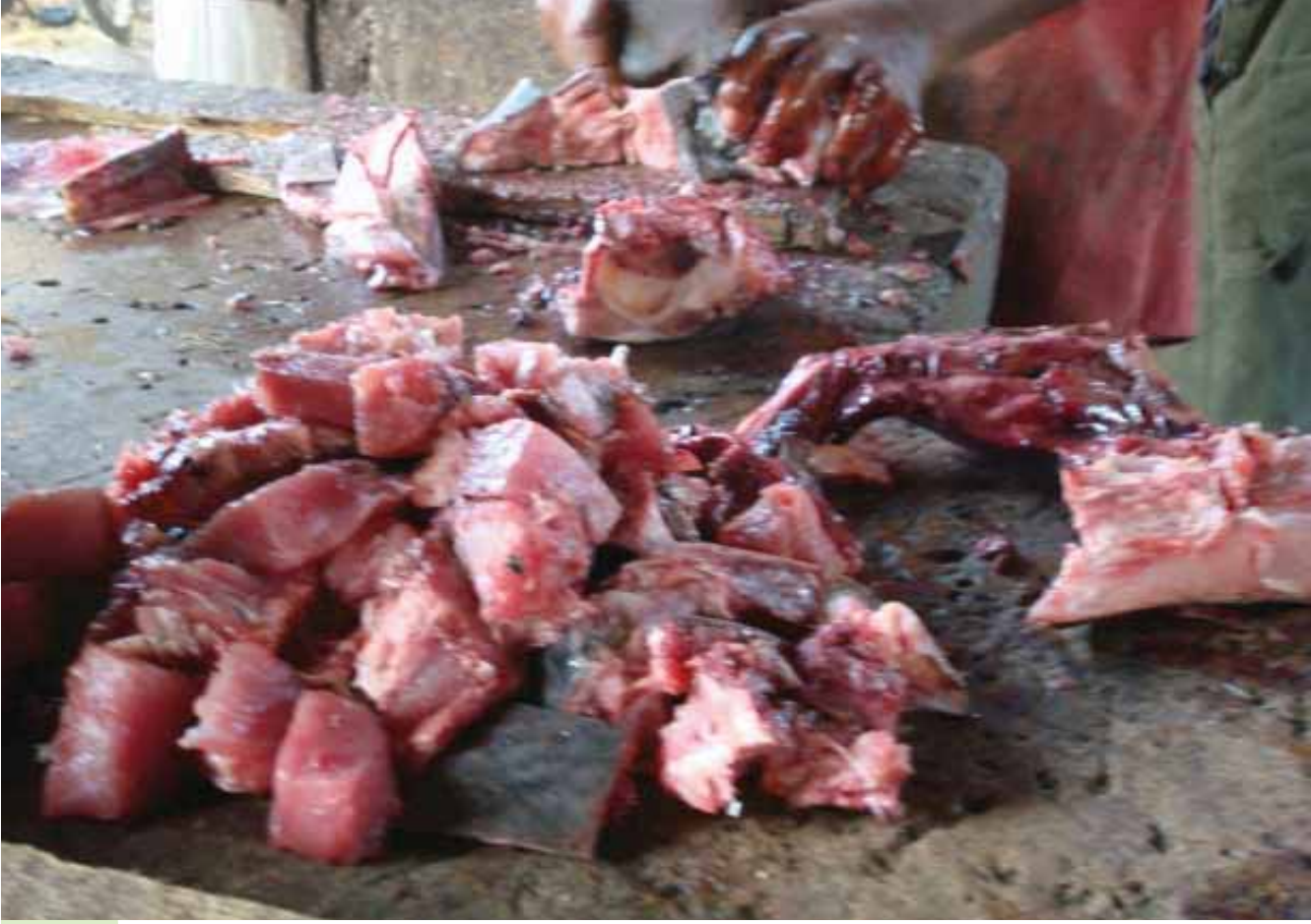
18. Wewe unapendekeza kitu gani kifanyike na Serikali ili kusitisha uharibifu wa mazao unayouza?

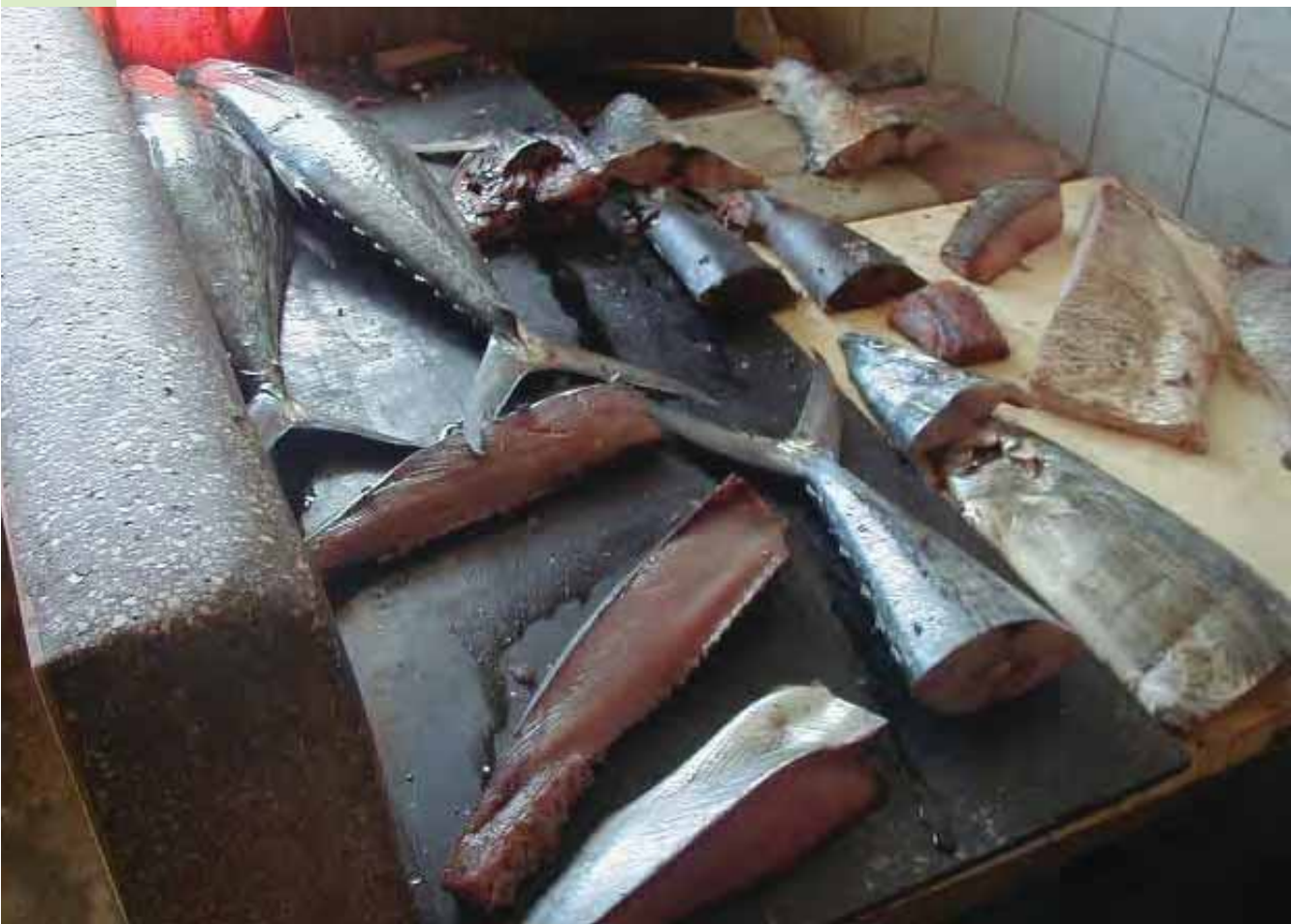
.....

.....

.....

.....





# Annex 3:

## Guide for the assessment of food losses at fish markets

## Mwongozo wa mazungumzo na wauza samaki sokoni

1. Jina la muuza samaki…..

2. Jinsia ya muuza samaki……..

3. Eneo la Biashara……..

4. Aina ya Biashara: a) Rejareja b) Jumla c) Jumla na rejareja

5. (Bila kuuliza swali andika aina na kiasi cha samaki unaowaona wakiuzwa na mfanyabiashara huyu)

……

……

……

……

6. Uliza kama hii biashara ya samaki kwa siku ya leo ni ya kawaida au kuna mabadiliko yoyote na aeleze mabadiliko hayo ni yapi katika biashara yake

……

……

……

……

7 Je biashara hii umeifanya kwa muda gani na kwa nini ulichagua biashara hii?

……

……

……

……

8. Wewe unapata wapi samaki unaouza? (Eleza kama unaletewa, unavua au unafuata mwenyewe kuwanunua kwa wauzaji wa jumla)

……

……

……

……

9. Kwa wastani unauza samaki kiasi gani kwa siku? (Taja mafungu au kgs na thamani yake)

……

……

……

……

10. Ni mara ngapi umewahi kukosa wateja na samaki wakaharibika na ulipata hasara ya kiasi gani?

.....

.....

.....

.....

11. Ni tahadhari gani unachukua ili samaki wasiharibike na kukupatia wewe hasara katika biashara yako?

.....

.....

.....

.....

12. Kwa maoni yako ni kitu gani kinasababisha uharibifu mkubwa zaidi wa samaki?

.....

.....

.....

.....

13. Unapendekeza kitu gani kifanyike ili kuzuia uharibifu wa samaki baada ya kuvua?

.....

.....

.....

.....

14.Je ulikwisha kupata mafunzo yo yote kuhusu jinsi ya kuhifadhi samaki?

.....

.....

.....

.....

15. Je unafahamu njia za asili za kuhifadhi samaki na je unatumia njia hizo?

.....

.....

.....

.....

16. Kwa ujumla unaweza kusema uharibifu wa samaki unakupunguzia kipato kwa kiasi gani kila siku au kila wiki?

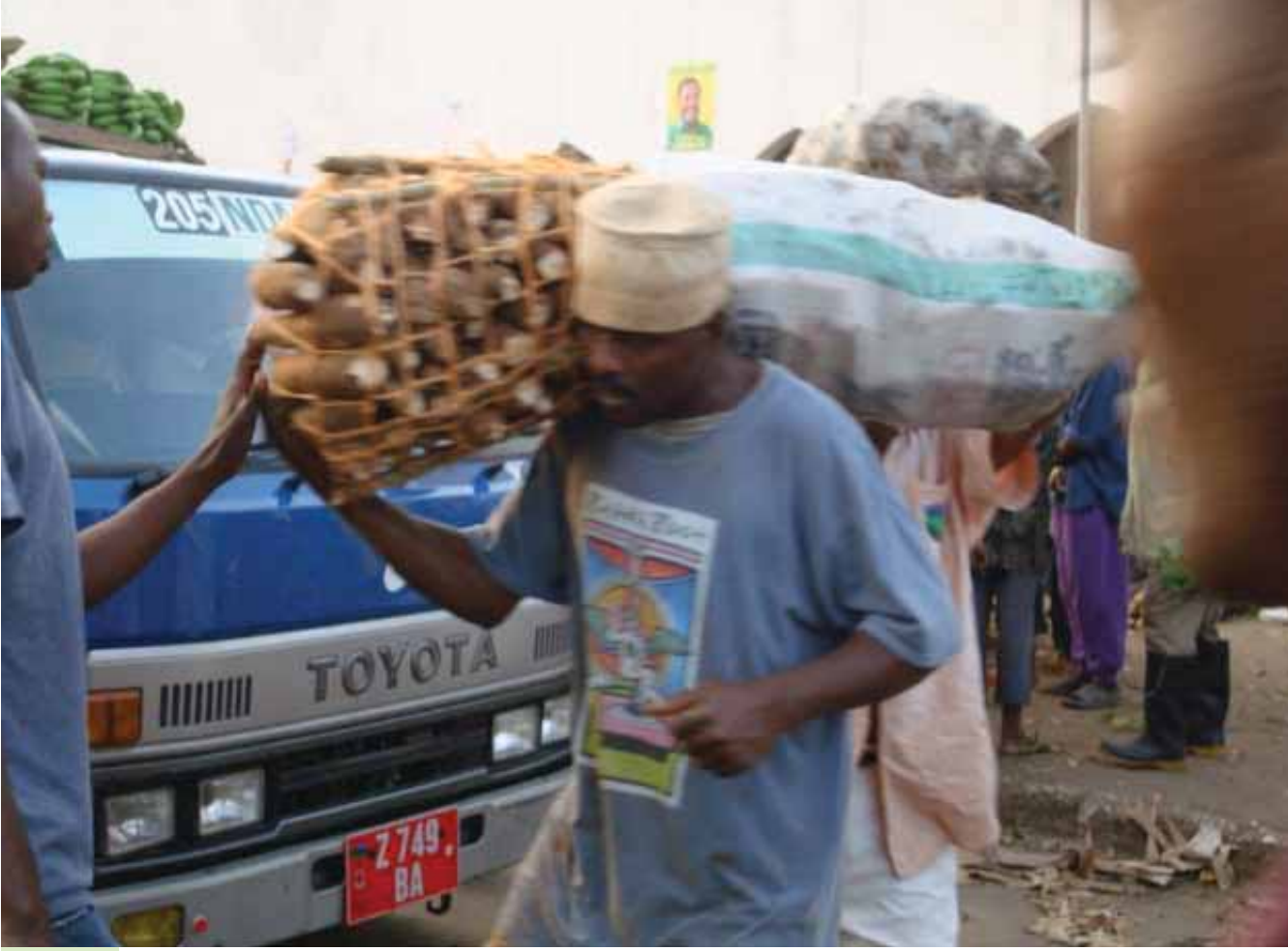
……
……
……
……

17. Je samaki wanapoharibika, inakubidi kupandisha bei ya samaki waliobaki ili kufidia gharama zako?

……
……
……
……

18. Wewe unapendekeza kitu gani kifanyike na Serikali ili kusitisha uharibifu wa samaki na kuboresha biashara yako ya samaki?

……
……
……
……

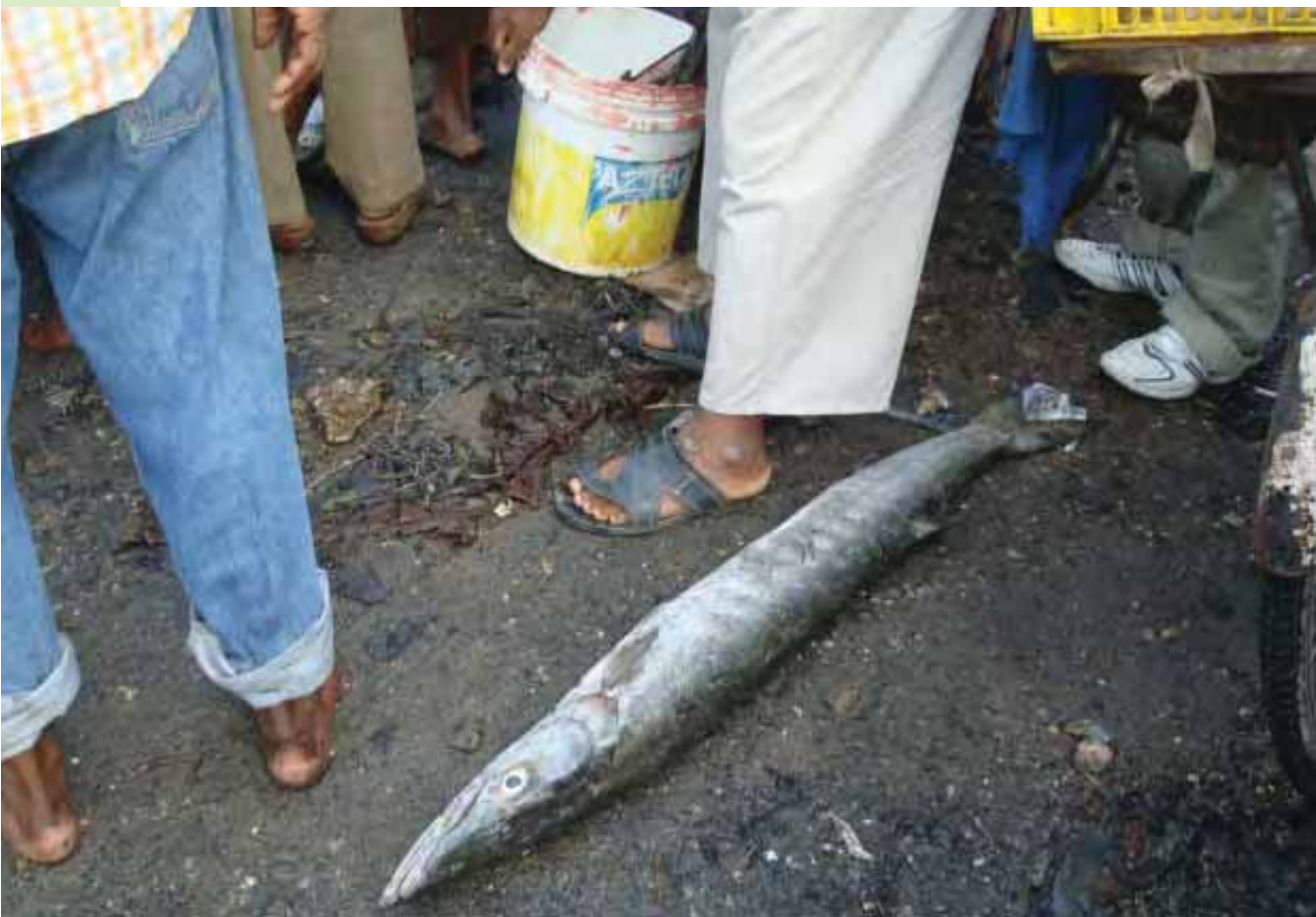

TOYOTA
Z 749
BA

# Annex 4:

## Table of comparison of findings of the 2003 and 2007 frame surveys

| S/N | Item | 2003 Survey | 2007 Survey | % Change |
|---|---|---|---|---|
| 1 | Number of landing sites | 224 | 166 | - 25 |
| 2 | Number of fisher | 18618 | 26,666 | + 43 |
| 3 | Number of fishing vessels | 4129 | 7155 | +73 |
| 4 | Number of outbound engines | 351 | 815 | +132 |
| 5 | Number of inbound engines | 11 | 34 | +209 |
| | | | | |
| **Gears by type** | | | | |
| 1 | Number of gill nets | 878 | 5328 | +507 |
| 2 | Number of shark nets | 151 | 1647 | +991 |
| 3 | Number of movable traps | 8257 | 10,599 | +28 |
| 4 | Number of hand lines | 10,538 | 18,865 | +79 |
| 5 | Number of mixed fences | 21 | 13 | - 38 |
| 7 | Number of spears (stick) | 1848 | 2349 | + 27 |

Source: Extracted from the Zanzibar Frame Survey, 2007



# Annex 5:

## Table of fish landed in zanzibar, 2002 – 2007

| District | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tonnes | Value | Tonnes | Value | Tonnes | Value | Tonnes | Value | Tonnes | Value | Tonnes | Value |
| North 'A' | 5,286.0 | 3,472,095.0 | 2,583.0 | 1,794,897.0 | 3,182.0 | 2,718,733.0 | 3,864.0 | 4,121,905.0 | 3,893.0 | 4,286,577.0 | 3,363.0 | 5,159,037.0 |
| North 'B' | 146.0 | 110,622.0 | 115.0 | 90,559.0 | 134.0 | 136,518.0 | 187.0 | 191,554.0 | 231.0 | 293,092.0 | 404.0 | 518,964.0 |
| Central | 692.0 | 532,828.0 | 1,001.0 | 687,362.0 | 831.0 | 854,351.0 | 1,002.0 | 1,070,350.0 | 1,120.0 | 1,301,504.0 | 1,309.0 | 2,188,037.0 |
| South | 443.0 | 300,209.0 | 1,261.0 | 360,148.0 | 1,213.0 | 1,168,732.0 | 1,213.0 | 1,166,108.0 | 1,599.0 | 1,969,818.0 | 1,937.0 | 2,759,029.0 |
| West | 755.0 | 672,268.0 | 585.0 | 553,417.0 | 745.0 | 647,200.0 | 902.0 | 975,494.0 | 1,212.0 | 1,464,967.0 | 1,937.0 | 2,759,029.0 |
| Zanzibar Town | 3,976.0 | 1,590,710.0 | 6,137.0 | 3,268,638.0 | 6,296.0 | 5,251,889.0 | 6,400.0 | 7,485,864.0 | 5,431.0 | 6,213,667.0 | 6,196.0 | 9,442,372.0 |
| **Total Unguja** | **11,298.0** | **6,678,732.0** | **11,682.0** | **6,755,021.0** | **12,401.0** | **10,777,423.0** | **13,568.0** | **15,011,275.0** | **13,486.0** | **15,529,625.0** | **15,146.0** | **22,826,468.0** |
| Wete | 3,048.0 | 1,419,744.0 | 1,514.0 | 958,806.0 | 1,672.0 | 963,659.0 | 1,697.0 | 1,709,091.0 | 1,951.0 | 2,049,928.0 | 1,898.0 | 2,557,357.0 |
| Micheweni | 1,522.0 | 1,000,118.0 | 3,461.0 | 1,220,765.0 | 3,531.0 | 3,141,279.0 | 2,688.0 | 2,670,963.0 | 2,593.0 | 2,995,046.0 | 1,521.0 | 1,865,149.0 |
| Chake chake | 987.0 | 702,283.0 | 989.0 | 641,091.0 | 1,182.0 | 875,749.0 | 1,405.0 | 1,500,826.0 | 1,481.0 | 1,562,538.0 | 711.0 | 1,072,463.0 |
| Mkoani | 3,488.0 | 2,736,418.0 | 3,222.0 | 3,612,000.0 | 3,085.0 | 2,804,440.0 | 3,897.0 | 3,779,258.0 | 3,775.0 | 4,424,602.0 | 4,819.0 | 6,816,535.0 |
| **Total Pemba** | **9,045.0** | **5,858,563.0** | **9,186.0** | **6,432,662.0** | **9,470.0** | **7,785,127.0** | **9,687.0** | **9,660,138.0** | **9,800.0** | **11,032,114.0** | **8,949.0** | **12,311,504.0** |


United Nations
TANZANIA

F
A
O
FIAT
PANIS