CONTRIBUTION AND POTENTIAL OF INDIGENOUS FRUITS TO HOUSEHOLD FOOD SECURITY IN ULUGURU MOUNTAINS AREAS IN MOROGORO DISTRICT, TANZANIA

BY

JASMINE B. TIISEKWA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS (RURAL DEVELOPMENT) OF THE SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2002

ABSTRACT

Tanzanians in different parts of the country, experience various degrees of food insecurity. However, as in other tropical and sub tropical countries, exploiting fully indigenous fruit resources available in their areas can alleviate the situation. A study was therefore conducted to assess the food security situation, the contribution and potential of indigenous fruits to household food security in the Uluguru mountain areas in Tanzania. The attitudes towards utilization by traders, consumers in Morogoro Municipality and attitude of fruit processors based in Morogoro and Dar es Salaam were also assessed. Data were collected by using face-to-face interviews using 123 respondents. The respondents consisted of 87 farmers in six villages, 22 urban consumers of fresh fruits and fruit products, nine processors and five traders of IFs. Collected data were analysed using statistical Package for Social Science. In the study area some households were found to be food insecure, particularly during the rainy season. Families adjust down the meal portions, sell labour and obtain gifts as coping strategies. Thirty six different types of IFs were available in the study area, however, these were known to about one-third of the population. The five top-most popular fruits known to about 50% of the population are *Saba florida* (rubber vine) *Vitex doniana* (black plum), *Tamarindus indica* (tamarind), *Sclerocarya birrea* (marula) and S*yzygium guineense* (zambarau). IFs are used mainly as a snack and as part of the meal. Their contribution to household food availability and income is rated low (about 3%) probably due to lack of knowledge on value and handling

technologies. A small proportion (2.9 - 21.7%) of respondents (n = 87) in the villages were engaged in marketing different types of fruits, mainly due to lack of demand for the fruits. A very small proportion of households practiced limited processing and preservation of the identified fruits. The fruit processors, however, were willing to process the fruits if made available in adequate quantities. Similarly, consumers were willing to consume fresh or processed IFs if made available. Consumers preferred IFs to exotic ones because IFs are naturally produced i.e. without use of chemicals. The fact that local people, consumers as well as processors are ignorant on value and use of IFs, calls for intervention strategies that will create awareness among them.

DECLARATION

I, Jasmine B. Tiisekwa, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work, and has not been submitted for higher degree in any other University.

Signature.....

Date.....19-11-2002.....

COPYRIGHT

ACKNOWLEDGEMENT

First and foremost, I thank GOD, THE ALMIGHTY, the creator and giver of life to every living soul, who empowered me to fulfill this work. My profound gratitude is due to Dr. B. J. Kasimila for his valuable guidance, supervision, constructive criticism, encouragement and tireless efforts throughout the study. I also express my most sincere thanks to farmers, fruit processors and consumers who availed themselves to respond to the questionnaire and made data available for this work. I acknowledge the International Centre for Research in Agroforesty (ICRAF) for funding the research and the Winrock International through the Association of Women Leaders in Agriculture and Environment (AWLAE) and its national arm Tanzania Women Leaders in Agriculture and Environment (TAWLAE) for their partial funding. The kind financial support extended to me lessened the burden to my family who's resources had been overstretched in order to pay my first and second year tuition fees. I am whole-heartedly indebted to you all and may you live a successful long life. Thanks are also due to the Ministry of Education and Culture for granting me a study leave.

My beloved family members, my children little Deo, sweet Fadhilla and big Adili and most of all my husband Prof. B.P.M. Tiisekwa I owe them many thanks for their encouragement and love while I was busy with my studies. If and when I did not pay attention to you, please forgive me. Lastly, but equally important my

acknowledgement go to my classmates and staff members of the Development Studies Institute for their moral support and cooperation.

DEDICATION

To my beloved children Adili, Fadhilla and Deogratius, and my husband Prof. B.P.M. Tiisekwa.

To my late mother Angela Emmanuel, who while she was with me invested all she had to lay a solid foundation for my education.

To my late grandfather Emmanuel Libagula and my late grandmother Afra Mahiga.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

ABBREVIATIONS

AWLAE	-	African Women Leaders in Agriculture and Environment
EF	-	Exotic fruits
ICRAF	-	International Centre for Research in Agro-forestry
IF	-	Indigenous fruit
IFs	-	Indigenous fruits
FAO	-	Food and Agriculture Organization of United Nations
NEMC	-	National Environment Management Council
No.	-	Number
PEM	-	Protein Energy Malnutrition
SADC	-	South African Development Community
SUA	-	Sokoine University of Agriculture
TAFOPA	-	Tanzania Food Processors Association
TARP II – SUA	-	Tanzania Agricultural Research Project – Phase II – at Sokoine University of Agriculture.
TAWLAE	-	Tanzania Association of Women Leaders in Agriculture and Environment
UNDP	-	United Nations Development Programme
UNICEF	-	United Nations Children Fund

CHAPTER 1

INTRODUCTION

1.1 Background to the study

Every year Tanzanians in different parts of the country experience various degrees of food insecurity. Tanzanians suffer from all forms of malnutrition with Protein Energy Malnutrition (PEM) and micronutrient (vitamins and minerals) deficiencies being of great concern (Kavishe, 1993). Micronutrients of great concern are iron, iodine and vitamin A. Thousands of Tanzanians go blind, hundred thousands of adolescent girls, children and pregnant women are anaemic every year due to causes that could be controlled. This happens despite the rich sources around their communities. A major pre-occupation of the development and scientific communities in the last 50 years have been how to resolve the conflict between increasing demands for food and the degradation of the environment. For instance, over 50 fruit tree species have been identified in the Miombo woodlands in Tanzania, many of which remain unexploited. However, based on reports in other countries (Maghembe *et al.*, 1998; Schmburg *et al.* 2000) it is apparent that some of the identified tree/shrub species bear widely used and marketed edible fruits. These under exploited fruits are rich in sugars, essential vitamins, mineral, proteins, oils and fibre and serve as important food reserves for humans especially during seasonal food shortages (Saka and Msonthi, 1994; Kwesiga *et al.*, 1998). According to Schmburg *et al.* (2000) due to high nutritional value of

Uapaca kirkiana, the fruit is claimed to have potential to improve nutrition of HIV/AIDS affected and household people in Malawi.

The International Centre for Research in Agro-forestry (ICRAF) in collaboration with various institutions have worked on various aspects of indigenous fruit trees and fruits (Kwesiga *et al.* 2000). Accordingly, the next phase of ICRAF activities is to assess the feasibility of cottage (processing) industries. In a study by Tiisekwa and Ndlangamandla (1996), a delicious jelly was prepared from fruits of **Marula** (*Sclerocarya birrea)*. According to Irvine (1979) a drink from the pulp of baobab fruit (*Adansonia digitata)* has been used locally for treating fever, haemoptysis and diarrhoea. In Tanzania, Ndabikunze *et al.* (2000; 2002) reported on the nutrition and utilization of indigenous tree food sources as being rich in all nutrient categories in varied concentrations. Pulps of some fruits such as *Hyphaena compressa* were reported as containing 964 mg/100g of vitamin C. Interestingly, these authors noted that on per 100 g basis fruit pulp from all analysed indigenous tree fruits contained vitamin C values above the recommended daily intake. Consequently, eating these fruits would meet the individual requirement of vitamin C. Because of high sugar content in some wild fruits, they make refreshing drinks with water and can be fermented into an alcoholic beverage. However, farmers prefer not all tree fruits. For example, Maghembe *et al.* (1998) observed within country variations in farmers preference for different fruit tree species. Farmers are interested in growing trees that provide both food and cash. Some indigenous fruits fall into this category.

The Southern Africa Development Community (SADC) Tree Seed Centre Network (TSCN) project's six years (1992-1998) work on tree seeds and ICRAF now promotes the domestication and development of fruit trees in the SADC region (Shumba *et al.*, 2000; Kwesiga *et al.*, 2002). According to Lavediere (2000) the development of indigenous fruit trees have a great potential to significantly contribute to food security and better livelihood, particularly in rural areas, through improved nutrition and income generation. Basing on literature available, Kajembe *et al.*, (2000) concluded that available information in Tanzania regarding potentials of non-wood forest products is inadequate. According to these authors, most of the information available was of the general nature thus indicating lack of depth in the analysis of non-wood forest products' contribution to food security. It was hence recommended that in order to address this a purposive field study to determine non-wood forest products use in the context of the total household economy be undertaken. This study, in part, addressed this concern.

1.2 Problem statement

Most people in agricultural poor countries in Southern and Eastern Africa are food insecure and chronically malnourished. Overcoming poverty remains, therefore, the most daunting development challenge in these areas. Five countries in the region (Tanzania, Malawi, Zambia, Mozambique and Zimbambwe) rank among the lowest quartile of poor countries world-wide, with poverty rates of 30-50%. Fruits and other

products from indigenous fruit trees constitute the cheapest yet rich source of food on which the poor survive. Interest has therefore grown in these fruits.

Ethno-botanical surveys carried out in Tanzania, Malawi, Zambia and Zimbabwe miombo eco-zone in which indigenous multipurpose trees and shrubs were characterized in farmers' fields found that over 50 indigenous fruit trees are important sources of timber (Kwesiga *et al*, 2000) as well as strategic food reserves during famine periods (Karachi *et al*, 1991; Kwesiga and Chisumpa, 1992; Maghembe and Seyani, 1992; Saka and Msonthi, 1994). There is adequate evidence to show that indigenous fruits contribute greatly to the nutrient welfare of the rural people (Saka and Msonthi, 1994; Ndabikunze *et al.,* 2000; 2002; Saka *et al*., 2002). However, the contribution of IFs to food security is limited to areas where trees grow naturally apparently due to the absence of processing and preservation technologies and marketing opportunities. Recent studies have demonstrated that improved marketing and adding value to primary products can greatly increase smallholder incomes (Van Eckert, 1997).

Nearly all the focus on previous marketing research has been given to field crops, whilst little attention has given to IFs products. One approach towards improving the nutrition of the increasing population is to effectively harvest and utilize the indigenous species of fruits. However, to date there is very limited published information on their use. A study was therefore conducted to assess the potential of

IFs in the areas north and western side of Uluguru mountains in Morogoro, Tanzania. This field of investigation is well supported by Tanzania and the SADC region as contained in the proposed SADC initiative on the domestication and commercialisation of indigenous fruit trees in the region (Shumba, 2000). The domestication of selected indigenous fruit trees as proposed by SADC is targeted at improving rural food security and incomes and reducing the threat being imposed on these trees through over-exploitation.

1.3 Objectives

1.3.1 General objective

The general objective is to assess the contribution and potential of indigenous fruits to household food security in the Uluguru Mountain areas in Morogoro District.

1.3.2 Specific objectives

1. To assess the food security status of farmers in the north-west areas bordering Uluguru mountains.
2. To identify indigenous tree/shrub fruits available in the villages in the study area.
3. To assess the contribution of indigenous fruits to household food availability and income.
4. To identify indigenous knowledge and methods of processing and preservation of indigenous fruit products in the villages in the study area.

5. To assess the attitudes of food processors (especially women) and consumers in Morogoro District and Dar es Salaam region towards processing and consumption of indigenous fruit products.
6. To identify factors that limit the utilization of indigenous fruits and products in the study villages and in Morogoro Municipality.

1.4 Hypothesis

The following were the null hypotheses tested in the study:

(a) People living in the study area are food secure

(b) Indigenous fruits do not have potential to contribute to household food availability and incomes.

(c) Food process and consumers have negative attitudes towards the utilization of indigenous fruits.

(d) Processors as well as consumers have no local indigenous or externally acquired knowledge regarding the utilization of indigenous fruits.

1.5 Limitation of the study

This study was limited to residents (farmers) in the five wards bordering Uluguru mountains to the north-west side. However, consumers came from a variety of places in the villages, colleges and town. Fruit collectors and traders who were in business at the time of data collection were involved in the study. Some of the collectors could only give information on fruits that were in season.

1.6 Significance of the study

Tanzania is listed among the lowest quartile of poor countries world-wide. With her rich forest fruit resources the country could benefit from the current initiatives within SADC that seek to promote the utilization of IFs. Women groups such as those under the Tanzania Food Processors Association (TAFOPA) are already using (processing) conventional (exotic) fruits (EFs). They have the technology and could adapt it to indigenous fruits for their benefit and the community at large. The results of this work will help to create awareness to the women food processors on the potential for expanding their income source by utilizing IFs. Also, it will allow product formulators to know the attitudes and requirements of potential processors. More importantly, the findings will be used to increase awareness among farmers especially the youth, on the potential and values of IFs as food and income resource. The limiting factors for increased availability and utilization from the source will become apparent so that appropriate interventions can be pursued.

CHAPTER 2

LITERATURE REVIEW

2.1 The concept of food security

Food security has been given different definitions and receiving varying interests in the past. The committee on World Food Security defined food security as economic and physical access to food by all people at all times (FAO, 1990). The World Bank defined food security as the access by all people at all times to enough food for a healthy and active life (Maxwell and Frankhenberger, 1992). Ishengoma (1998) systematized food security concerns in Tanzania at different epochs. In the 1970's food security was mostly concerned with food supply, usually in the form of grain stocks and was being applied at regional or district levels. In the 1980's the focus shifted to questions beyond supply. It also included access to food at household and individual level (Maxewell and Frankenberger, 1992). Emphasis was also placed on food chain as a component of food security analysis to encompass production, marketing and consumption.

Through the collaboration of Universities of the North and Africa a conceptual framework was developed that considers the position of food security in relation to the ultimate goal i.e. nutrition security.

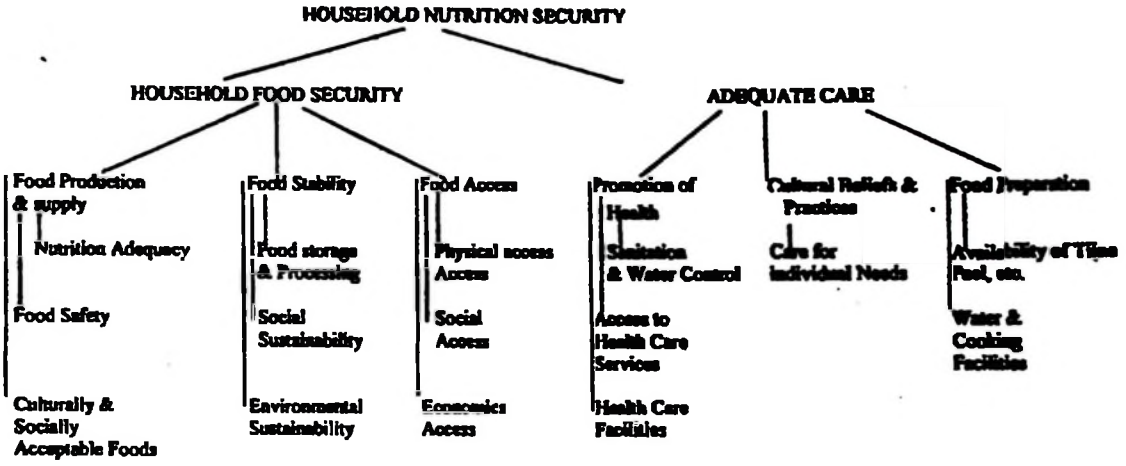

Fig. 1. Conceptual framework for food and nutrition security

Source: NATURA-NECTAR (1993)

Figure 1 summarizes the components and determinants of food security as adopted by NATURA – NECTAR (1993) for use in postgraduate training. The concept considers food security as a major component of nutrition security. Food security is in turn determined by food production and supply, food stability and food access. Access to food can be seen as the process through which food reaches people. It also signifies that the level of analysis is no longer only the Region or District. It must also encompass the household or the individual. According to Mosha (1990) household food security prevails if the actual food intake of all household members required to fulfill their dietary requirements is secured in terms of both quantity and quality throughout the year. Household food security concerns the distribution of food in the household. In particular it describes the use of food in the household, access to it by various members in the household, household survival strategies and the role of

gender. In addition, household decisions concerning the use of resources, output and cash income are some of the important critical variables in the overall household food security analysis (Ishengoma, 1998). Therefore, a household is said to be food insecure when it fails to meet its dietary food intake in terms of quantity and quality. The World Bank definition of food security cited above has been widely accepted and is adopted in this work. It encompasses two elements: food supply and the access or the ability of a household to acquire food, either through their own production or purchase. There is evidence to suggest that household food insecurity is widespread and chronic in some areas of Tanzania, since there seems to be a certain degree of food deficit at one time or another during the year. This is especially true prior to harvesting season. The present study addresses some elements of the determinants of food security by assessing the attitudes of farmers and consumers towards IFs utilization (cultural and social acceptability of IFs), IFs storage and processing practices and access elements including income levels and IFs consumption within the households.

2.2 The nutritional value of wild food plants

Malnutrition is prevalent in Tanzania, as evidenced by the fact that 27% of children are underweight, and micronutrient malnutrition affects a large proportion of the population of Tanzania. Some 2 000 – 4 000 children go blind each year due to lack of vitamin A in the diet. It has been estimated that 40% of the people live in iodine-deficient areas and about 1.6% have severe deficiency and therefore suffer from

goitre. Prevalence of anaemia due to iron deficiency is 86% in children and 85% in pregnant women (FAO, 1990; Kavishe 1993, UNICEF, 1990). The major cause of malnutrition is inadequate intake of nutrients. In addition, there is insufficient information and knowledge on the foods that are rich in nutrients, and especially micronutrients, vitamins and minerals. In Tanzania, therefore, wild plants that could supply these important nutrients are important since many people cannot afford to buy the variety of foods otherwise needed for an adequate diet.

Few Tanzanian wild food plants have been analysed for their nutritional content, but available data indicate that many local vegetables and fruits have a higher nutritive value than exotic vegetables commonly sold in markets. For example, *Amaranthus spinosus, Bidens pilosa* and *Sesamum angolense* are among the local vegetables which are high in protein, fat and minerals (calcium and iron). Other local vegetables have calcium contents 1.5 - 3.2 times higher than those of the cabbage-family species whose calcium content is the highest of all exotic vegetables. Ruffo *et al.* (2002) reported that some wild fruits such as *Adansonia digitata, Annona senegalensis* and *Parinari curatellifolia* are high in proteins and fat. Further more, the fruit of A. digitata and Ximenia caffra have a higher vitamin C content than mango *(Mangifera indica)* or orange *(Citrus sinensis)*.

2.3 Contribution of indigenous fruits to household food security

In general, people in Tanzania still rely on surrounding forest for both meeting their subsistence needs and as a source of income.

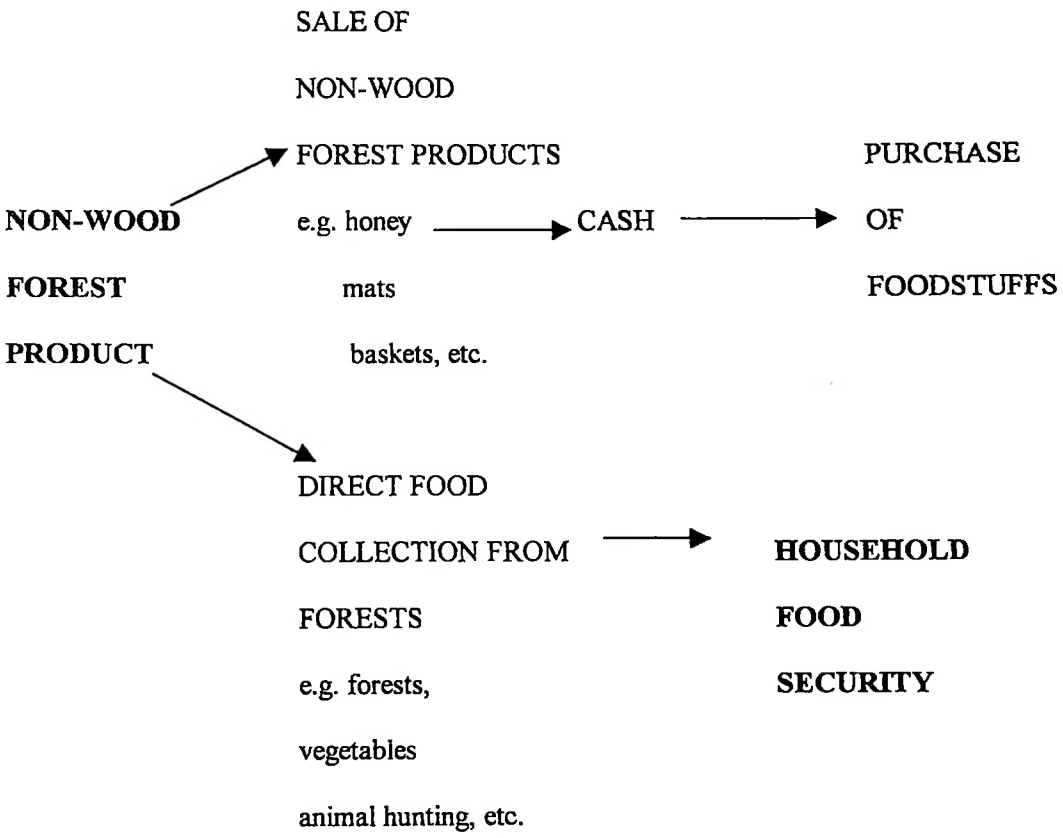

Figure 2. The relationship between non-wood forest products and household food security

Source: Kajembe *et al.*, (2000)

The relationship between non-wood forest products (that includes fruits) and household food security has been elaborated in Figure 2 (Kajembe *et al.*, 2000). According to Hives and Eckman (1993), in many areas people would have difficulty surviving if they had to depend only on cultivated land for food, fuel and cash income. Most rural people depend on forests and bushlands for both economic and food security, and in many cases this dependency is increasing with improved living

standards and increasing population. In Brazil Falconer and Arnold (1989) observed that collection and processing of Babassu palm fruit provide major sources of million of tenant farmers who have few opportunity for earning cash income.

Many forest fruits are valued as food for children and are collected mostly by children while in the woods. In many cases adults eat these fruits when carrying out other activities in the forests. Hives and Eckman (1993) argued that where non-indigenous fruits such as mango, papaya and banana are planted, little use is being made of forest fruits. Likewise where a large number of indigenous fruit trees have been retained or planted, the variety of exotic fruits is small.

Table 1. Preferred fruit trees

Botanical name	Local name*	Botanical name	Local name
Adansonia digitata	Mbuyu	*Phoenix reclinata*	Bukindu[5]
Annonan senegalensis	Mtopetope	*Rhus natalensis*	Mkumba
Azanza garckeana	Mtowa[1]	*Sclerocarya birrea*	Mng'ongo
Balanites aegyptiaca	Mwambangoma	*Strychnos cocculoides*	Strychnos cocculoides
Berchemia discolor	Mnago	*Strychnos innocua*	Mkwakwa
Borassus aethiopium	Mvumo	*Strychnos spinosa*	Mpapa
Bridelia micrantha	Mkarati	*Syzygium cordatum*	Mshiwi[6]
Cordia sinensis	Nyamate	*Syzygium guineense*	Mzambarau
Cordyla africana	Mgwata	*Syzygium owariense*	Mzambarauziwa
Diospyros mesipiliformis	Mgiriti	*Tamarindus indica*	Mkwaju
Eriobotria japonica	Msambia	*Uapaca kirkiana*	Mkusu[4]
Ficus sycomurus	Mkuyu	*Vangueria infausta*	Vanguaria infausta
Flacourtia indica	Mgola[2]	*Vangueria madagascariensis*	Mviro
Grewia similis	Mkole	*Vitex doniana*	Mfudu
Grewia villosa	Olmalungai[3]	*Vitex keniensis*	Mfuu
Lannea schweinfurthii	Mtundu	*Vitex mombassae*	Mfudu maji
Manilkara mochisa	Msapa	*Ximenia americana*	Mpingi
Parinari curatellifolia	Maula[4]	*Ziziphus mauritiana*	Mkunazi

Source: Ndabikunze *et al.* (2000; 2002), Mbuya *et al.* (1994), Hines & Eckman (1993), FAO (1983), Tiisekwa *et al* (2002)

* The local names are in Kiswahili except where a superscript number is indicated, it refers to tribal languages in Tanzania as follows; 1 = Hehe, 2 = Zigua, 3 = Arusha, 4 = Nyamwezi, 5 = Sukuma, 6 = Sambaa

Table 1 summarizes the work of FAO that show the most common and preferred indigenous and naturalized fruit trees in some parts of Tanzania. FAO (1983) identified 40 food and fruit bearing forest species in Tanzania. This publication details botanical and vernacular nomenclature, ecology, distribution, multiple uses,

period of fruit collections, nutritional values. Propagation, cultivation, economics and local marketing potential of the species are also covered.

Few studies have attempted to look into percentage contribution of wild fruits to the diets of local people. An example of a study that goes this far is that of Uiso and Johns (1996) who assert that a total of 38 fruits were recorded in the food frequency data and it was found that on the average fruits contributed about 11% of all foods consumed. Fruits categorized as high in beta-carotene, which actually coincided with the cultivated fruits mainly mangoes, papaya and oranges contributed slightly less than 6%. By implication, the remaining 5% is contributed by wild fruits. The edible wild fruits in Tarime district, in northern Tanzania have been documented (Johns *et al.*, 1996). Some examples of the species of fruits include *Afromanum mala*, *Anona senegalensis*, *Balanite aegyptiaca*, *Carissa edulis*, *Ficus sur* and *Hibiscus acetusella*.

Based on work by Kajembe *et al.* (2000) it was concluded that non-wood forest products that include fruits are important for household food security and that they play an important role in coping with food shortage. According to these authors the literature available in Tanzania regarding potentials of non-wood forest products is inadequate as most of the information cited was of general nature, it does not indicate specific (for example, percent) contribution to household food security. Consequently, among others, Kajembe *et al.* (2000) recommended that a detailed

study be conducted to tap the available local knowledge with respect to the wild foods before the fast modernization process dilute it.

2.4 The role of wild food plants for food security in Tanzania

In humid areas of Tanzania, wild food plants, especially vegetables such as *Amaranthus spinosus* and *Bidens filosa,* are available throughout the year. But others are only available seasonally. For example, in dry areas of Tanzania vegetables are most abundant between December and June, while fruits are abundant from April to June. Ruffo *et al.* (2002) observed that some of the wild food plants, e.g. *Ceratotheca sesamoides, Adansonia digitata* and *Azanza garckeana,* are collected during the peak season and preserved for use during the off-season. Some fruits such as *Adansonia digitata* and *Tamarindus indica* are dried in the sun and stored. Other fruits, for example *Azanza garckeana* and *Vangueria infausta,* may be steamed before being dried and stored. Vegetables are usually collected in large amounts, dried in the sun before or after being steamed and stored. Leafy vegetables are often dried, pounded and stored in powder form. Other wild foods such as roots and tubers of *Ritchiea albersii* and *Dioscorea* spp. are important sources of food during periods of food scarcity.

In addition, to making significant additions to individual family food supplies, wild food plants can contribute to household food security in other ways. Income and employment can be obtained from sale or exchange of fruit, nuts and vegetables.

Juices and local alcoholic drinks are made from *Adansonia digitata, Tamarindus indica, Sclerocarya birrea* and *Uapaca kirkiana.*

2.5 Initiatives for promoting indigenous forest fruit utilization

Although the majority of rural Tanzanians use many wild food plants, they are still not as much appreciated or valued as some of the introduced food plants such as mango, orange, cabbage or Chinese cabbage. Ruffo *et al.* (2002) observed that to a certain extent these wild food plants are still regarded as inferior and only appropriate for the poor. There is also a widespread decline in knowledge about wild food plants, especially among young people and those who live in urban areas. As noted earlier, however, many wild food plants are both nutritious and important for food security. Many tasty dishes can be prepared from such plants. In addition, the indigenous species are adapted to the local environment and therefore propagate and grow easily with few requirements for external input such as fertilizers and pesticides. Thus they can be easily integrated into sustainable farming systems.

A number of steps have already been undertaken in several SADC member states geared to promote forest tree/shrub fruit utilization. According to Mattee and Lassalle (1999), there are other initiatives that have been taken to gather information on forest products. Unfortunately, as mentioned by Kajembe *et al.*, (2000) the information is too generalized. In Namibia (Rugheimer, 2000) reported that Non Governmental Organizations (NGO's) such as the Women's Action for Development, are promoting

the use of indigenous fruits such as S*clerocarrya birrea,* for income generation. They formed a co-operative to manufacture and market a jelly from *S. birrea* in Northern Namibia..

Chirwa and Ngulube (2000) published work on nutritional evaluation of indigenous fruits in Malawi. In Zimbabwe, commercial utilization of indigenous fruits, widely accepted as the best catalyst for adoption and increased fruit tree production has not started except for some sporadic tests by a few companies and NGO that have attempted to produce alcoholic beverages (Nyoka and Rukuni, 2000). A small farm based company is producing fruit slabs that are being exported to Europe. Marketing on the other hand, has largely remained informal, and as a result has failed to attract that attention of the more influential consumers who normally pride the formal markets.

Farmers prefer not all fruit tree or tree fruits. A survey by Maghembe *et al.* (1998) suggested that farmers based their preferences on the following factors:

- contribution to food security especially during famine years,
- ability of fruits to generate an income both cash and in kind,
- ability of fruits to be processed into various products,
- ability of fruit to be preserved and stored for the later use (for example, due to its hard shell). *Strychnos cocculloides* was reported to be easily stored and transported,

- personal satisfaction when the food is consumed (taste) , and
- availability/occurrence of the fruit species in the area.

2.6 Potential contribution of indigenous fruits to small-scale food processing

The small-scale enterprises sector plays an important role in the economies of developing countries. It spars a whole variety of industries from agro-processing to small-scale dairy industries. A small-scale enterprise is expected to fulfill many objectives, generate financial surplus, help reduce unemployment, develop skills and contribute to growth and technical progress (Nanjundan, 1987). According to Ritcher *et al.* (1996), food processing has traditionally been the domain of women in many countries. Processing food for sale can earn them money they badly need to cater for the basic needs of their families and themselves.

Shitta (1998) noted that women in Tanzania engaged in agricultural production comprise nearly 75 percent of the total population. They are mostly engaged in subsistence small holder farming, and are to a very large extent solely responsible for the care and well-being of families. Mdoe *et al.* (2000) showed that small scale processing enterprises provide adequate returns and generate employment especially for women. Most of the small scale processing enterprises in the three surveyed regions in Tanzania were owned and operated by women suggesting that they have a great potential for poverty alleviation. Small scale food processing does not only generate income by selling outside the production area but they also preserve foods

for local consumption during off season. During off-season a number of indigenous tree/shrub fruits that are abundant in the villages and surrounding bushes/forests are left to wild animals or spoil probably due to lack of knowledge on utillzation. These fruits that are freely available could serve as raw materials for women food processors. The recent discovery and utilisation of Ng'ongo pori (*Sclerocarya birrea*) by Mwamko Women Group in Kipera village in Mlali Morogoro, enabled them to increase their income by processing the fruit into jam (Lyimo and Tiisekwa, 2000).

2.7 Conservation of natural resources including food plants

With increasing deforestation, exploitation and changes in land use, the diversity of natural vegetation in Tanzania is declining and many of these wild foods and fruits are no longer readily available. Some of the important wild food plants have already disappeared or are becoming very rare. Examples are the orchids *(Habenaria* and *Satyrium* spp.) covered in Ruffo *et al.* (2002), which are amongst many orchid species that have become endangered because of recent massive collecting, harvesting or trading for food purposes, particularly in the Southern Highlands.

Several authors (Shumba *et al.*, 2000; Kwesiga *et al.*, 2002) point out that there is a great need for some of these indigenous wild plants to be domesticated, starting with those that have a high nutritive value and are easy to propagate. They also need genetic improvement and further development of methods for storage, processing and cooking.

There are numerous programmes, projects and activities in Tanzania aimed at the conservation of the country's natural resources. The main sectors involved are agriculture, forestry, fisheries, wildlife, water and lands. Most programmes aim at capacity building, restoration or rehabilitation, creation of awareness and facilitation or enhancement of sustainable utilization of natural resources. Such efforts are supported by Government policies such as the National Environmental Policy and the National Environmental Action Plan. The establishment of the National Environment Management Council (NEMC) has also been important.

2.8 Local/indigenous knowledge and its importance for development

According to Berkes (1999) indigenous knowledge is defined as the body of knowledge, practice and beliefs, revolving by adaptive process and handed down from one generation to the next generation by cultural transmission, and concerns about the relationship of human beings with one another and with their environment. Many studies have shown that rural people in developing countries have intimate knowledge of their natural environment and of environmental processes. They make rational resource management decisions based on that knowledge. Communities have well established systems and carefully developed techniques which over many years allowed them to survive in harsh conditions (Van Vlaenderen and Nkwinti, 1993). Van Vlaenderen (1999) citing Korten (1980) stated that building on that local knowledge and resources reduces the likelihood that a development intervention de-

links the local people and increases their dependency on external experts. On the contrary, taking local knowledge as the basis for development empowers local people by increasing their self reliance, their confidence and their capacity to utilise and manage their local resources. Van Vlaenderen (1999) gave a detailed treat of the subject discussing the relation between indigenous, local and indigenous technical knowledge and available methods for collecting data.

CHAPTER 3

METHODOLOGY

3.1 Study coverage

3.1.1 Population distribution in wards in the study area (year 2001)

Table 2. Population distribution in wards in the study area (year 2001)

Ward	Number of residents	Percent
Bigwa	12 102	24.5
Mlimani	4 270	8.7
Mzinga	12 648	25.7
Mlali	17 821	36.1
Mkambarani	2 485	5.0
Total	**49 331**	**100.0**

Source: Candidate's research data (2002)

Table 2 shows population distribution in the Wards covered. Based on the year 2001 data the area has a total population of 49,331 people. The study population included all households, vendors and consumers residing in the study area. Consumers included those from the villages and the general public within the Morogoro Municipality. Processors of fruit–based products were from within Morogoro Municipality and members of Tanzania Food Processors Association (TAFOPA) in Morogoro and Dar es Salaam.

3.1.2 Geographical, administrative and institutional set-up in the study area

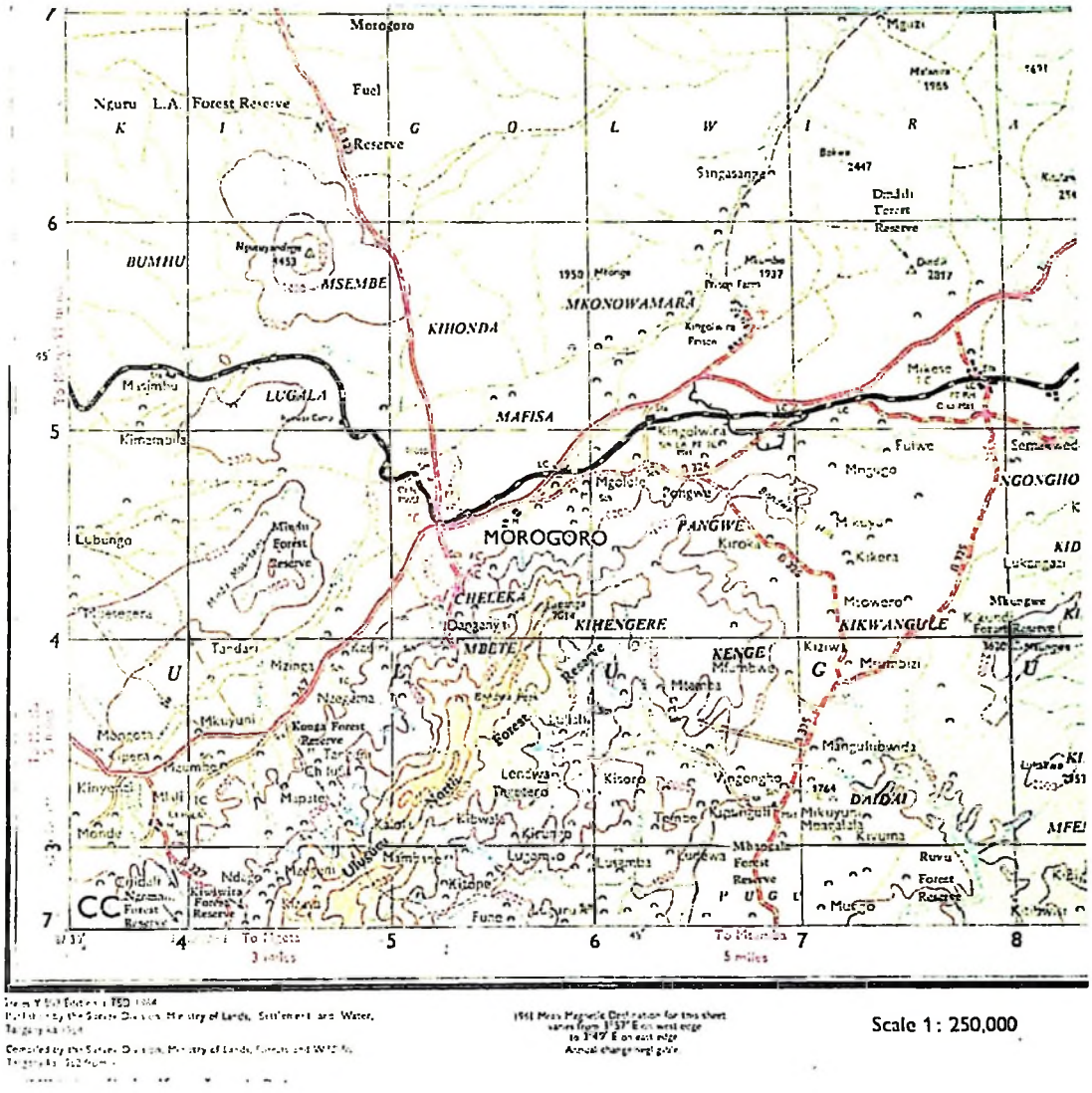

Fig. 3. Map of study area

Source: Land use map of Tanganyika (1953), Sokoine National Agricultural Library

Fig. 3 depicts a map of the studied area. The area is situated between 6° 45' and 7° South and 37° 30' and 37° 55' East. It stands at an altitude starting from 600 m to 1850 m above sea level. The area enjoys varied annual rainfall density that ranges from 900 mm to 1200 mm. This area includes the five wards that surround Uluguru Mountains in Morogoro, Tanzania. This is the area that borders the north-west slopes of the mountains. It stretches from Pangawe to Mlali villages. For along time now, a number of forest tree/shrubs fruits from the Uluguru mountain area and areas surrounding it have been brought by vendors into Morogoro Municipality to sell to the locals as well as tourists. This business area could be contributing to the livelihood of the people in the study area, hence the investigation.

3.2 Sampling

3.2.1 Sampling techniques

Different sampling methods were applied to different groups of respondents as follows:

- The focus group in each village consisted of at least two village government officials and three middle aged farmers, who were familiar with their village and surrounding areas.
- Households (farmers) (87) out of 8 560 households in the study area were selected by using two stage sampling. In the first stage systematic random sampling based on participating village registers was used to choose 140 farmers. The second stage involved choosing 90 respondents by considering

balanced representation of low, medium and high-income status and sex. Categorization based on income was done through the assistance of focus groups. The sample units consisted of approximately equal number of women and men. However, only 87 respondents turned out for the interview.

- Five fruit vendors were selected out of unknown population size by interviewed those who appeared in Morogoro Municipality centres for their vending business.
- Urban consumers (22) of fruit products were randomly selected from community members of Sokoine University of Agriculture and those visiting supermarkets in Morogoro Municipality in Tanzania.
- The entire population of three food processors in Morogoro Municipality and six from Dar es Salaam city was included in the study due to their limited number.

3.2.2 Sample units

Table 3. Distribution of sampled units by study categories of respondents

Category of respondents	Number of sampled units	Origin (Wards)
Farmers from sampled households	87	Mlali, Mzinga, Boma, Bigwa, Mkambalani
Urban consumers	22	Morogoro Municipality
Indigenous fruit traders	5	Choma and Mazimbu villages
Fruit processors	9	Morogoro Municipality and Dar es Salaam region
Total	**123**	

Source: Candidate's research data (2002)

Table 3 shows the sample units used in the study. Four different sample units were used. The unit size varied with category and was related to the population size.

3.3 Data collection and instrument

Data were obtained by using face-to-face interview employing closed and open-ended questions. The questionnaire was subdivided according to different study objectives. These questionnaires were pre-tested in one village in the study area. Additional data were obtained from five focus group discussions in each of the Ward covered and through observations of the fruits available during the research.

3.4 Data analysis

The data collected was coded and analysed by using Statistical Package for Social Scientists (SPSS).

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

The results are presented and discussed in sections 4.1 – 4.10. Section 4.1 discusses the demographic characteristics of the farmer respondents while section 4.2 describes the status of food security in the area. In the subsequent sections i.e. 4.3 – 4.10 the results based on the study objectives two to six are presented and discussed.

4.1 Family size of sampled households and their characteristics (n = 87)

Table 4 shows family size distribution of sampled households in the study area.

Table 4. Family size distribution of sampled households in the study area (n = 87)

Number of households	Number of individuals	Total
4	1	4
10	2	20
17	3	51
18	4	72
16	5	80
6	6	36
5	7	35
2	8	16
5	9	45
1	10	10
1	11	11
2	12	24
Total **87**		**404**

Source: Candidate's research data (2002)

A total of 87 farmer-household's representatives were interviewed. These consisted of 404 family members with 213 (52.7%) male and 191 (47.3%) female. On the average therefore, each household has approximately 5 family members.

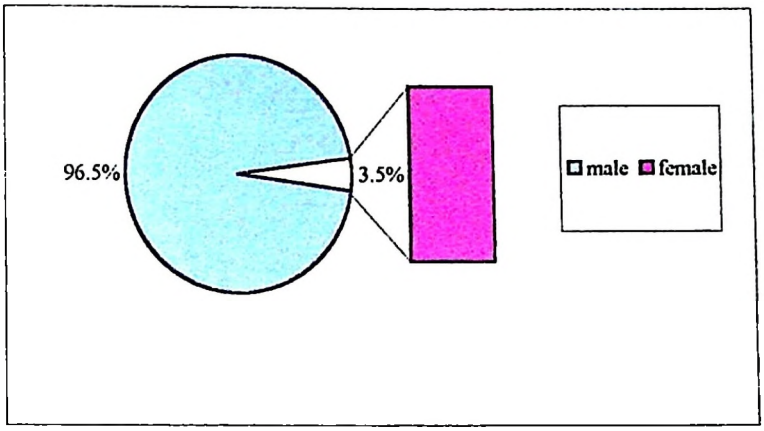

Fig. 4. Household Heads distribution by sex of sampled household respondents(n=87)

Source: Candidate's research data (2002)

Fig. 4 shows that the proportion of male-Headed households was 84 (96.5%) and female-Headed was 3 (3.5%).

Table 5. The distribution of household membership by education in the sampled units (n = 404)

Education level	Frequency	Percent
Primary	273	67.6
Secondary	25	6.3
College	3	0.7
No education	102	25.4
Total	**404**	**100.0**

Source: Candidate's research data (2002)

Table 6. The distribution of household members by major occupation in the sampled units (n = 404)

Occupation	Number	Percent
Dependants*	83	20.5
Farmer	254	62.9
Trader	11	2.7
Others**	56	13.9
Total	**404**	**100.0**

*Include children, the old and the disabled

**Include paid employees

Source: Candidate's research data (2002)

The distribution of household members by education level and occupations is given in Tables 5 and 6. The results in Table 5 show that the farmers with primary education were 273 (67.6%) of the respondents and those with no education at all numbered 102 (25.4%). However, since the no-education category also includes the pre-school aged children and babies, the figure should not be taken to reflect the level of illiteracy. These results imply that, most farmers are able to read and write and can therefore read messages on developmental activities. Should there be interventions on IFs, it will be easy to pass written messages to target farmers. The results in Table 6 indicate that most members 254 (62.9%) are farmers. Traders form the least proportion 11 (2.74%). The dependant group with 83 (20.5%) is composed mainly with school children, very old people and disabled ones. The group of others whose total is 56 (13.9%) is composed of paid employees.

Table 7. The distribution of household members by marital status in the sampled units (n = 404)

Occupation	Number	Percent
Married	200	49.5
Unmarried	182	45.0
Widowed	16	4.0
Divorced	6	1.5
Total	**404**	**100.0**

Source: Candidate's research data (2002)

Table 7 shows the distribution of respondents by marital status. A great number of households members 200 (49.5%) are married. Most of the unmarried 182 (45% are likely to be children who are under-age of marriage.

Table 8. Age distribution of household members (n = 404)

Age category (years)	Number	Percent
Equal or less than 21	241	59.7
21 - 40	84	20.8
Equal or greater than 41	79	19.5
Total	**404**	**100.0**

Source: Candidate's research data (2002)

Table 8 gives the age distribution of household members. The data shows that 241 (about 60%) of the respondents were less or equal to 21 years of age. Eighty-four (20.8%) had age between 21 - 40 years. This shows that the population in the study

area is young and is consistent with the observed high proportion of unmarried members of the households. The young age implies that they know little about IFs since their importance was appreciated in the past before they were born.

4.2 Food security status in the study area

According to FAO (1989) the committee on World Food Security defines food security as economic and physical access to food by all people at all times. The World Bank defined food security as the access by all people at all times to enough food for a healthy and active life (Maxwell and Frankhenberger, 1992). The resources that are available to the household members determine access to food. In order to understand the potential for availability of food in the studied area it was therefore important to assess some resources available in the households and the needs for the households.

4.2.1 Household resources in the study area

Variable resources were identified in the households in the study area. All 87 respondents (representing their households) in the study area owned land that ranged from one to 15 acres per household. On the average each household owns 4.6 acres. The household poses other assets that include livestock and some household items.

Table 9. Livestock numbers kept by households in the study areas and proportion of households owning (n=87)

Livestock type	Number of animals			Households owning	
	Mean	Minimum	Maximum	Number	Percent
Goats	4.2	2.0	10.0	17	19.5
Donkeys	5.0	-	-	1	1.1
Pigs	4.8	1.0	15.0	6	6.9
Chicken	1.0	6.0	8.0	47	54.0
Ducks	6.0	2.0	16.0	12	13.8
Other*				4	4.7
Total				**87**	**100.0**

-There is no range for single response.

*Include animals that are kept in very small numbers such as sheep and doves.

Source: Candidate's research data (2002)

Table 9 shows data on main livestock kept by households. The results show that more respondents 47 (54%) keep chicken with a range of 6 to 8 per household followed by those who own goats 17 (19.5%) with a range of 2 to 10. The number of livestock kept by household is markedly low indicating limited source of meat protein. The implication of these results is the probable state of food insecurity resulting from nutrient imbalance.

Table 10. Household assets (number) kept by households in the study area and proportion of households owning assets (n=87)

Assets type	Number of items			Household owing	
	Mean	Minimum	Maximum	Frequency	Percent
Bicycle	1.1	1.0	3.0	40	47.1
Axes	1.2	1.0	4.0	75	86.2
Radio	1.3	1.0	4.0	75	86.2
Sprayer	1.0	1.0	1.0	7	8.0
Hoes	3.4	1.0	13.0	87	100.0
Machetes	1.7	1.0	6.0	77	88.5
Sickles	1.7	1.0	5.0	46	52.8

Source: Candidate's research data (2002)

The main assets owned by households are given in Table 10. All households 87 (100%) own hoes indicating that they are a farming community. Machetes, axes and radios that are owned by 77 (88.5%), 75 (86.2%) and 75 (86.2%), respectively are the next most popular items. Very few respondents 7 (8.0%) own sprayers indicating that there is low level of purchasing power because they are costly.

4.2.2 Household incomes and expenditure

Table 11. Summary of average household income and expenditure in frequencies and percentages (n = 87)

Income source	Frequencies	Percent	(Tsh.)
Income from crop sales	78	89.6	1 055 196
Other sources*	65	74.7	735 847
Total			**1 791 043**
Expenditure			
Food	63	72.4	202 606
Non-food**	87	100.0	353 395
Durable assets	80	91.9	227 082
Total			**783 083**
Income – Expenditure = ("savings")			**1 007 960**

*Examples include fruits, livestock as detailed in appendix 3.

**Examples include health services, education as detailed in appendix 5.

***Examples include items like radio, bicycle, hoes as detailed in appendix 6.

Source: Candidate's research data (2002)

The average household income and expenditure are given in Table 11. The results indicate that the major source of income for many individuals 78 (89.6%) is from crop sales i.e. TSh. 1 055 196.00 per annum. Expenditure on non-food is the greatest for all respondents 87 (100%) costing them TSh. 353 395.00which exceeds considerably that on food (TSh. 202 606.00) and durable assets (TSh. 227 082.00). Details of incomes and expenditure are given in appendixes 2 - 6. A comparison between income and expenditure suggest that there is, on the average, a significant

saving (56.3%) of income. If all this saving is used for food then we could assume a high level of food security in the studied households. However, in reality, given the culture of the tribe one can also assume that part of the income is used for marriage ceremonies and associated traditions not accounted for in the collected data. According to Maxwell and Frankenberger (1992) knowledge on intra-household food distribution is also necessary before one can conclude whether every member in the household gets the right quantity and quality of food.

4.2.3 Mix of food for household consumption

Foods consumed by household members (respondents) are either produced by households themselves, bought, or given to them as gifts.

Table 12. **Consumption of own-produced food during dry and rainy season in frequencies (n = 87)***

Food type	Household involved		Amount consumed (kg)		
	Frequency	Percent	Mean	Minimum	Maximum
Dry season					
Maize	70	80.4	569	40	20 000
Cassava	34	39.1	94	2	500
Sweet-potatoes	4	4.6	63	40	100
Sorghum	7	8.0	88	8	200
Beans	20	23.0	46	10	120
Peas	10	11.5	180	10	1 400
Banana	12	13.8	412	40	2 000
Rice	27	31.0	153	25	400
Vegetables	4	4.6	242	50	500
Yams	6	6.9	53	10	200
Rainy season					
Maize	57	65.5	280	30	1 150
Cassava	30	34.5	69	2	250
Sweet-potatoes	3	3.4	76	50	100
Sorghum	6	6.9	78	9	200
Beans	19	21.8	45	10	120
Peas	7	8.0	270	13	1 400
Banana	12	13.8	577	24	3 000
Rice	26	29.9	157	10	400
Vegetables	3	3.4	170	50	360
Yams	5	5.7	62	10	200

* Discussions on the results are given on page 41

Source: Candidate's research data (2002)

Table 13. **Bought food for household consumption during dry and rainy seasons (n = 87)***

Food type	Household involved		Amount of bought food (kg)		
	Frequency	Percent	Mean	Minimum	Maximum
Dry season					
Maize	22	25.3	171	20	1 600
Cassava	2	2.3	90	80	100
Beans	21	24.1	37	5	100
Peas	2	2.3	35	20	50
Banana	2	2.3	25	20	30
Rice	30	34.5	66	1	450
Vegetables	1	1.1	40	-	-
Meat	4	4.6	25	15	36
Fish	3	3.5	53	5	144
Rainy season					
Maize	34	39.1	170	40	600
Beans	22	25.3	49	10	320
Peas	1	1.1	30	-	-
Banana	1	1.1	30	-	-
Rice	23	26.5	36	1	250
Vegetables	1	1.1	20	-	-
Meat	3	3.5	33	20	50
Fish	2	2.3	10	6	15

-There is no range for single response.

* Discussions on the results are given on page 41

Source: Candidate's research data (2002)

Table 14. Food for household consumption obtained in form of gift during dry season (n = 87)*

Food type	Household involved		Amount of gift food (kg)		
	Number	Percent	Mean	Minimum	Maximum
Dry season					
Maize	3	3.4	33.0	20.0	40.0
Cassava	1	1.1	20.0	-	-
Beans	1	1.1	50.0	-	-
Rice	2	2.3	40.0	-	-
NIL	80	92.1			
Total	87	100.0			

*Only 7 out of 87 respondents received food as gift

Source: Candidate's research data (2002)

Table 12 gives data on consumed food during rainy and dry season that is grown by households themselves while Tables 13 and 14 present similar information on bought and food received as gift, respectively. By comparing the three food sources it is apparent that own-produced food is the main source followed by bought food. The results further show that more own-produced food is consumed during the dry season than in the rainy season. This is somehow expected since it is during the dry season when most crops are harvested. Maize followed by cassava and beans are the main crops consumed during both seasons. However, there is a marked reduction in quantities of food consumed during rainy season, probably due to scarcity. For

example, during the dry season, 569 kg of maize is consumed. This figure is reduced to 280 kg during the rainy season. The same is observed for bought food. This trend is used as a coping strategy to food scarcity. This shows a certain degree of food insecurity that may result in malnutrition. A very small proportion of households 7 out of 87 (8%) receive gift of food only during the dry season. Only 3.4% of the households receive maize as gift to the extent of 33 kg with a range of 20 - 40 kg during dry season (Table 14). Lack of gift of food during rainy season is probably due to scarcity that indicates food insecurity during the season. It is during this season that more food is purchased (Table 13). The study area has never received relief food neither from the Government nor from an NGO. The observed food trend is consistent with the observations by Ishengoma (1998) in Kilosa district and by TARP II-SUA (2002) in various districts in the Southern and Eastern highland zones in Tanzania. The fact that food shortage occurs in the study area indicates that some households are food insecure.

4.2.4 Food calendar

There are two main seasons in the study area, dry and rainy seasons. The dry season lasts for 8 months and starts in June and ends in January. In some years short rains may break the dry season during October and November. The main rainy season begins late February and extends to May. In the study area, 25 (28.7%), 45 (51.8%) and 17 (19.5%) of the respondents indicated that July, August and September, respectively, as periods of surplus food. The months of deficits were February 42

(48.3%) and March 45 (51.7%). These results are expected since the surplus months coincide with post harvest period while the deficit months is the period when most of the stocks are exhausted being used as food stuff and probably as seed.

Table 15. Important crops ranking by sampled households during dry season (n = 87)

Crop	Number	Percent
Maize	70	80.5
Cassava	8	9.2
Banana	4	4.6
Rice	3	3.4
Other*	2	2.3
Total	87	100.0

*Include: yams, cowpeas, sorghum, sweet potatoes, Irish potatoes, beans, pigeon peas, fish, "dagaa", vegetable, and oranges.

Source: Candidate's research data (2002)

Table 16. Important crops ranking during rainy season by sampled household respondents (n = 87)

Crop	Number	Percent
Maize	63	72.2
Cassava	9	10.0
Rice	7	8.9
Yams	4	4.4
Banana	2	2.2
Other*	2	2.3
Total	**87**	**100.0**

*Include sweet potatoes, Irish potatoes, sorghum, beans, cowpeas, pigeon peas, vegetable, dagaa/fish and oranges.

Source: Candidate's research data (2002)

Tables 15 and 16 show the overall ranking of crops during the dry and rainy seasons, respectively. In both seasons, maize ranks first, followed by cassava. The high frequency for maize usage indicates that it is the main source of nourishment. Crop failure in maize would therefore, result in food insecurity.

4.2.5 Coping strategies with respect to food shortage

Table 17. Coping strategies used by household members and proportion of responses in frequencies (n = 87)

Coping strategy	Frequency	Percent
1. Buying food	59	67.8
2. Meal adjustment	45	61.7
3. Sale of labour	23	26.4
4. Utilization of wild foods	16	18.4
5. Livestock adjustment	11	12.6
6. Community support	14	16.2
7.Others	7	8.0

Source: Candidate's research data (2002)

Table 17 indicates what households do in case of food scarcity. Several strategies were mentioned as being used to cope with food shortage. The importance of strategies used is reflected in the proportion of respondents mentioning a specific strategy. Most 59 (67.8%) respondents mentioned buying food followed by meal adjustment 45 (57.7%) and sale of labour 23 (26 4%) as used strategies. The results that suggest meal adjustment are consistent with the observation made above whereby the quantity of maize consumed is markedly reduced during shortage. The fact that several coping strategies (including labour sale) are used in case of food scarcity confirms that the observed apparent savings is not real; it is used for other family activities thereby leaving households food insecure. The worst of the situation is that a family may go hungry while money is banked!

4.3 Indigenous fruits available in the study area

Table 18. Indigenous fruits available in the study area*

Fruit name				
Kiswahili/ Local	**English***	**Scientific***	**Frequency**	**Per cent**
Bungo	Rubber vine	*Saba florida* (Benth.) Bullock	52	59.7
Fulu	Black plum	*Vitex doniana*	52	59.7
Mkwaju	Tamarind	*Tamarindus indica*	45	51.7
Ng'ongo pori	Marula	*Sclerocarya birrea*	41	47.1
Zambarau pori	-	*Syzygium guineense* (Willd.) DC	39	44.8
Pera pori	Guava	*Strychnos cocculoides*, Baker	21	24.1
Ubuyu	Baobab	*Adansonia digitata*	20	23.0
Vitoja	Wild passion	-	14	16.1
Topetope	Wild custard	*Annona senegalensis*	10	11.5
Milimiki	apple	-	9	10.3
Fifi	-	-	9	10.3
Tomokwe	-	*Annona squamosa*	9	10.3
Mizangwe	-	-	9	10.3
Ududu	-	-	8	9.2
Mmingi	-	-	8	9.2
Musu	-	-	8	9.2
Kweme	-	-	8	9.2
Others***	-		7	8.0

Source: * Candidate's research data (2002), * * FAO (1983)

***Mentioned by 8% or less include **sezi, *Grewia similis*, *Flacourtia indica*, tonga, tulatula, ugobedi, stafeli, *Artocarpus heterophyllus*, kitundandege, Vangueria infausta, kungumanga, ngwambe, mselemelele, matunda moyo, sambura, tunda simba, nanasi pori, tangabuwa, mbuda, buni** and **tomboti.**

The indigenous fruits (IFs) available in the study area are listed in Table 18. Thirty six indigenous fruit types were mentioned to be available in the study area. This is only a very small proportion of the many agro-ecological zones in Tanzania. Considering the vast size of Tanzania, it is expected that hundreds of other types may be found country-wide. This view is supported by a survey in the miombo of Tabora district alone whereby Kwesiga *et al.* (2000) reported 50 species in Tanzania, Malawi, Zimbabwe and Zambia, while Mumba *et al.* (2002) identified 33 IFs in Tabora district alone. The percentages of responses mentioning a particular fruit as important are also included. Based on these percentages it is clear that the most common fruits known to over 30% of the respondents are *Saba florida*, *Vitex doniana*, *Tamarindus indica*, *Sclerocarya birrea* and *Zyzgium guinaense*. The data further reveals that a large number of fruits are not known to many people. It is also notable that fruits with different scientific names bear same tribal name. For example, **Mfudu** is known as *Vitex keniensis* or *Vites doniana.* Over 60% of the fruits mentioned are known to less than 10% of the respondents. These observations imply that there is lack of knowledge on many IFs even by local people. If such IFs are found to be of great value, there is therefore a need to educate local people about them. Similar observations were made in various places within and outside Tanzania (Mumba *et al*, 2002). Plates 1 - 11 depict some of the fruits identified during data collection (January to February). Using different characteristics identifies the fruits.

Plate 1: ***Saba florida***

Source: Candidate's research data (2002)

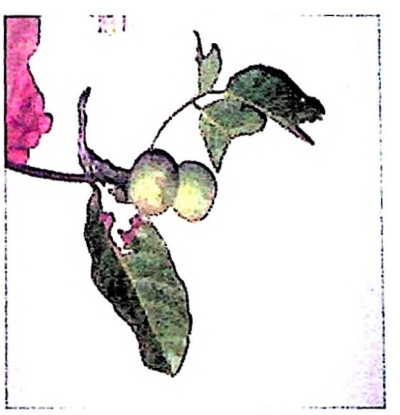

Plate 2: ***Sclerocarya birrea*** (unripe)

Source: Candidate's research data (2002)

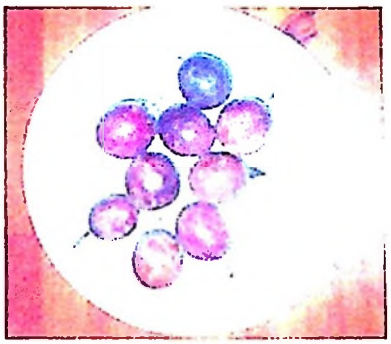

Plate 3: Wild passion fruit

Source: Candidate's research data (2002)

Plate 4: ***Adansonia digitata***

Source: Candidate's research data (2002)

Plate 5: *Tamarindus indica*

Source: Candidate's research data (2002)

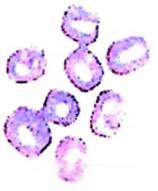

Plate 6: ***Vitex doniana***

Source: Candidate's research data (2002)

Plate 7: *Annona senegalensis* (unripe)

Source: Candidate's research data (2002)

Plate 8: Black berries

Source: Candidate's research data (2002)

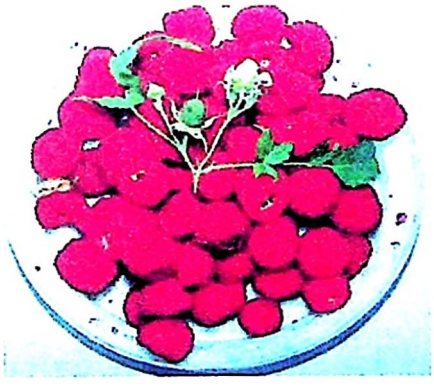

Plate 9: Red berries

Source: Candidate's research data (2002)

Plate 10: Goose berries

Source: Candidate's research data (2002)

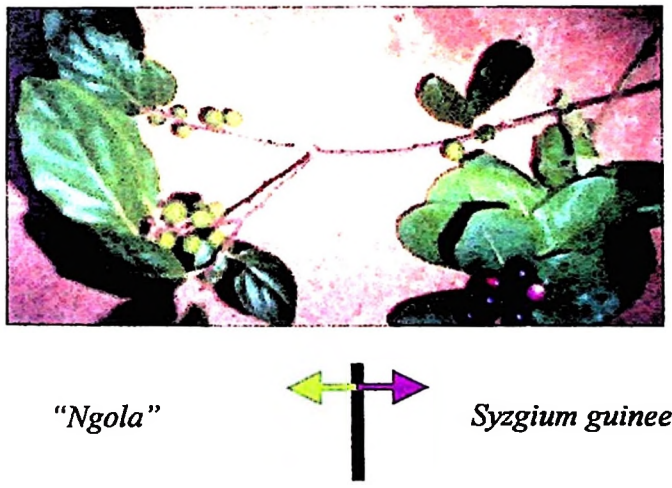

Plate 11: "Ngola" (unripe) and *Syzgium guineense*

Source: Candidate's research data (2002)

4.3.1 Characteristics of IFs

The main characteristics used by local people to identify IFs vary with fruit type. Fruits are described by being tree or non-tree types, by colour, shape or by its taste. The nature of exocarp may also be used to identify a particular fruit type. These identification characteristics are clearly supported by the varied features exhibited by IFs shown in Plates 1- 11. However, since some identification features (e.g. colour) change with degree of ripeness before or post harvest, it may be necessary to identify the changes during various stages of ripening. The characterization of this type will allow users to determine the exact stage at which a given fruit is useful for a specific use. Nutrient content accompanying these changes is another interesting area of research in order to guide users on the fruit values.

4.4 Contribution of IFs to household food availability and income

4.4.1 IF collection and utilization

Through interviews with 87 respondents it was observed that different people are engaged in IFs collection. Most respondents 61 (69.6%) indicated children, followed by firewood collectors 40 (45.7%), children herders 16 (18.5%), hunters 8 (9.5%) and other 12 (14.1%). Some respondents indicated more than one type of collectors. Fruits are collected for various uses.

Table 19. Relative importance of fruit for use in snack and in meals by sampled households (n = 87)

Fruit	Snack		Meals	
	Number	Percent	Number	Percent
T.indika	4	4.6	1	1.1
V. infausta	3	3.4	9	10.3
Vitex. doniana	3	3.4	7	8.0
S. birrea	4	4.6	7	8.0
S. florida	4	4.6	0	0.0
S. guineense	5	5.7	3	3.4
A. senegalensis	0	0	5	5.7
All others*	14	16.1	4	12.6
NIL	50	52.6	51	51.0
Total	**87**	**100.0**	**87**	**100.0**

*Include: **milimili, vitoja, A. digitata, topetope, ududu, mmingi, mizangwe, fifi, tomokwe, perapori, gobedi, stafeli, fenesi, tunda ndege, kweme, usulu, tunda sirubi, nanasi pori, buni.**

Source: Candidate's research data (2002)

Based on the mentioned six popular fruits shown in Table 19 it is apparent from the data that all fruits are mostly used as a snack or in meals. The use IFs as snack was reported by 37 (42.7%) out of 87 of respondents and by 36 (41.4%) for use in meals. *S. florida* and *T. indica* rank highest in both uses. The relative importance of the six fruits with respect to use in meals varies considerably among fruits and the order is in consisted with use as a snack. *Vangueria infausta, Sclerocarya birrea* and *Vitex doniana* are commonly used in meals. *A. senegalensis* is used in meals only. However, *Sclerocarya birrea* and *Vangueria infausta* rank highest (10.5 – 14.6%

frequency) for other uses. These results indicate that different fruits are preferred differently for varied uses. The desire to promote utilization of IF must therefore, consider the use value attached to a particular fruit type. Studies by Maghembe *et al.* (1998) and Mithöfer and Waibal (2002) in Zimbabwe also indicate similar use variations in preference for different fruits. Within the households, the children were found to be the main consumers of fruits but cash income from sale benefits all the household members.

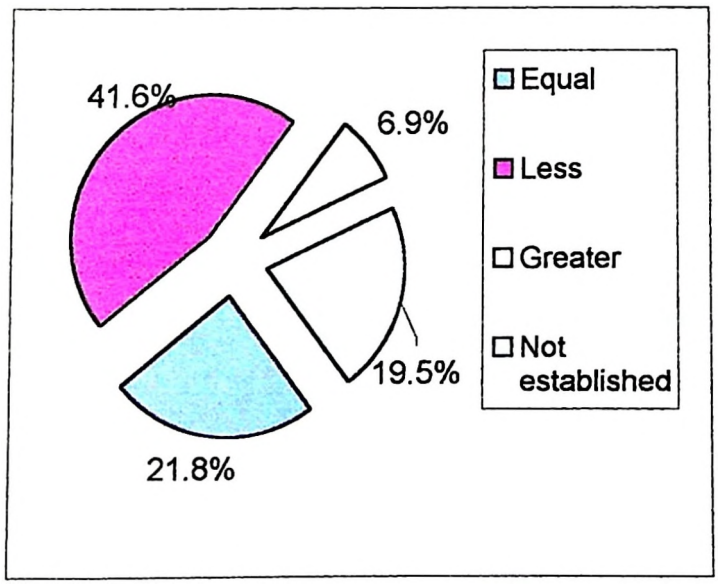

Fig. 5. Contribution of indigenous fruits to fruit portion of meal for 78 (89.6%) users

Source: Candidate's research data (2002)

Fig. 5 shows the relative contribution of IFs to fruit portion in a meal. The majority of user respondents 36 (41.6%) stated that IFs contributed less than EFs to fruit portion of the meal. A moderate proportion 19 (21.8%) mentioned IFs as contributing equal proportion to meal fruit while a small proportion 6 (6.9%) stated greater IFs contribution. A further proportion of 9 (10.4%) do not use IFs.

Table 20. Indigenous fruits collected by sampled households in past 2 years in frequencies and percentages (n = 87)

Fruit name	Frequency	Percent
S. guineense	14	16.2
S. birrea	10	11.5
Vitex. doniana	10	11.5
S. florida	8	9.2
T. indika	7	8.0
Vangueria infausta	7	8.0
Others*	31	35.6

*Include: all fruits listed under Table 19

Source: Candidate's research data (2002)

Table 20 presents data showing the proportion of respondents recalling the fruit type collected during the past two years (2000 – 2001). The results show a low level of responses confirming that a small proportion of people are engaged in fruit collection. *Syzygium guineense*, *S. birrea* and *Vitex doniana* were the most frequently collected as indicated by 14 (16.2%), 10 (11.5%) and 10 (11.5%) respondents, respectively.

Table 21. Fruits and quantities handled by sampled household respondents during previous year in frequencies (2001) (n = 87)

Quantity of fruit (kg)	Frequency	Percent	Fruit in quantity category
1	2	2.3	*Vangueria infausta*, *Vitex. spp.*, **tomokwe**
2	6	6.9	*Vitex. doniana.*, *S. birrea*, ***mmingi***
5	5	5.7	*T.indika*, *Vitex. doniana*, *S. birrea*
10	35	40.2	*Vitex. doniana*, *S. birrea*, *S. florida*, *S. guineense*
20	30	34.5	*T.indika*, *Vangueria infausta*, *S. birrea*, *S. guineense*, **mizangwe**, *Annona senegalensis*
24	30	34.5	*T.indika*
40	26	29.9	*S. guineense*
50	18	20.7	*S. florida*
60	7	8.0	*S.birrea*
100	9	10.3	*S. guineense*
120	5	5.7	*S. guineense*, *Vangueria infausta*
150	2	2.3	**Kweme**
200	8	9.2	*S. florida*
300	2	2.3	*S. birrea*

Source: Candidate's research data (2002)

The relative quantities of IFs collected during the previous year (2001) are listed in Table 21. The results show that the quantities of IFs collected varies with fruits type and range from 1 to 300kg per annum. Respondents reported different quantities

collected of the same fruit. For example, one, 20 or 120 kg of *Vangueria infausta* fruit may be collected and 2, 60 or 300kg of *Scherocarya birrea* also may be collected by different people. However, the majority of respondents 35 (40.2%) collect 10 kg of *Vitex. doniana.*, *S. birrea, S. florida* and *S. guineense* in one season. These results are consistent with earlier observations that different people collect fruits for different uses. The variation in the quantities collected perhaps depends on the number of household members involved in fruit collection or marketing that was shown above to vary from two to six members.

4.4.2 IFs marketing

Table 22. Important marketed indigenous fruits in frequencies and proportion of sampled households engaged (n = 87)

Fruit type	Frequency	Percent
S. guineense	9	10.4
T. indica	8	9.2
Vitex doniana	5	5.7
S. florida	5	5.7
A. digitata	3	3.4
Vitoja	2	2.3
Fifi	2	2.3
S. cocculoides	2	2.3
Vangueria infausta	2	2.3
Other*	7	8.0

* Include: **mizangwe, fenesi, kwema, tunda damu, simbi, mbuda**, *A. senegalensis Sclerocarya birrea and Vitex doniana* rank relatively high (11.2 – 15.7%) in order of frequency of collection.

Source: Candidate's research data (2002)

The proportions of respondents engaged in marketing of particular fruit are given in Table 22. Four of 16 IFs that are marketed were mentioned by 5 (5.7%) or higher respondents. *Szyzgium guineense* was the top ranking with 9 (10.4%) response. This was followed by *T. indica* 8 (9.2%).

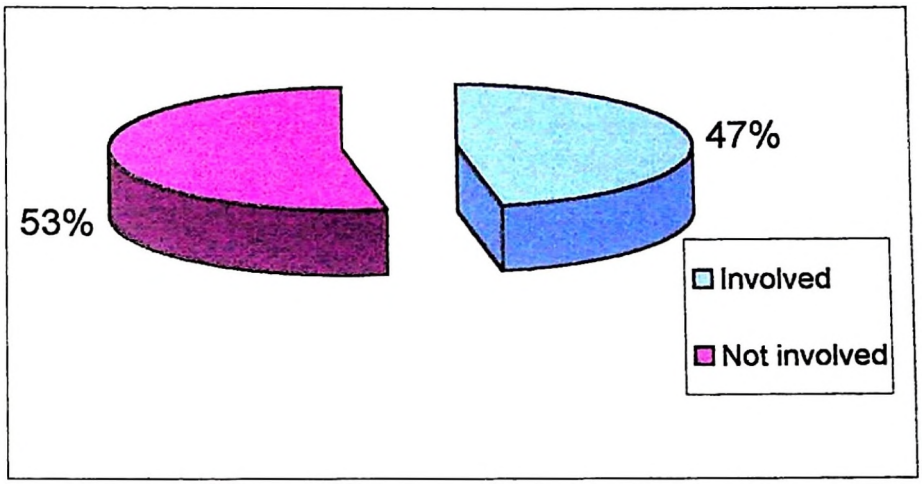

Fig. 6. Proportion of households involved in fresh fruit marketing indicated by sampled household respondents

Source: Candidate's research data (2002)

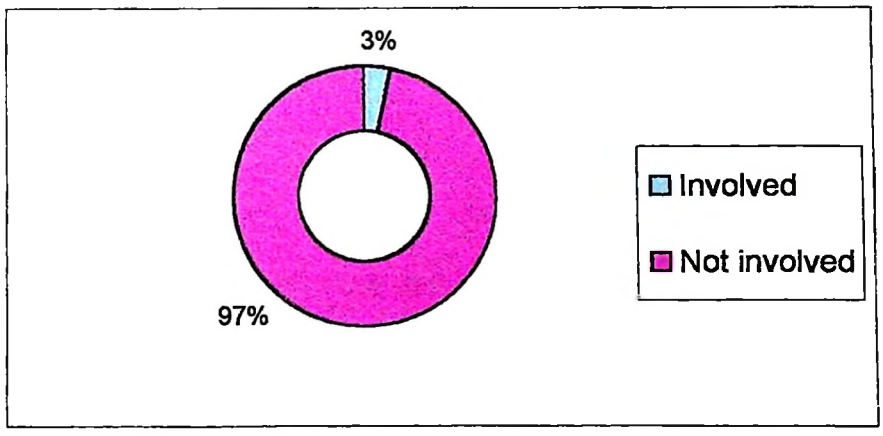

Fig. 7. Number of households involved in processed fruit marketing indicated by sampled household respondents (n = 87)

Source: Candidate's research data (2002)

Figs. 6 and 7 represent the proportions of household members involved in fresh fruit and processed fruit marketing, respectively. Out of 87 respondents 41 (47%) were involved in fresh fruit marketing while only 3 (3%) were engaged in processed fruit marketing. The results show that on the average, in a given household, one or two persons may be involved in the marketing. However, in the majority of cases 34% of respondents mentioned two people as being involved in the marketing of IFs. Where processed fruits are marketed a greater number of household members are involved in their marketing. Two-thirds of the respondents stated that up to 6 persons in a household may be involved in processed fruit marketing. According to the respondents a limited number of individuals are involved in the marketing of IFs due to lack of knowledge of the demand for them.

In Zimbabwe however, and Mithöfer and Waibal (2002) reported that women are mostly engaged in the sale and purchase of household goods from the revenues accrued from IFs. These authors identified *Uapaca kirkiana* and P*arinari curatellifolia* as the most important fruits in Zimbabwe. However, Mumba *et al.* (2002) identified *Vitex mombasae*, *V. doniana*, *Strychnos cocculoides* and *P. curatellifolia* as important in Tanzania in terms of preference, abundance and multipurpose use.

(a) IFs buyer

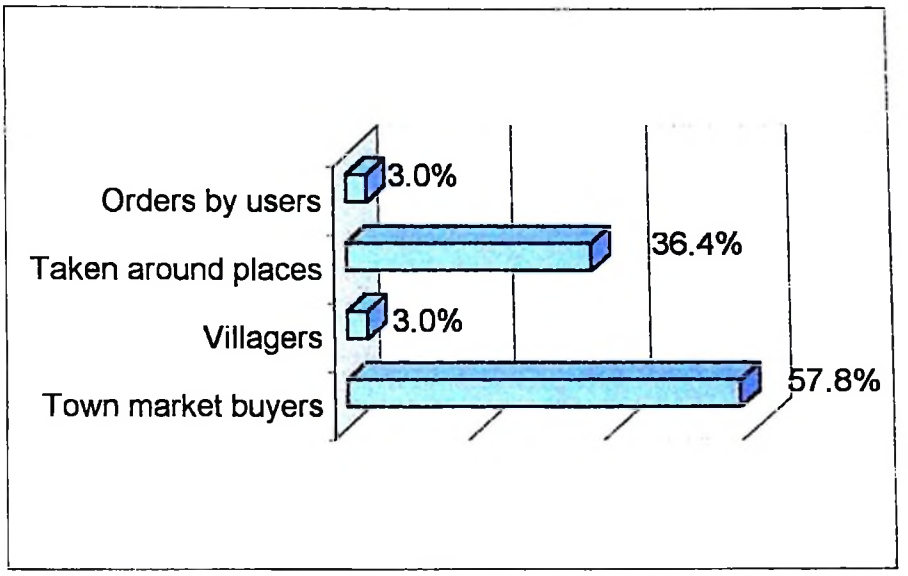

Fig. 8. Means of selling IFs indicated by sampled household respondents (n = 87)

Source: Candidate's research data (2002)

The results showing the selling method, the type of buyer and the proportion of 7 respondents engaged are shown in Fig.8. The data shows that most respondents 50 (57.6%) sell IFs to town market buyers and may involve taking the fruits around the streets 32 (36.8%). The remaining proportion is either due to sales in villages or through orders made to sellers. It was noted that one collector can sell to more than one type of buyers. It appears that the IFs are valued by town or city dwellers, probably due to the learned knowledge they have about them. These results are consistent with observations of other workers. For example, market analysis of *Uapaca kirkiana* in Zimbabwe indicates that its market system is still under-

developed and dominated by imperfect competition (Ramadhan and Schmidt, 2002). These authors reported that market outlets are limited to villages, roadsides, district growth points and central markets. Many producers and retailers but few wholesalers causing less competition at their level characterized the system. Since IFs are nutritionally valued (Ndabikunze *et al.*, 2002; 2002; Saka *et al.*, 2002), the value about them should be disseminated to local people where the fruits are found. It is hoped that knowledge about their value can increase their utilization thus improving their food and nutrition security.

(b) **IFs pricing**

Table 23. Price offered for fresh fruit indicated by 41 respondents out of the sampled households (n = 87)

Price (TSh.)	Frequency	Percent	Fruit name
20	2	2.3	*S. florida, S. guineense*
40	6	6.7	*Vitex doniana*, **simbi**
50	6	6.7	*T. indica, Vitex doniana, S. birrea, S. florida, S. guineense*
100	20	23.0	*Vitex doniana, S. florida, S. guineense, A. senegalensis*
150	12	13.8	*Vitex doniana, S. guineense*
160	9	10.3	Vitoja
200	11	12.6	*Vitex doniana*
300	10	11.5	*Vitex doniana, S. guineense, A. digitata*
500	12	13.8	*T. indica, S. guineense, Artocarpus heterophyllus*
600	8	9.2	**Vitoja**
1 500	2	2.3	**Mizangwe**

Source: Candidate's research data (2002)

Table 23 shows the price offered for different fresh IFs. Forty one respondents out of 87 sampled households were involved in their marketing. It is evident from the results that different IFs fetch different prices. The unit price may range from TSh. 20.00 – 1 500.00 per kilogramme (mean TSh. 200.00). This trade earns the farmer an average annual income of TSh. 4 000.00 that range from TSh. 20.00 to

41 000.00. The most highly priced IF is **mizangwe** (TSh. 1 500.00) followed by **vitoja** (TSh. 600.00). It is notable from the results that some other factors affect the price offered for a given fruit. For example, *Saba florida* may be sold at TSh. 20.00 or 100.00 while *Syzgium guineense* may be sold at TSh. 20.00 or TSh. 500.00. Very few farmers 2 (2.3%) are able to sell **mizangwe** at TSh. 1 500.00. Farmers indicated that higher prices are obtained when the fruits are sent to Dar es Salaam market and very few people can afford to go there. In Zimbabwe, Ramadhan and Schmidt (2002) noted that price offered for *Uapaca kirkiana* was based on size and colour but there were limited pre-sale activities. The results show that when marketing channels are well established IFs could offer relatively more attractive price than the available EFs. This implies that people living in areas where these fruits are available could benefit from selling these natural resources. Once benefits are realized, the trees from which these fruits grow will have to be protected thus conserving the forest and biodiversity.

(c) Income from IFs

Table 24. Annual income obtained from sold fresh fruit indicated by 41 respondents out of the sampled households (n = 87)

Income level (TSh.)	Frequency	Number	Fruit name
20	4	4.6	*S. guineense*
100	6	6.7	*S. birrea*
200	6	6.7	*S. florida*
250	8	9.2	*Vitex doniana, S. guineense*
500	16	18.4	*T. indica, Vitex doniana, S. guineense, Artocarpus heterophyllus*
800	15	17.2	***Vitex doniana*, simbi**
1 000	16	18.4	*S. florida, S. guineense*
1 500	18	20.7	*Vitex doniana*
2 000	12	13.8	*S. florida*
2 500	10	11.5	*T. indica*, **mbuda**, *A. senegalensis*
3 000	4	4.6	*Vitex doniana, S. guineense*
4 000	3	3.3	*Vitex doniana*
6 000	3	3.4	*S. guineensei, A. digitata*
8 000	3	3.4	**Vitoja**
10 000	2	2.3	*T. indica, S. guineense*
20 000	2	2.3	**Mizangwe**
30 000	1	1.1	**Vitoja**

Source: Candidate's research data (2002)

The results in Table 24 show the annual income accrued from sales of various IFs as indicated by the 41 out of 87 respondents. The results show that local people can earn

income that ranges from TSh. 20.00 to 30 000.00 by selling only one type of IF. The majority of those involved in IF trade 10 –16 (11.5 – 18.4%) earn between TSh. 500.00 and 2 500.00 per annum. Furthermore, the results show that variable incomes can be obtained from different fruits. This clearly indicates that some traders in IFs consider the business more seriously than others or the supply of a particular fruit type may be limited for one trader than for another. With this type of variability it is therefore, possible for the local people to choose which fruit type(s) should they concentrate on after considering all other factors related to its availability, handling and marketing. Based on the information obtained, more income could be generated if the local people were informed of value, use and marketing opportunities. Unfortunately, it appears that business in IFs seem to be limited to the little that the person knows about the fruit. Unlike some exotic fruits there is no established marketing institution responsible for them, hence much of whatever goes on may be considered as a matter of chance. However, survey results in other parts of Tanzania (Mumba *et al.*, 2002; Swai *et al.*, 2002) show that households and women groups are financially benefiting from processing of IFs. In southern Africa, commercial product development and marketing has reached advanced stage. In Malawi, for example, consumers preferred *S. cocculoides* and *U. kirkiana* jam. The fruit features well in regional trade between Zimbabwe and Botswana (Mkonda *et al.*, 2002). It also fetches higher price, as much as US $ 0.25 per fruit.

4.4.3 Fruit handling

Table 25. Time used from fruit source to selling destination indicated by sampled households (n = 87)

Time (h)	Frequency	Percent	Fruit
0.5	5	5.7	*Vitex doniana, S. florida, S. guineense, Artocarpus heterophyllus*
1.0	5	5.7	*T. indica, Vitex doniana, S. florida, vitoja, S. guineense, A. digitata,* **mizangwe**, *S. cocculoides, A. senegalensis*
1.5	8	9.2	*S. guineense*, **mbuda**
2.0	8	9.2	*T. indica, Vangueria infausta, Vitex doniana, S. florida, S. guineense*
6.0	3	3.4	*S. guineense*
24.0	1	1.1	**Vitoja, simbi**

Source: Candidate's research data (2002)

Table 25 shows time used from fruit source to selling destination. Except for one in six cases involving *Tamarindus indica*, all other fruits are collected from sources and brought home before being sold. IFs were available from variable distances. Most respondents 8 (9.2%) indicated 1.5 h to 2 h as the times required to reach fruit sources while only 1 (1.1%) indicated 24 h. The implication of these results is that where longer times are involved to transport fragile fruits there is a danger of spoilage before reaching their selling points. This may require special packaging that will ensure their protection. During transportation and handling between fruit source and consumption,

losses ranging between 5 and 70% were reported by respondents. These losses are consistent with those reported by Mumba *et al.* (2002) who quoted values ranging from 10 – 58% depending on fruit type.

Table 26. Transport method used by sampled households for various fruits (n = 87)

Transport method	Number	Percent	Fruit
Foot	70	80.4	*T. indica, Vangueria infausta, Vitex doniana, S. florida, vitoja, S. guineense, A. digitata*, **fenesi, mbuda**, *A. senegalensis.*
Bicycle	9	10.3	*Vitex doniana, S. guineense*
Bus	8	9.3	**Vitoja, mizangwe**, *S. cocculoides*
Total	87	100.0	

Source: Candidate's research data (2002)

Table 26 shows the means of transport employed to bring specified fruits to the household compound. Three methods of transportation are used. The results indicate the fruits collection may involve walking, using a bicycle or bus transport. Walking was indicated by 70 (80.4%) as the most common method followed by bicycling 9 (10.3%) and use of bus 8 (9.3%). The results further indicate that more than one means of transport may be used for one fruit type. This is probably dependent on the distances involved. It is not surprising therefore, that an IFs trader would board a bus

to collect fruit from distances that would normally require 24 hours of walk as suggested earlier.

4.5 Fruit availability

Table 27. Duration of fruit availability as stated by sampled households (n = 87)

Duration (months)	Number	Percent
1	15	17.2
2	13	14.9
3	14	16.1
4	14	16.1
5	7	8.1
6	6	6.9
7	5	5.7
8	3	3.5
9	2	2.3
10	2	2.3
11	1	1.2
12	5	5.2
Total	**87**	**100.0**

Source: Candidate's research data (2002)

Table 27 shows the period for which IFs become available. The results show that fruits are widely available mostly for a short period i.e. 1 - 4 months. Respondents pointed out that although they may be available for more than four months, however, they are not accessible to all people. Increased trade can possibly offset the

localization of IFs. The short period of availability points to the need to process and preserve them so that they can be available during the off-season period.

Table 28. Fruits availability in villages within the studied area indicated by sampled households (n =87)

Village	Number	Percent
Mkambalani	10	11.5
Mlali	9	9.2
Mbete	8	10.3
Bigwa	5	5.8
Mchungo	5	5.8
Mzinga Camp	5	5.8
Kilakala	5	5.8
Peko	4	4.6
Lukuyu	3	3.4
Mungi	3	3.4
Other (35 villages)	30	34.4
Total	**87**	**100.0**

Source: Candidate's research data (2002)

Table 28 shows fruit availability by villages. It is apparent from these results that IFs are available virtually in all villages. However, the availability in Mkambalani was ranked first by 10 (11.5%) followed by Mlali 9 (10.5%) and Mbete 8 (9.2%).

Table 29. Distance to fruit source indicated by sampled households (n = 87)

Distance	Location	Number	Percent
Less than 100 m	Cultivated farms	14	16.1
100 m – 0.9 km	Nearby bush	29	33.3
1 – 5 km	Light forest	27	31.1
Greater than 5 km	Thick forest	17	19.5
Total		**87**	**100.0**

Source: Candidate's research data (2002)

Table 29 shows the distance from fruit source to homestead. The results show that the distances vary from less than 100 m (in cultivated farms) to over 5km in thick forest. These results are consistent with those observed earlier where it was reported that in some cases it takes 24 hours to walk to reach the source. Approximately, an equal number of respondents indicated that the IFs are available between 100 m and 5 km.

Table 30. Availability of common fruits at certain distances indicated by sampled households (n = 87)

Distance	Number	Percent	Fruit
Less than 100 m	9 – 13	10.3 – 14.9	*T. indica, S. birrea, S. guineense*
100m – 0.9 km	6 – 11	5.6 – 13.0	*T. indica, Vangueria infausta, Vitex doniana, S. birrea, S. florida, S. cocculoides*
1 – 5 km	6 – 10	5.2 – 11.5	*T. indica, Vangueria infausta, Vitex doniana, S. birrea, S. florida.*
Greater than 5 km	4 – 17	4.6 – 19.5	*T. indica, Vangueria infausta, Vitex doniana, S. birrea, S. florida,* **vitoja**

Source: Candidate's research data (2002)

Table 30 shows the mentioned distances for common fruits. The results indicate that there is no specific distance for a particular fruit. For example *T. indica* is found at distances ranging from less than 100 m to greater than 5 km. This means that some fruits are near homes while others are far away in the bush or forest. The varied distances imply that IFs can be accessed in all situations. This observation is consistent with the data in Table 29 that confirms that fruits are available in cultivated farms as well as in thick forests.

4.6 Indigenous knowledge and methods of processing and preservation of IFs

4.6.1 Fruits utilization in the villages

Table 31. Form in which indigenous fruits are consumed indicated by sampled households (n = 87)

Form consumed	Frequency	Percent
As they are	76	87.3
As juice	20	23.0
As jam/jelly	2	2.3
As wine/beer	2	2.3
Other	1	1.1

Source: Candidate's research data (2002)

Table 31 shows the form in which IFs are consumed and the proportion of respondents using a particular form. It is evident from the results that most 76

(87.3%) of respondents use the fruits in fresh form. The remaining use IF in the processed or other forms as juice 20 (23.0%), jam/jelly 2 (2.3%) or wine/beer 2 (2.3%). A limited number of IFs are preserved or processed.

Table 32. Preserved and processed indigenous fruits indicated by sampled households (n = 87)

Preserved			Processed		
Fruit	**Frequency**	**Percent**	**Fruit**	**Frequency**	**Percent**
T. indica	3	3.4	*T. indica*	38	43.6
Vitoja	3	3.4	**Vitoja**	11	12.6
A. digitata	2	2.3	**Fulu**	2	2.3
A. senegalensis	3	3.4	*S. birrea*	2	2.3
			Milimili	1	1.1
			S. florida	2	2.3
			Fifi	1	1.1
			Tangabua	1	1.1
			Buni	1	1.1

Source: Candidate's research data (2002)

Table 32 shows the list of preserved or processed fruits. Some of the IFs (*Tamarindus indica* and **vitoja**) undergo both processing and preservation while others undergo either processing alone or preservation. Preservation was practiced by only 3 (4.6%) of the 87 respondents. *Tamarindus indica* was the most processed 38 (43.6%) followed by **vitoja** 11 (12.6%). The remaining is processed by 10 (11.3%) of the respondents. It appears from the results that farmers do not have the knowledge of processing the fruits or they do not see the need to do so.

4.6.2 Fruit processing operations

Table 33. Application of specific operations to identified fruits indicated by sampled households (n =87)

Processing operation	Frequency	Percent	Fruit
Dehusking and storage in plastic bags	6	6.9	*T. indica, A. digitata*
Spreading in basin	23	26.4	**Vitoja, kweme**
Pounding and stirring	23	26.4	*A. digitata, T. indica, Vitex. doniana*
Soaking in water	23	26.4	*A. senegalensis, S. florida*
Peeling	30	34.5	*T. indica*
Extracting by boiling	25	28.7	**Milimili,** *S. florida*
Sorting and cutting	30	34.4	**Vitoja**
Peeling and soaking	20	23.0	*T. indica*, **buni**
Pressing juice	4	4.6	*S. birrea*, **vitoja, fifi**
Washing, drying, pounding and sieving	5	5.7	**Tanga bua**

Source: Candidate's research data (2002)

Table 33 shows applied processing operations to specified fruits. Various processing operations were reportedly used. They included sorting, peeling, washing, drying, pounding, sieving, stirring, cutting, extraction by boiling and soaking. About 38 (44%) of the operations concerned juice extraction operations. Varied processing operations are evident for different as well as similar fruit. The majority of respondents 20 – 30 (23.0 – 34.5%) sort, peel, cut, soak or pound and boil fruits in the course of processing them. However, there is no standardized processing procedure.

The resulting product is therefore expected to vary in quality depending on operations and efficiency. There is therefore a need to standardize their processing methods if their marketing potential has to be exploited.

Table 34. Added or removed components during specific fruit processing indicated by sampled households (n = 87)

Component	Applicable fruit	Frequency	Percent
Added			
Water and honey	*T. indica, Vitex.doniana*	12	13.3
Sugar	*T. indica, S. florida*	31	35.7
Sugar and water	*T. indica,* **vitoja, buni**	10	11.5
Yeast and sugar	*T. indica*, **fifi**	7	8.0
Ash	*S. birrea*	2	2.3
Cooking oil, onion and tomatoes	**Milimili**	4	4.6
Removed			
Seeds	*T. indica, furu, S. florida*, **vitoja, buni**	34	39.1
Husks	**Tanga bua**	25	28.7
Dirty	**Milimiki**	30	34.4

Source: Candidate's research data (2002)

Table 34 shows added or removed components during specific fruit processing. It is evident that during extraction different ingredients may be added or removed. The additives added include water, honey, sugar, yeast, ash, cooking oil, onion and

tomatoes. Sugar and water are the most common additives used by many farmers 31 (35.7%) followed by water and honey 12 (14.3%). The removed components include seeds, husks, and dirty in general. Seventy seven percent of the removed components are mainly seeds. There are reasons associated with adding and removing additives during processing.

Table 35. Reasons for added or removed component for specific fruit during processing indicated by sampled households (n = 87)

Reason	Frequency	Percent	Applicable fruit
Liquefy and sweeten fruit extract	27	31.3	*T. indica*, **fulu, buni**
Obtaining juice and planting seed	22	25.0	*T. indica*, *S. florida*, **vitoja**
Removing seed	16	18.8	*T. indica*, **vitoja**
Clearing juice	5	5.7	**Tanga bua**
Increasing sweetness and gas and killing bacteria	5	5.7	**Fifi**
For alcohol preparation	5	5.7	*S. birrea*
Taste/flavour	5	5.7	**Milimiki**

Source: Candidate's research data (2002)

Table 35 provides reasons for adding or removing components during fruit processing. Many respondents 27 (31.3%) use additives to liquefy the fruit and make it sweeter. This is followed by 22 (25%) who do it with intention of obtaining juice and planting seed and for extracting seeds 16 (18.8%). The remaining operations each

operations each have 5 (5.7%) proportions. The results further show that different fruits share the same process.

4.6.3 Source of knowledge in villages about fruit processing

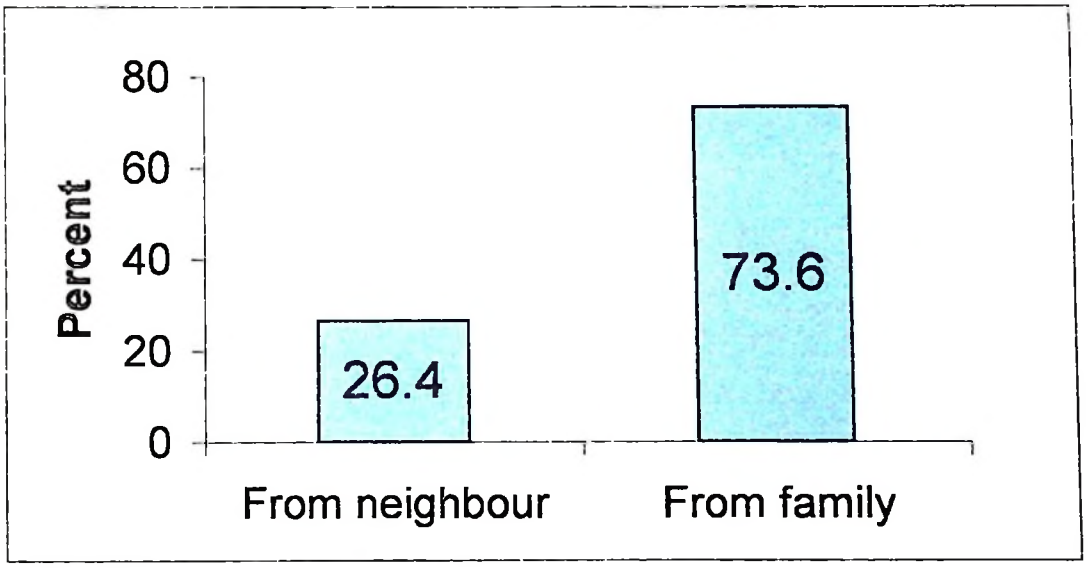

Fig. 9. Source of knowledge about used processing operations indicated by sampled household respondents (n = 87)

Source: Candidate's research data (2002)

Fig. 9 shows the source of knowledge about fruit processing operation. Most of the respondents 64 (73.6%) got the knowledge from their families while the remaining 23 (26.4%) received knowledge from neighbours. Knowledge about processing a certain fruit could either come from both family or neighbour. In some cases knowledge about processing a certain fruit was confined to one source only. For

family provided knowledge on the processing of *T. indica, Vitex doniana, S. birrea,* **Milimili, vitoja** and **tanga bua** whereas neighbours gave knowledge on *S. florida,* **fifi** and *T. indica.*

4.7 Village consumers attitudes towards consumption of IFs

Table 36. Attitudes of village consumers as frequency of agreement by sampled household respondents on aspect of IFs (n =87)

Aspect related to fruit consumption	Degree of agreement					
	Agree		Neither agree or disagree		Disagree	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
IFs are for children	24	27.6	11	12.6	52	59.8
IFs are for herders and firewood collectors	16	18.4	19	21.8	52	59.8
IFs are good for everyone	71	81.6	8	9.2	8	9.2
IFs are for villagers	27	31.1	16	18.4	44	50.5
IFs are for animals	8	9.2	8	9.2	71	81.6
IFs are good for health as exotic ones	63	72.4	12	13.8	12	13.8
IFs are good for health	8	9.2	8	9.2	71	81.6
IFs are poisonous	0	0.0	12	13.8	75	86.2
IFs are for tourists	4	4.6	12	13.8	71	81.6
IFs are for poor people	8	9.2	12	13.8	67	77.0

Source: Candidate's research data (2002)

The attitudes of consumers on certain ideas about IF are presented in Table 36. The results show variable levels of agreement. The respondents disagreed (with frequencies greater than 50 %) with the ideas that: IFs are for children, for headers, for firewood collectors, for villagers, for animals, for tourists, for poor people, poisonous and that are good for health. However, 71 (81.6%) of the respondents agree that IF are good for everyone as are the exotic ones. A small proportion of respondents 8 - 16 (9.2 – 18.4 %) were not sure about the ideas presented.

Table 37. Popularity of consumed indigenous fruits indicated by sampled households respondents (n = 87)

Fruit	Number	Percent
S. florida	12	13.8
T. indica	12	13.8
S. guineense	8	9.2
Furu	8	9.2
Vangueria infausta	8	9.2
S. birrea	4	4.6
S. cocculoides	4	4.6
A. digitata	4	4.6
Vitoja	4	4.6
Other (38 fruits)	23	26.4

Source: Candidate's research data (2002)

Table 37 shows the top ranking IFs consumed in the study area. The number proportion of respondents consuming specific IFs were 12 (13.8%) for *S. florida,* 12

(13.8%) for *T. indica* and 8 (9.2%) for S. *guineense*. The results show that the popularity of consumed IFs varies greatly. However, the level of willingness to consume indigenous fruit-based products is very high.

Table 38. Relative level of willingness of sampled households to consume products prepared using indigenous fruits (n = 87)

Product	Willing		Indifferent		Not willing	
	Number	Percent	Number	Percent	Number	Percent
Jam	80	92.0	7	8.0	0	0.0
Juice	78	89.7	7	8.0	2	2.3
Wine	79	90.8	8	9.2	0	0.0

Source: Candidate's research data (2002)

Table 39. Popular juice fruit sources by sampled household respondents (n = 87)

Fruit	Number	Percent
T. indica	16	18.4
S. florida	12	13.8
S. guineense	11	12.6
Vangueria infausta	8	9.2
S. birrea	8	9.2
A. digitata	8	9.2
Vitex doniana	4	4.6
Vitoja	4	4.6
Other (27 fruits)	16	18.4
Total	**87**	**100.0**

Source: Candidate's research data (2002)

Table 40. Popular wine fruits by sampled household respondents (n = 87)

Fruit	Frequency	Percent
S. florida	12	13.8
S. birrea	12	13.8
T. indica	12	13.8
Vangueria infausta	8	9.2
Vitoja	8	9.2
S. guineense	8	9.2
Furu	4	4.6
A. digitata	4	4.6
Other (20 fruits)	19	21.8
Total	**87**	**100.0**

Source: Candidate's research data (2002)

Results in Table 38 indicate that over 78 (89.7%) of respondents are willing to consume IFs in the form of jam, juice or wine. The ranking of used IFs juice sources are given in Table 39. Data show that *T. indica*, followed by *S. florida* and *Z. guanense* are the most highly ranked. However, for wine making, *S. florida, S. birrea* and *T. indica* are highly ranked by 12 (13.8%) respondents (Table 40).

4.7.1 Attitudes towards purchasing IFs in villages

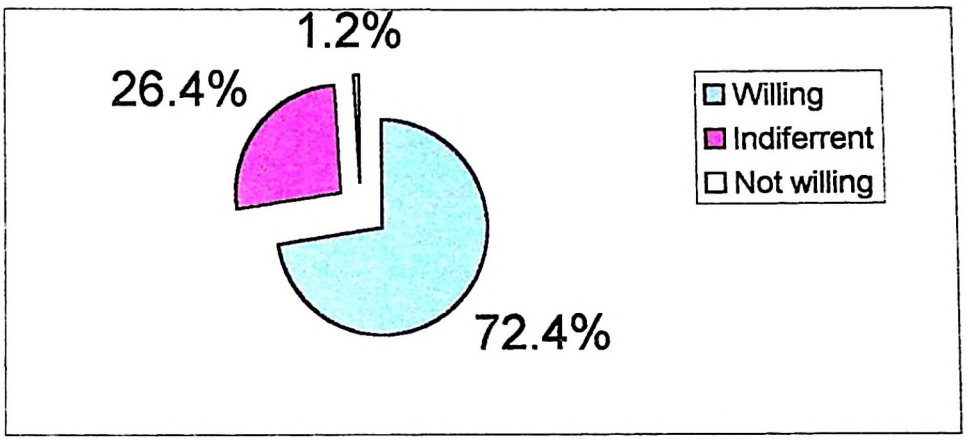

Fig. 10. Willingness to buy IF processed products by sampled household respondents (n = 87)

Source: Candidate's research data (2002)

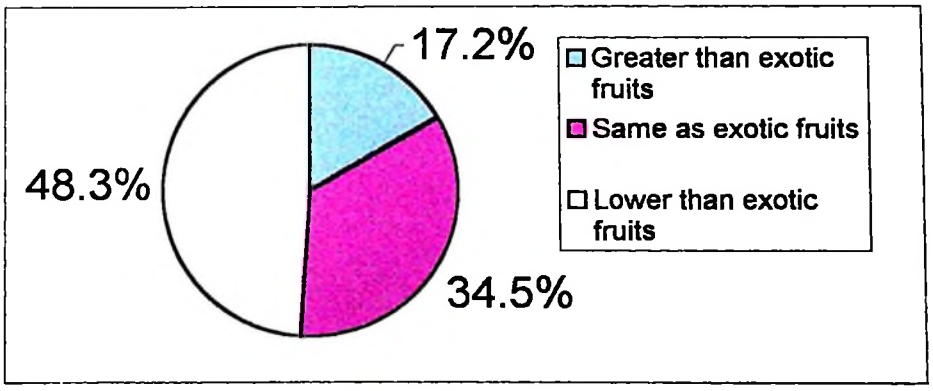

Fig. 11. Price willing to pay for IF processed products indicated by sampled respondents (n = 87)

Source: Candidate's research data (2002)

Figs. 10 and 11 depict the proportion of respondents willing to buy IF processed products and the price that they are willing to pay for them. The results show that a greater proportion 63 (72.4%) of respondents are willing to buy processed IFs (Fig. 10). However, the results in Fig. 11 show that 42 (48.3%) of these respondents are willing to buy processed IFs at lower price than exotic fruits. A smaller proportion 15 (17.2%) would pay greater price for IFs than for the exotic fruits. However, 30 (34.5% of the respondents were willing to pay the same price for IFs as for exotic fruits.

Table 41. Reasons of sampled household respondents for willingness to pay specific level of prices (n = 87)

Price of IFs	Reason	Frequency	Percent
Greater than for EFs	All are equal	8	9.2
	Ability to buy	7	8.0
	Delicious than EF	28	32.2
	High quality	12	13.8
	Longer distance source	8	9.2
	No modern dietary related disease	8	9.2
	Natural	8	9.2
	Good taste	8	9.2
Same as EFs	All are equal	60	69.0
	Ability to buy	4	4.6
	Fair	4	4.6
	Similar production cost	15	17.2
	Are many and for free	4	4.6
Lower than EFs	Ability to buy	28	32.2
	Not used to, preferred	8	9.2
	Similar production cost	8	9.2
	Are many and available for free	23	26.4
	Not aware of their nutritive value	4	4.6
	Sour	4	4.6
	EF are more nutritious	4	4.6
	Texture	4	4.6
	Locally available	4	4.6

Source: Candidate's research data (2002)

Table 41 presents reasons given by respondent for paying a certain price for IFs relative to exotic fruits. The main reasons given for paying greater price for IFs than for EFs were: being delicious and being considered of high quality. For paying same price as EFs respondents 60 (69.0%) considered IFs as being equal to EFs. Those respondents who were willing to pay lower price reasoned that IFs are many and available for free 23 (26.4%) and also due to the inability to buy 28 (32.2%).

4.7.2 IF product consumption quality factors in villages

Table 42. Percent of response scoring important quality factors when consuming specific fruit indicated by sampled household respondents (n = 87)

Fruit product	Quality aspect									
	Colour		Texture		Sweetness		Sourness		Taste	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Dried fruit	11	12.6	28	32.2	40	46.0	4	4.6	4	4.6
Juice	15	17.2	32	36.8	32	36.8	4	4.6	4	4.6
Squash	15	17.2	32	36.8	28	32.2	8	9.2	4	4.6
Jam	15	17.2	28	32.2	36	41.4	4	4.6	4	4.6
Wine	15	17.2	28	32.2	32	36.8	8	9.2	4	4.6

Source: Candidate's research data (2002)

Table 42 contains data on the important quality aspects and associated frequencies for various IF products. The results indicate varied importance attached to different IF

products. The most appreciated quality attributes are sweetness (32.2 – 46.0%) followed by texture (32.2 – 36.8%) and colour (12.6 – 17.2%).

Table 43. Buying quality factors of IF indicated by sampled household respondents (n = 87)

Quality parameter	Frequency	Percent
Taste	44	50.6
Colour	23	26.4
Smell	4	4.6
Appearance/shape	4	4.6
Texture	4	4.6
Price	4	4.6
Other*	4	4.6

*Include nutritive value and ripening

Source: Candidate's research data (2002)

Table 43 indicate valued quality factors when buying IFs. The results suggest that when consumers decide to buy IFs 53 (60.9%) value taste and 23 (26.4%) value colour as being important. IFs are sold by taking them to buyers or buyers going for them.

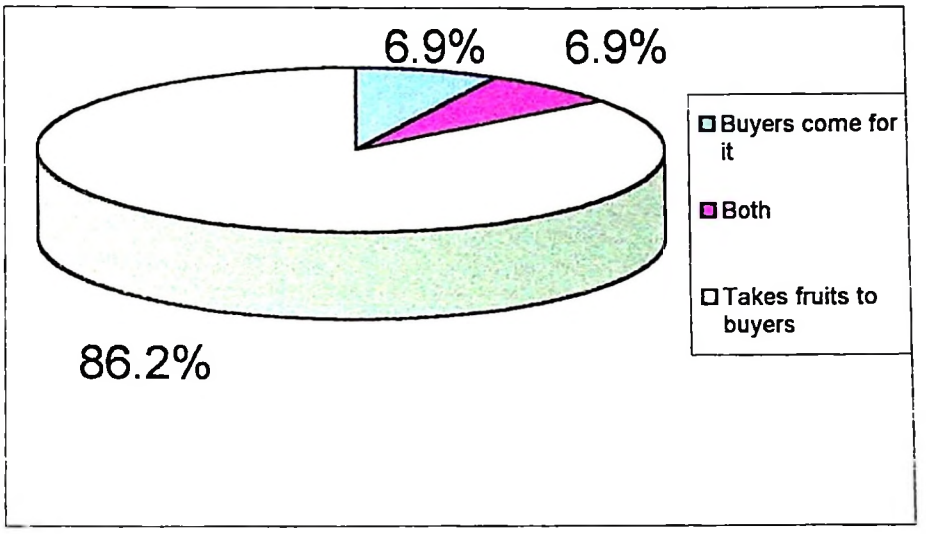

Fig. 12. Ways of selling IFs by sampled household respondents (n = 87)

Source: Candidate's research data (2002)

Fig. 12 shows the way of selling IFs. The results show that the majority 75 (86.5%) of sellers takes the fruits to buyers. This shows that most consumers do not see the need to make a follow-up for IFs from source, perhaps because of not appreciating their importance.

4.7.3 Suggestions for increasing contribution of IFs to food security

Table 44. Suggestions given for fruits increased contribution to food security by sampled household respondents (n = 87)

Suggestion	Number	Percent
Education on importance	27	31.0
Domestication of fruit research	12	13.8
Provide seed and reliable market	8	9.2
Massive production	4	4.6
Establish nursery trees	4	4.6
Create sustainable market	4	4.6
Promote IFs	4	4.6
Market development for IFs	4	4.6
Develop packaging and storage techniques	4	4.6
Other*	16	18.4
Total	**87**	**100.0**

* Include: emphasize IFs as EFs, cultivate them, popularize fruits, promote as source of income and diet, government to provide reliable transport, provide land for growing fruits, technology and storage technique needed, enact bylaws to prevent deforestation, education and support for cultivation and processing.

Source: Candidate's research data (2002)

Table 44 lists some of the suggestions that would increase the role of IFs in contributing to improved food security. IFs are considered important in contributing to better food security. The main suggestion (with percentage response in brackets) includes giving education on importance of IFs (31.0%), research on domestication of IFs (13.8%) and provision of seed and reliable market (9.2%). Domestication of IFs would reduce their rate of disappearance as acknowledged by Swai *et al.* (2000).

4.8 Factors that limit the utilization of indigenous fruits and fruit produces in the study area

4.8.1 Demographic characteristics of IFs traders

Five IF collectors were interviewed. Indigenous fruits (IFs) collectors were from two villages mainly from Choma 4 (80.0%) and 1 Chamwino (20.0%). These villages are in Mlimani and Mazimbu wards, respectively. All collectors were males without formal education 2 (40%) or with primary education 3 (60%). Four (80%) of the respondents were married while 1 (20%) was single.

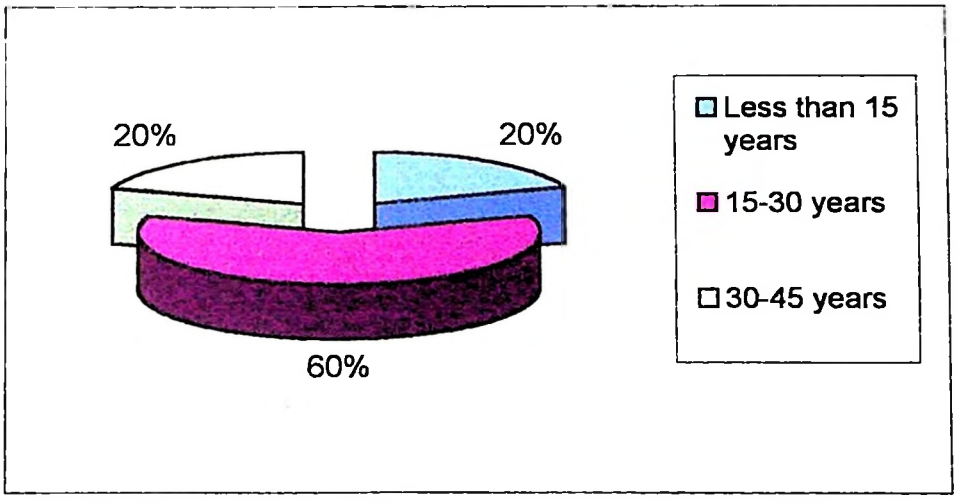

Fig. 13. Age distribution of sampled traders (n = 5)

Source: Candidate's research data (2002)

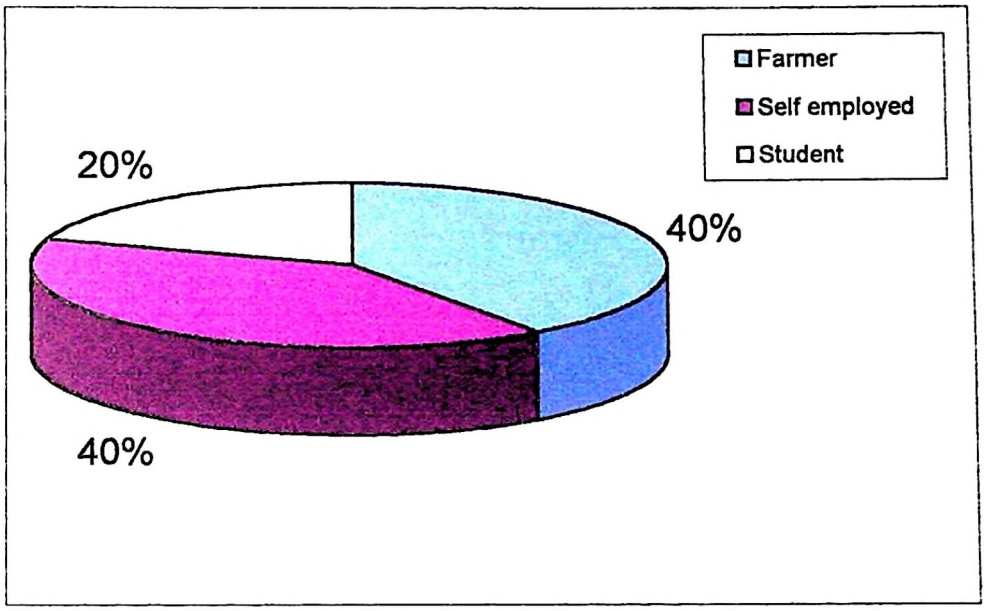

Fig. 14. Main occupation of sampled traders (n = 5)

Source: Candidate's research data (2002)

The age distribution of the 5 respondents is given in Fig. 13. The illustration shows that the majority of respondents 3 (60%) were within 30-45 year age ranges. An equal number of the remaining respondents were less than 15 years of age or between 15 and 30 years. Fig. 14 shows that apart from IF trading the respondents were either self employed 2 (40%), farmers 2 (40%) or students 1 (20%).

4.8.2 Fruit trade

According to the respondents the major IFs traded, in order of decreasing importance, are *S. florida, S. guineense,* **vitoja,** cherries, black berries, raspberries and gooseberries. These results are consistent with observations reported by farmers in the five administrative wards covered.

Table 45. Average traded quantities of IFs indicated by sampled traders (n = 5)

Quantity	Frequency	Percent
50	2	40
100	2	40
6 00	1	20
Total	**5**	**100**

Source: Candidate's research data (2002)

Table 45 shows the quantities of IF that are traded. The results show that the traded quantities vary considerably from as small as 50 kg to as high as 600 kg. Most traders 2 (40%) trade quantities of between 50 and 100 kg. The small quantities handled by the majority of traders suggest low demand for the fruits. This proposition is in line with what has been reported earlier that a lot of fruit is uncollected and therefore left to rot. Most respondents 4 (about 75%) stated that they take fruits to buyers while the remaining 1 (about 25% either take the fruits to buyers or let the consumers go for them.

4.8.3 Price and income from IFs

Table 46. Price offered by traders for IF per kilogramme of gooseberry indicated by sampled traders (n = 5)

Price (TSh.)	Number	Percent
100.00	2	40.0
800.00	1	20.0
1 000.00	2	40.0
Total	**5**	**100.0**

Source: Candidate's research data (2002)

Table 46 presents data of the price offered for one kilogramme of gooseberry. However, the price offered for IFs varies with fruit type, buyer and season. According to these results two (40%) respondents reported lower price of TSh. 100.00 per kilogram. A higher price of up to TSh. 1 000.00 per kilogram of fruit is also obtainable.

Table 47. Average income (TSh.) obtained in one season indicated by sampled traders (n = 5)

Income (Tsh.)	Frequency	Percent
25 000.00	1	20.0
50 000.00	1	20.0
70 000.00	1	20.0
80 000.00	2	40.0
Total	**5**	**100.0**

Source: Candidate's research data (2002)

Table 47 gives an average income obtained by a single IFs trader in one season. The data shows that 2 (40%) respondents earn an income of between Tsh. 80 000.00 during one season. Calculations based on the average income of TSh. 1 791 043.00 in the study area earn an average income of TSh. 50 000.00 earned by collectors indicate that about 3% of the income is due to IFs. This is indeed a small contribution but has a great potential if the issues rose on consumer attitudes and constraints towards IFs utilization are seriously addressed. As long as greater proportion of IFs are left uncollected, their full potential would remain unexploited. Local people who reside in areas where IFs are found can benefit by selling them to the traders. The appreciation of their value could therefore lead to the protection of trees where the fruits grow. This action would naturally improve the income status of people involved thereby improving the food and nutrition security. In addition, as a consequence of protecting the trees, the conservation of environment will be achieved.

4.8.4 Constraints of IFs trade

Table 48. Collection constraints and level of agreeing indicated by sampled traders (n = 5)

Constraint	Frequency	Percent reported
Availability of time	1	20.0
Distance from source	3	60.0
Geographical location of fruit	1	20.0
Quick spoilage	3	60.0
Lack of storage facilities	2	40.0
Lack of buyers	5	100.0
Lack of knowledge on use or value	4	80.0

Source: Candidate's research data (2002)

Table 48 summaries these constraints of IFs collection. The collection and trade in IF is constrained by a number of factors. It is apparent from these results that the number one constraint that affects all traders is lack of buyers as pointed out by all five traders (100%), followed by lack of knowledge on use or value 4 (80%), post-harvest spoilage 3 (60%) and long distance from source 3 (60%). This means that if promotion of IFs trade was to be instituted it would be necessary to target on the main constraints identified. These constraints have also been cited by other workers (Mumba *et al.* 2000). These authors stated that only about 30% of the total available fruit is harvested from the forest for home consumption and marketing. Depending on the fruit species, between 10 and 58% of fruit rot once brought home due to high perishability and lack of storage facilities in rural areas. In Zimbabwe, Kadzere *et al.*

(2002) reported that the shelf life that range from less than four days (in the case of fresh ripe *U. kirkiana*) to more than one year in the case *of A. digitata* and sun-dried *Z. mauritiana.*

Through interviews with sampled trader respondents in Morogoro, it was stated that there are a number of problems pertaining to fruit IF transportation. However, only one (20%) trader acknowledge existence of transportation problem. The most affected fruits were ***S. florida*** and *S. guineense*. They were affected by spoilage through rotting. However, the respondents mentioned the use of grass fabricated crates ("tengas") and proper packaging as being the measures used to reduce losses. The commonly packaged fruits include *S. florida, S. guineense*, gooseberries and cherries. The respondents stated that poor handling during harvesting, storage and transportation were the causes of post-harvest fruit loss.

4.8.5 Availability trends

Results obtained through interviews with sampled traders showed that the majority of the respondents 4 (80%) stated that over the past three years (1998 - 2001) IFs availability was decreasing while the remaining thought they were increasing. The difference in responses could be attributed to variation in climatic conditions between the two main fruit sources. Choma village that is in the mountain areas continuously enjoys better and relatively consistent climate than Mazimbu. Three (60%) respondents reasoned out that other factors for the observed changes are mainly due to

increased users (consumers) of IFs, one (20%) due to deforestation and one (20%) due to increased trade on IFs. The increasing demand for IFs increases the number of new traders that in turn reduce the quantity of fruit traded by an individual trader.

Change in price trend during the past three years was also reported. Two (40%) respondents reported increasing trend or no change while one (20%) reported decreasing trend. The reasons given for the changes (with equal importance) were mixed. They included increased or decreased demand or unchanged demand. However, four (80%) of the respondents agreed that IFs can contribute to increased income of those involved in IFs trade. The following suggestions (with equal importance) were suggested for sustainable contribution of IFs to food availability: education on importance of IFs, creation of sustainable markets for IFs, offer of education and support on IFs processing and capital for those involved in IFs trade.

4.9 Attitude of urban consumers towards the consumption of indigenous fruit and fruit products in the study area

4.9.1 Demographic characteristics of sampled urban consumer respondents

Table 49. Distribution of sampled urban consumer respondents by villages/streets ("mitaa") in Morogoro Municipality (n =22)

Village/Street	Number	Percent
Kaunda	1	4.5
SUA	8	36.4
Kitope	4	18.2
Mazimbu	2	9.2
Misufini	1	4.5
Sabasaba	2	9.2
Tumbaku	1	4.5
Nunge	1	4.5
Forest Hill	1	4.5
Uhuru	1	4.5
Total	**22**	**100.0**

Source: Candidate's research data (2002)

Table 49 gives the distribution of 22 urban consumer respondents by area/street of residence. These results show that the majority of the consumers were from SUA. Most of the respondents 13 (59.1) were females.

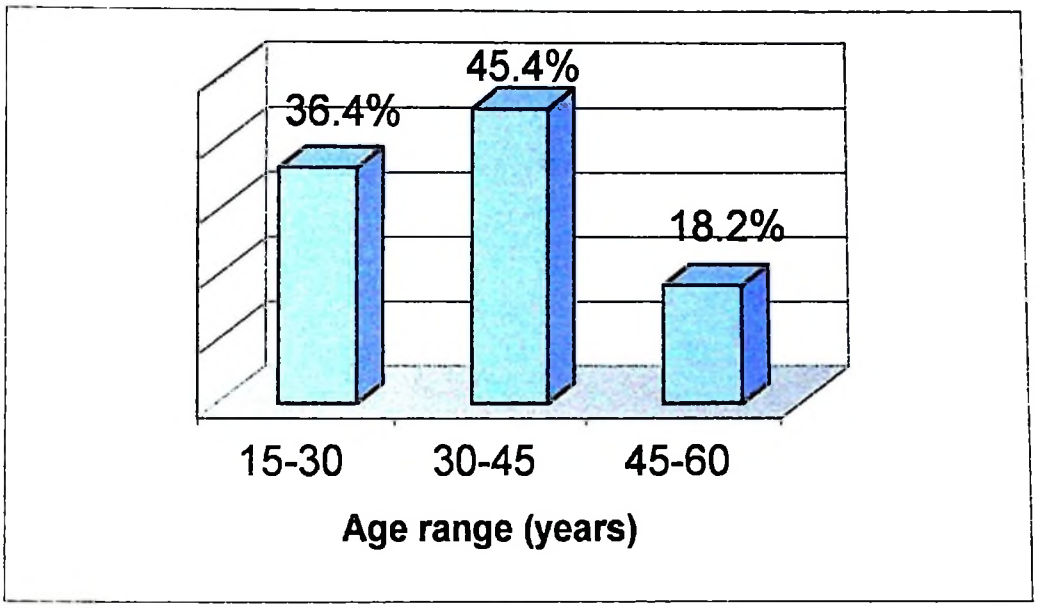

Fig.15. Age distribution of sampled urban consumer respondents (n = 22)

Source: Candidate's research data (2002)

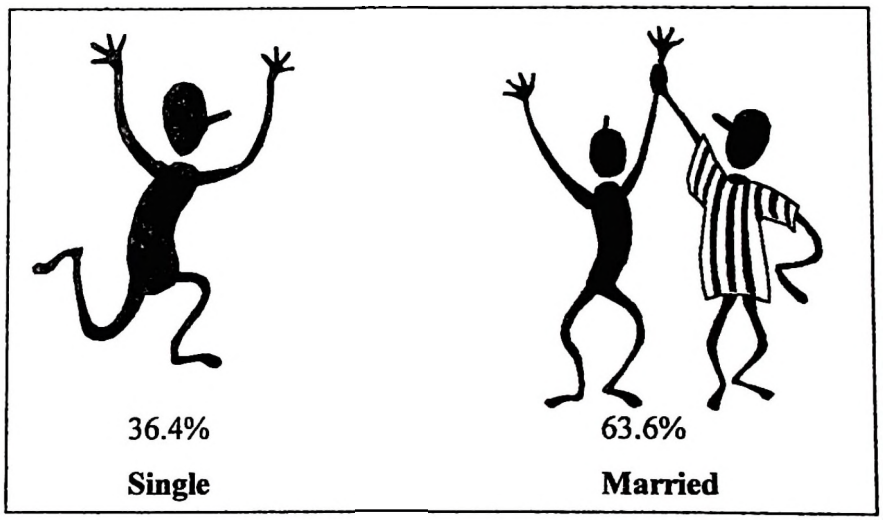

Fig. 16. Marital status distribution of sampled urban consumer respondents (n = 22)

Source: Candidate's research data (2002)

Fig. 15 depicts age distribution of respondents. Most of the respondents 10 (45.4%) were in the 30 - 40 years age bracket. The next group 8 (36.4%) was the young age group (15 - 30 years). The distribution of respondents by marital status (Fig. 16) shows that 14 (63.6%) are married and 8 (36.4%) single.

Table 50. Distribution of sampled urban consumer respondents by education (n = 22)

Education level	Number	Percent
Primary	1	4.5
Secondary	4	18.3
College	3	13.6
University	14	63.6
Total	**22**	**100**

Source: Candidate's research data (2002)

Table 51. Distribution of sampled urban consumer respondents by main occupation (n = 22)

Main occupation	Number	Percent
Paid employee	11	50.0
Self employed	4	18.2
Student	7	31.8
Total	**22**	**100.0**

Source: Candidate's research data (2002)

Tables 50 and 51 show the education and main occupation distribution of respondents. Table 50 shows that most of the respondents had university education 14

(63.6%) followed by secondary school 4 (18.3%). The majority of respondents were paid employees 11 (50%) and four (18.2) were self-employed. Others were students.

4.9.2 Fruit consumption habits of sampled urban consumer respondents

Table 52. Distribution of sampled urban consumer respondents by the form of fruit consumption (n =22)

Fruit form	Frequency	Percent
Fresh	22	100.0
Fermented	3	13.6
Dried	7	31.8
Juice	22	100.0
Jam and Jelly	17	77.3
Fruit leathers	0	0
Squash	15	68.2
Wine	11	50.0
Spirit	1	4.5

Source: Candidate's research data (2002)

Table 52 shows the distribution of respondents by the form of fruit consumption. All respondents consumed fruits in fresh or processed form. The results show that all respondents consume fresh fruit and juice but had never tasted processed fruit leathers. However, a considerable proportion does consume fruit jam or jelly 17 (77.3%), squash 15 (68.2%) and wine 11 (50%). Small proportions of respondents do consume fruits in the form of fermented products three (13.6%) and spirit one (4.5%). The respondents therefore, have an experience of nature and quality of fruit and fruit

products. This enables them to evaluate or form a valid experience and expresses their attitudes on IFs in their fresh or processed forms.

Table 53. Attitude of sampled urban consumer respondents towards IFs consumption in frequencies and percentages of IFs (n = 22)

Aspect related to fruit consumption	Agree		Neither agree nor disagree		Disagree	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
IFs are for children	2	9.1	3	13.6	17	77.2
IFs are for herders and firewood collectors	2	9.1	2	9.1	18	81.8
IFs are good for everyone	20	90.9	1	4.5	1	4.5
IFs are for villagers	3	13.6	1	4.5	18	81.8
IFs are for animals	3	13.6	2	9.1	17	77.2
IFs are as good for health as cultivated ones	18	81.8	2	9.1	2	9.1
IFs are not good for health	0	0	1	4.5	21	95.4
IFs are poisonous	0	0	3	13.6	19	86.4
IFs are for tourists	0	0	3	13.6	19	86.4
IFs are for poor people	0	0	1	4.5	21	95.4

Source: Candidate's research data (2002)

The attitudes of consumers towards some IFs consumption are given in Table 53. Over 17 (77.2%) of the respondents disagreed with the ideas that IFs are for children, for herders and firewood collectors, for villagers, for animals, not good for health, for tourists, for poor people or are poisonous. However, over 18 (81%) of the respondents agree that they are good for everyone and that they are as good for health as are the

exotic ones. A small proportion of the respondents one (4.5% – three (13.6%) did not have definite opinion about these ideas. These results are closely consistent with the attitudes indicated by local people where IFs are found (section 4.6). A minor difference noted between the opinions of local people in areas where IFs are found and those from the general public interviewed is probably due to the difference in the level of education between the two groups. The latter are more educated and therefore could have opinion based on experiences that is influenced by formal education.

4.9.3 Buying IF Products

Table 54. Price for IFs relative to EFs that sampled urban consumer respondents would be willing to pay (n = 22)

Price for IF products	Number	Percent
Greater than for EFs	2	9.0
Same as for EFs	10	45.5
Lower than for EFs	10	45.5
Total	**22**	**100.0**

Source: Candidate's research data (2002)

The results in Table 54 show the level of price for IF products relative to EF that respondent would be willing to pay. The results show that most respondents 10 (45.5%) would be willing to pay lower or same price for IFs as for EFs. Only two (9%) of respondents would pay greater price than for EFs.

There were differences based on education level on willingness to pay a certain price for indigenous products relative to EFs. Primary school level-respondents were willing to pay lower price for IFs than EFs while secondary level education respondents were willing to pay same price and lower price. The university graduates had split decision. Some of the graduates, two (10%) were willing to pay greater price, 10 (45%) same price or lower price, 10 (45%).

The respondents expressed varied reasons for the level of prices they indicated willing to pay. The most important reason for willingness to pay less for IFs was that the IFs were obtained at significantly low price and sometimes at no cost. Those who indicated willingness to pay higher price for IFs stated that IFs were not polluted by chemicals but their collection from forests and bushes was tedious.

4.9.4 Buying quality for IFs

Table 55. Quality attributes considered important for buying IF indicated by sampled urban consumer respondents (n = 22)

Quality attribute	Number	Percent
Appearance	6	27.4
Taste	5	22.7
Nutrient content	5	22.7
Colour	3	13.6
Market price	2	4.5
Other*	2	9.1
Total	**22**	**100.0**

*Include, size and smell.

Source: Candidate's research data (2002)

The results on quality attributes that are considered important when buying IFs are summarized in Table 55. The data indicate that consumers attach varied importance to different quality attributes when buying IFs. Of the five main attributes evaluated, over 6 (22%) of consumers considered appearance, taste and nutrient content as the most important.

4.9.5 Willingness to consume IFs and IFs products

The consumers stated that the three most important IFs consumed were *T. indica* 7 (30.3%), *A. digitata* 7 (30.3%) and *S. florida* 3 (15.2%). The remaining collective proportion 5 (33.3%) indicated consumption of a variety of IF including **maswisa, mitowo, votoja, minyapi, *Uapaca kirkeana*, songwe, zabibu pori, *S. birrea*, nyanya pori**, *Vitex doniana*, **misasawati, mpulu and mbiku**. These fruits were consumed either in fresh or processed form.

Table 56. Level of willingness to consume IFs in a specified product form indicated by sampled urban consumer respondents (n = 22)

Fruit form	Fruit type	Willing		Not willing	
		Frequency	Percent	Frequency	Percent
Juice	*S. guineense, T. indica, A. digitata*, **msasati,** *Clotaria brevidens*	21	95.5	1	4.5
Jam	*S. guineense, T. indica, A. digitata*	19	86.4	3	13.6
Wine	*S. guineense, T. indica, A. digitata*	13	59.1	9	40.9

*The remaining of the respondents was indifferent.

Source: Candidate's research data (2002)

Table 56 gives the fruits and processed fruit form of jam, juice and wine and the proportion of respondents willing to consume the products. The results show that a

very high proportion 21 (95.5%) of the respondents are willing to consume S. *guineense, T. indica, A. digitata, Clotaria brevidens* and **msasati** in the form of juice while 19 (86.4%) are willing to consume *S. guineense, T. indica and A. digitata* in the form of jam. Only 13 959.1%) were willing to consume wine that had been fermented from the juice. All respondents were also willing to buy, jam, juice and wine prepared from *T. Indica* and *A. digitata* and *Clotaria brevidens.*

4.9.6 Consumption factors for processed IFs

Table 57. Relative importance of factors for consuming processed fruit products pointed out by sampled urban consumer respondents (n = 22)

Quality parameter	Dried fruit		Wine		Jam		Squash		Juice	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Colour	4	18.2	3	13.6	5	22.8	6	27.3	6	27.3
Texture	7	31.8	3	13.6	3	13.6	2	9.2	1	4.5
Sweetness	11	50.0	16	72.8	14	63.6	14	63.8	15	68.2
Total	22	100.0	22	100.0	22	100.0	22	100.0	22	100.0

Source: Candidate's research data (2002)

Table 57 shows the relative importance of factors for consuming processed IFs products. Based on the main quality parameters of colour, texture and sweetness, it is apparent from these results that sweetness was valued by the highest proportion 11 - 16 (50.0 – 72.8%) of respondents for all product forms. However, it was more

important in wine 16 (72.8%) and juice 15 (68.2%). These results imply that when developing IFs processed products it may be important to consider sweetness first followed by texture and colour.

4.9.7 General fruit-based products preference by consumers

Through interviews with sampled urban consumer respondents it was possible to identify preference differences for different IFs. Compared to EFs a total of 14 (66.7%) preferred IFs. *A. digitata* was preferred by 8 (33.3%) and the remaining 8 (33.3%) preferred *S. florida* and *A. digitata* products. Only the respondents with university education preferred *T. indica*. All university graduates preferred jam from all types of fruits as follows: *S. florida*, one (4.5%); *T. indica*, two (9.1%); *A. digitata*, 6 (27.2%); orange, two (9.1%); mango, one (8.3%) and passion, one (4.5%). The preference by university graduates for jam from all fruit types is perhaps explained by the education they have on the value of fruits. A similar trend of preference was observed for fruit juice, however, with greater proportion for *T. indica* (30.3%) instead of *A. digitata* 5 (22.7%). When assessed for wine production, *S. florida* 11 (50%) followed by *T. indica* 6 (27.2%) and *A. digitata* 6 (27.2%) were preferred. Secondary school graduates preferred *S. florida* wine, college graduates (*T. indica* wine) while university graduates preferred both *S. florida* and *A. digitata* wine.

4.10 Attitudes of women food processors in Morogoro district and Dar es Salaam towards processing of indigenous fruit products

4.10.1 Demographic characteristics of sampled respondents

The characteristics of individuals may influence their attitudes towards a certain concept. For example, age and education may affect decisions and ability to try a new idea.

Table 58. Distribution of sampled fruit processor respondents by district (n = 9)*

District	Number	Percent
Temeke	1	11.1
Kinondoni	3	33.3
Kisarame	1	11.1
Morogoro	3	33.3
Ilala	1	11.2
Total	**9**	**100**

* Discussion of these results are given on page

Source: Candidate's research data (2002)

Table 59. Age distribution of sampled fruit processor respondents (n = 9) *

Age (years	Number	Percent
15 – 30	1	11.1
30 – 45	3	33.3
45 – 60	3	33.3
Over 60	2	22.3
Total	**9**	**100.0**

* Discussion of these results are given on page

Source: Candidate's research data (2002)

Table 60. Distribution of sampled fruit processor respondents by education (n = 9)

Education level	Number	Percent
Primary	1	11.1
Secondary	3	33.3
College	4	44.5
University	1	11.1
Total	**9**	**100.0**

Source: Candidate's research data (2002)

The distribution of respondents by district of residence is given in Table 58. The results show that most of the respondents 3 (33.3%) are located in the Kinondoni district in Dar es Salaam and in Morogoro districts 3 (33.3%). The age distribution of the respondents is given in Table 59. It is apparent from these data that the majority of the processors fall between 30 - 60 years. A larger proportion of the respondents 8 (90%) were married and only one (10%) was single. Most processors 4 (44.5%) had

received college education, 3 (33.3%) had completed secondary education and a small proportion was composed of university graduates (Table 60). Most of them were self-employed 7 (81.8%) and 2 (18.2%) were paid employees.

4.10.2 Fruit processors' attitudes towards IFs processing

Table 61. Attitude of sampled fruit processor respondents towards processing IFs in frequencies and percentages (n = 9)

Aspect related to fruit processing	Degree of agreement					
	Agree		Neither agree not disagree		Disagree	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
It is possible to process IFs just as it is for EFs	9	100	0	0	0	0
IFs are not suitable because they are not available in large quantities	2	22.2	5	55.6	2	22.2
IF are not suitable because they are very expensive than the EFs	1	11.1	2	22.2	6	66.7
IFs are not suitable because nobody knows about then	2	22.2	5	55.6	2	22.2
IFs processing methods are not known	2	22.2	2	22.2	5	55.6
IFs are for use by local people only	1	11.1	2	22.2	6	66.7
Commercializatio5n of33.3 IFs would lead to competition with outsiders	5	55.6	3	33.3	1	11.1
We do not process IFs because we know nothing about them	3	33.3	1	11.1	5	55.6
We do not process IFs because we do not know who will buy them	0	0	4	44.4	5	55.6

Source: Candidate's research data (2002)

Table 61 shows data on processors attitudes on processing IFs. The results present mixed attitudes on IFs processing. However, all processors (100%) agreed that it was possible to process IFs just as it is for EFs. A considerable proportion 2 (22.2%) to 5 (55.6%) agreed that IFs processing are not suitable because they are not available in large quantities, the processing methods are not known, their commercialization would lead to competition with outsiders and that fruit processors may not have general knowledge about them and how they are processed. However, a higher proportion of respondents 6 (66.7%) disagreed with the idea that IFs are not processed because they are more expensive than EF and that they are for use by local people only. A considerable proportion 2 (22.2%) disagree with the idea that IFs are not processed because they are not available in large quantities, nobody knows about them 2 (22.2%), the processing methods are unknown 5 (55.6%), nothing is known about them 5 (55.6%) or there is no known market 5 (55.6%) for them. Some respondents 5 (55.6%) neither agreed nor disagreed about the ideas that IFs are not processed because they are not available in large quantities, no body knows about them and its market demand is unknown.

4.10.3 Willingness to process IFs Products

All processors (100%) respondents expressed willingness to process IFs. However, in order to process IFs the respondents required raw materials (IFs), processing machines and packaging materials. Two IFs products were mentioned as being the

candidates for processing. Pickles were mentioned by 8 (88.9% respondents while Roselle (*Hibscus subdafiffa*) was mentioned by only one (11.1%) respondent. Seven (77.7%) respondents further indicated to have knowledge of small scale food processors engaged in IFs processing. In addition, the respondents stated that the processing of IFs did not require technology that was different from EFs, however, all respondents indicated that if taught technology for IFs processing they are willing to include them in their business.

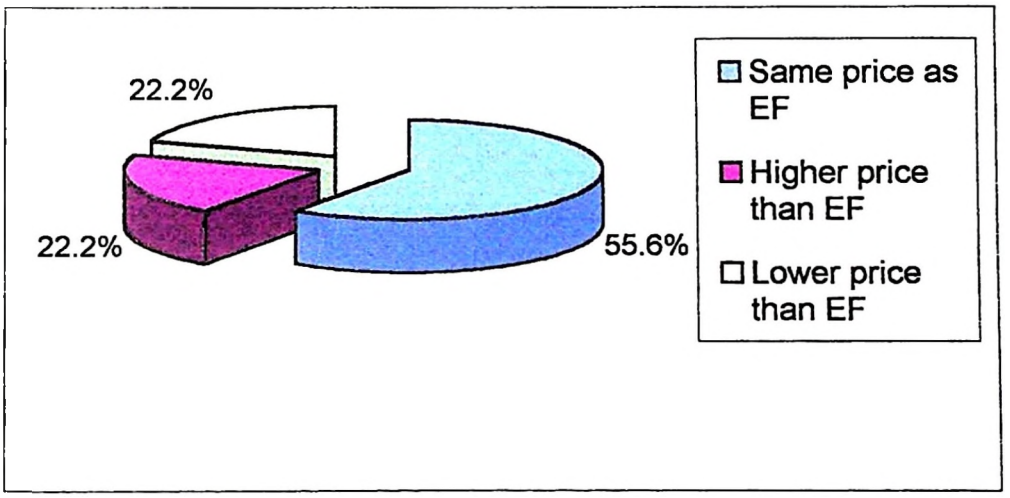

Fig. 17. Price that would be asked for processed IFs as indicated by sampled fruit processors (n = 9)

Source: Candidate's research data (2002)

Fig 17 shows the price that would be charged for processed IFs.The respondents contend that if they processed IFs most of them 5 (55.6%) would sell them at same price as EF products. Very few, two (20%) would sell either at higher or lower price.

Table 62. Products prepared from specific fruit or vegetable indicated by sampled fruit processors (n = 9)

Fruit/vegetable	Product (s)	Frequency	Percent
Mango	Pickle, jam, dried	4	44.4
Pineapple	Jam	2	22.3
Banana	Jam	1	11.1
Roselle	Wine		
Mbilimbi	Pickle		
Tomatoes	Tomato sauce, tomato paste	2	22.2
Pawpaw	Jam		
Guava	Jam		

Source: Candidate's research data (2002)

Table 62 shows the major fruit/vegetable handled and the products manufactured from them. The major fruits handled by respondents were mango, roselle, pineapples, pawpaw, bananas, guava and *Sclerocarya birrea*. They are processed in the dried form, juice, jam, wine and chutney. In addition, the processors have the technologies to process vegetables such as wild star fruit (mbilimbi), tomatoes and peanuts in the form of pickles, sauce and pastes.

The respondents indicated that the most popular manufactured products are pickles 4 (44.4%), jam 2 (22.3%), tomato sauce one (11.1%) followed by others 2 (22.3%) that include dried fruits, wine, juice and peanut paste. Mumba *et al.* (2002) reported that in a survey carried out in Tabora region of Tanzania, only (15%) of the respondents who

were mostly women process IFs into juice, local brews, wines and cakes using traditional methods. Preservation through sun-drying was reported to prolong shelf life of the fruits of *P. curatellifolia* and *Z. mauritiana* (Kadzere *et al.*, 2002).

Table 63. Ranking of factors identified as important for IFs processing indicated by sampled fruit processor respondents (n = 9)

Factor	Frequency	Percent
Raw materials availability	4	44.4
Availability of packaging materials	3	33.3
Promotion and marketing	2	22.3
Total	**9**	**100**

Source: Candidate's research data (2002)

Table 63 shows ranking of the important factors for IFs processing. According to these results, raw materials availability was considered as the most important factor ranked by 4 (44.4%) for processing indigenous fruits followed by availability of packaging material 3 (33.3%) and marketing promotion 2 (22.3%). Thus, these are some of the most important factors promoters of IFs processing need to consider. As discussed above, the availability of IFs is seasonal; therefore, they have to be made available for processing within a short time.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the study main objective, namely, to assess the contribution and potential of indigenous fruits to household food security in the Uluguru mountain areas in Morogoro district. The following can be concluded.

(i) In the study area there is some degree of food insecurity, particularly during the rainy season when most crops are growing occur yearly.

(ii) It is evident from the study that there is a considerable number of indigenous fruits available in the study area. However, limited members of the community know the existence of these fruits particularly the elders.

(iii) The indigenous fruits available in the study area are grossly under utilized. Very little of IFs is collected and consumed, leaving a lot to rot in the wild. IFs offer a minor contribution to household food availability and income. However, they are used as a snack or as part of the meal.

(iv) Processing of some fruits is practiced to a lesser extent mainly in preparation of juice and alcoholic drinks. Many community members are

not aware of their value and technologies for processing and handling them. However, small-scale fruit processors are aware of the existence of IFs and are willing to process them when available in adequate quantities.

(v) This study has proved that consumers of fruits are willing to consume IFs in fresh or processed forms. However, consumers demand certain quality of fruits or processed ones. Consumers attach greater utility value to IFs because they are "natural" i.e. free from chemicals, etc. These fruits therefore, have great potential in trade and contribution to nutrient supply.

(vi) Some trade on IFs is ongoing but involving a limited number of people and fruits. It has become apparent that the main reasons for limited trade is lack of demand and poor post harvest handling practices that results in losses due to spoilage. Other limitations include absence of technical storage facilities in production areas, at local as wellas urban markets, transport and packaging facilities of these fruits.

(vii) Overall, the study has provided the evidence that there are a lot of indigenous fruit resources growing naturally in the communities. These fruits, which are known to the communities, are acceptable for human consumption, but the utilization is limited to factors that include lack of knowledge on their values and their post-harvest handling. Considering the

reports of successful contribution of the IFs had had in improving food security in other countries it is an opportunity for Tanzania to promote IFs utilization.

5.2 Recommendations

Based on the study results the following recommendations are made:

(i) Awareness on the existence, value, handling and form of utilizing of IFs should be established among community members. It is proposed that as a follow up activity to this study, leaflets carrying messages of specific aspects mentioned above should be prepared and disseminated to village governments, clinics and welfare office for sensitizing communities. It is proposed that ICRAF and interested NGOs should provide some funds to enable the fulfillment of this activity.

(ii) In order to motivate fruit processors to include IFs in their business, information on quantities of IFs available, quality contents and product development should be obtained by the Department of Food Science and Technology at SUA in collaboration with stake holders in order to make the information available to processors.

(iii) Leaflets giving information on the values and relative advantages of IFs over exotic fruits should be prepared and distributed to consumers particularly in hotels, schools, colleges and Universities in order to stimulate their demands.

(iv) In order to increase contribution of IFs to household and trader incomes the marketing channel for these fruits should be studied and developed with the view to enable communities identify and access the urban markets.

(v) IFs are perishable agricultural products, the deterioration of their values in terms of their vitamins start after harvest. Thus they demand special handling. In order to maintain their contents/values there is a need to have a collective technical storage facilities in production areas where the peasants can keep them for a longer time without a deterioration of their values before they sell them to either wholesalers or to individual consumers. Equally important, there is a great need of having a technical storage facility for such perishable agricultural products at urban markets. Since the above suggestion demands heavy investments in terms of building cold rooms, electricity, refrigeration, etc. at mentioned level it is suggested that this project of establishing technical storage facilities in the country to be done in piecemeal,

taking some few regions for a certain period to establish these facilities. They should start with those which produce more IFs. A long-term plan has to be established. The trader has to pay a certain amount of money for preserving his/her IFs and other fruits and vegetables. While this long term plan is in operation, an improved traditional preservation of these IFs has to be undertaken for they don't demand heavy investment.

(vi) Plans for domesticating some important IFs should be worked out so that they can be available at short distances. With collective interventions on the above, it is hoped that the contribution of IFs to food security and more so to incomes of the traders could increase to a higher value than the present 3%.

REFERENCES

Berkes, F. (1999). Role and significance of traditions in indigenous knowledge. *Indigenous Knowledge and Development Monitor* 7: 19 - 21

Chirwa, P. W. and Ngulube, M. (2000). Research highlights, domestication of indigenous fruit trees in Malawi. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region (Edited by E.M.Shumba, et al.)*.13-14 March, 2000. Windhock, Namibia, pp. 36-41.

Falconer, M. and Arnold, T. H. (1991). *Household Food Security and Forestry. An Analysis of Socio Economic Issues.* Community Forestry Note No.1. FAO, Rome, pp. 16-27.

Food Association Organisation (1983a). *Forestry and Fruit Bearing forest Species: Examples from Eastern Africa.* FAO Forestry Paper 44/1. FAO Rome, pp. 2 - 8

Food Association Organisation (1990). *Forestry and Food security.* FAO Forestry Paper No. 90. FAO, Rome, 128pp.

Fernandes, P. (1983). An Approach to Evaluating the Performance of Public Industrial Enterprises. UNIDO *Industry and Development* 7: 30.

Hives, D. A. and Eckman, K. (1993). Indigenous multipurpose trees of Tanzania: uses and economic benefits for people. MISC/93/9 FAO Working Paper, 221 pp.

Irvine, F. R. (1979). *West African Crops.* MacMillan. Nigeria. Press pp. 187 - 188.

Ishengoma, C. G. (1998). The role of Women in household food security in Morogoro rural and Kilosa districts. Unpublished Dissertation for Award of PLD Degree at Sokoine University of Agriculture, Morogoro, Tanzania, pp. 16 – 20.

Johns, T. E., Mhoro, B. and Cuiso, F. (1996). Edible plants of Mara Region. *Ecology of Food and Nutrition* 35: 71-80.

Kadzere, I., Hove, L., Gatsi, T., Msarirambi, M. T., Tapfumaneyi, L., Maforimbo, E. and Magunise, I. (2002). Current status of post-harvest handling and traditional processing of indigenous fruits in Zimbabwe. In: *Procedings of the Regional Agroforestry Conference. (Edited by ICRAF)* 20-24 May, 2002. Warmbaths, South Africa, 82pp.

Kajembe, G. C., Mmenduwa, M. I. Mgoo, J.S. and Ramadhani, H. (2000). Potentials of Non-wood forest products in the household food security in Tanzania: the role of gender based local knowledges report. Gender, Biodiversity and Local Knowledge Systems (Links). (GCP/RAF/338/NOR/38) pp. 8 - 15.

Kavishe, F. P. (1993). Nutrition: *Relevant actions in Tanzania.* Monograph Series No. 1. Tanzania Food and Nutrition Centre, Dar es Salaam, pp. 1 – 8.

Kwesiga, F. (2002). Agroforestry research and development in Southern Africa: advances in the last decade and challenges ahead. In: *Procedings of the Regional Agroforestry Conference. (Edited by ICRAF)* 20-24 May, 2002. Warmbaths, South Africa, p.22.

Kwesiga, F. Akinnifesil, F., Ramadhani, T., Kadzere, I. and Sakaf, J. (2000). Domestication of indigenous fruit trees of the Miombo in Southern Africa. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region (Edited by E.M.Shumba, et al.*). 13-14 March, 2000. Windhock, Namibia, pp. 8 - 24.

Kwesiga, F., Maghembe, J. A., Simmons, A. J. and Hagman, J. (1998). Plan of operation for the period October 1997-September 2000. In: *Proceedings of Project on Domestication of Indigenous Fruit Trees of the Miombo Woodlands of Southern Africa.* ICRAF, Nairobi, Kenya, pp. 5 - 6.

Lavadiere, M. (2000). Address by the Food and Agriculture Organization (FAO) Representative. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region (Edited by E.M.Shumba, et al.*). 13-14 March, 2000. Windhock, Namibia. 1pp.

Lyimo, M. and Tiisekwa, B. P. M. (2000). *Income generation project for women group in Kipera village, end of project report*, Sokoine University of Agriculture Morogoro, Tanzania, 15pp.

Maghembe, J. A., Simmons, A. J., Kwesiga, F. and Rarieja, M. (1998). Selecting indigenous trees for domestication in Southern Africa: priority setting with farmers in Malawi, Tanzania, Zambia and Zimbabwe, ICRAF, Nairobi, Kenya, pp.16 - 21.

Mattee, A. Z. and Lasalle, T, (1999): Linking institutional research and extension to indigenous knowledge systems. In*: Proceedings on 105-115 in Forster and Maghimbi* (eds) Agrarian Economy: state and Society in Contemporary Tanzania. Ashgate, Aldershot, pp. 178 – 193.

Maxwell S.A. and T.R. Frankenberger (1992). *Household Food Security: concept, indicators and measurements.* A Technical Review. IFAD-UNICEF New York-Rome, pp. 1- 72.

Mbuya, L. P., Msanga, H. P., Ruffo, C. K., Birnie, A. and Tengnas, B. (1994). Useful Trees and Shrubs for Tanzania: Identification, Propagation and Management for Agricultural and Pastoral Communities. Technical handbook No.6. Regional Soil Conservation Unit (RSCU/SIDA). Nairobi, Kenya, 542pp.

Mdoe, N.S.Y., Isinika, A.C., Nyangori, E. and Mamiro, P. (2000). Evaluation of small scale food enterprises in Dar es Salaam and Morogoro. In*: Proceedings of the First University-wide Scientific Conference..* Sokoine University of Agriculture, Morogoro, Tanzania, 5 – 7th April, 2000. pp. 273 – 282.

Mithofer, D. and Waibal, H. (2002). Socio-economics factors in the collection and use of indigenous fruits in Zimbabwe. In*: Proceedings of the Regional Agroforestry*

Conference. (*Edited by ICRAF*) 20 - 24 May, 2002. Warmbaths, South Africa. 28pp.

Mkonda, A., Akinifesi, F.K., Swai, R., Kadzere, I., Kwesiga, F.R., Maghembe, J.A., Saka, J., Lungu, S. and Mhango, J. (2002). Towards domestication of "Wild orange' *Strychnos cocculoides* in Southern Africa: a synthesis of research and development efforts In: *Procedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*) 20 – 24th May, 2002, Warmbaths, South Africa, 40pp.

Mosha, A. C. (1990). Strategies for household food security: the role of Tanzania Food and Nutrition Centre. Household Food Security workshop Report No. 1269. Tanzania Food and Nutrition Centre, Dar es Salaam Tanzania. 160pp.

Mumba, M. S., Simon, S. M., Swai, R. and Ramadhani, T. (2002). Utilization of indigenous fruits of miombo woodlands: a case of Tabora district, Tanzania. In: *Procedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*) 20 - 24 May, 2002. Warmbaths, South Africa, 31pp.

Nanjundan, E. (1987). Small and medium enterprises: some basic developmental issues. Industry and Development No. 20, UNIDO. 27pp.

NATURA-NECTAR (1993). RegionalTraining Module on Food and Nutrition Security for Health and Development. Wageningen University, the Netherlands, 212pp.

Ndabikunze, B. K, Chamshama, S. A. O, Tiisekwa, B. P. M. and Mugasha, A. G. (2000). Nutrition and utilisation of indigenous tree food sources in Tanzania. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region* (*Edited by E.M.Shumba, et al.*). 13-14 March, 2000, Windhock, Namibia, pp.56 - 61.

Ndabikunze, B. K. Mugasha, A. G., Chamshama, S. A. O. and Tiisekwa, B. P. M. (2002). Nutritive values of selected forest/woodland edible fruits, seed and nuts in Tanzania. In: *Procedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*). 20 - 24 May, 2002. Warmbaths, South Africa, 79pp.

Ogle, B. M. and Gigrivette, L. E. (2000). Value of traditional foods in meeting micronutrient needs: the wild plant connection. *Nutrition Research Review* 13: 1 - 6.

Ramadhani, T. and Schmidt, E. (2002). The marketing analysis of *Uapaca kirkiana* indigenous fruits in Zimbabwe: which way forward? In: *Procedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*) 20 - 24 May, 2002. Warmbaths, South Africa, p.79.

Ritcher, J., Basler, A. and Franzen, H. (1996). Small scale food processing contribution to food security. In*: Proceedings of the International Workshop.* 14 – 18 March 1996, Bonn-Rottgen, Germany, pp 47 – 51.

Ruffo, C. K., Birnie, A. and Tengnäs, B. (2002). *Edible wild plants of Tanzania.* Technical Handbook No. 27. LELMA/SIDA, Nairobi. 766pp.

Rugheimer, S. (2000). Utilisation and Development efforts on indegenous fruit trees in Namibia. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region* (*Edited by E.M.Shumba, et al.*). 13-14 March, 2000, Windhock, Namibia, pp.44-48.

Saka, J. D. K. and Msonthi, J. D. (1994). Nutritional value of edible fruits of indigenous wild trees in Malawi. *Forest Ecology and Management* 64: 245 - 248.

Saka, J. D. K. Swai, R., Mkonda, A., Schomburg, A., Kwesiga, F. and Akinifesi, F. K. (2002). Processing and utilization of indigenous fruits of the miombo in southern Africa. In*: Procedings of the Regional Agroforestry Conference.* (Edited by ICRAF). 20-24 May, 2002, Warmbaths, South Africa, 81pp.

Schomburg, A., Kussein, C. G., Saka, J., Bohringer, A. and Kwesiga, F. (2002). The potential contribution of indigenous *Uapaka kirkiane* fruit to improving nutrition of HIV/AIDS affected and household people in Malawi. In*: Procedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*). 20-24 May, 2002, Warmbaths, South Africa, 91pp.

Shitta, D. (1998). Bleak prospects in agro-processing food manufacturing industry in Tanzania. Financial Times. February. pp. 2 – 8.

Shumba, E. M. (2000). Background and Objectives of the technical meeting on indigenous tree species. In: *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region* (*Edited by E.M.Shumba, et al.*). 13-14 March, 2000, Windhock, Namibia, pp.1 - 2.

Shumba, E. M. Lusepani, E. and Hangula, R. (Eds.) (2000). *Proceedings of SADC tree Seed Centre Network Workshop on Domestication and Commercialisation of Indigenous Fruit Trees in the SADC Region.* Windhock, Namibia 13 - 14 March, 2000, 25pp.

Swai, R. E. A., Maduka, S. M., Mumba, M., Mbamba, L. and Otsyina, R. (2002). Domestication of indigenous fruit and medicinal trees in Tanzania. In*: Procedings of*

the Regional Agroforestry Conference. (*Edited by ICRAF*). 20 - 24 May, 2002, Warmbaths, South Africa, 38pp.

TARP II– SUA (2002). Baseline data on food security and household income for smallholder farmers research projects. Vol. I. Aggregated Data. The Food Security and Household Income for Smallholder Farmers Applied Research with Emphasis on Women. TARP II – SUA Project, Sokoine University of Agriculture, Morogoro, 43 pp.

Tiisekwa, B. and Ndangamandla, S. B. (1996). Suitability and limitations of some indigenous fruits of Swaziland for manufacturing jams and jellies. *UNISWA Journal of Agriculture* 5: 106 - 111.

Tiisekwa, B. P. M., Ndabikunze, B. K., Samson, G. and Juma, M. (2002). Suitability of some indigenous trees/fruit for manufacturing juice and jam in Tanzania. In: *Proceedings of the Regional Agroforestry Conference.* (*Edited by ICRAF*). 20 - 24 May, 2002, Warmbaths, South Africa, 80pp.

Uiso, F. A. and Johns. T, (1996). Consumption patterns and nutritional contribution of *Crotalaria brevidens* (Mitoo) in Tarime District, Tanzania. *Ecology of Food and Nutrition* 35: 59 - 69.

UNICEF (1990). Strategies for improved nutrition of children and women in developing countries. (E/ICEP/1991.6). UNICEF, New York, 6pp.

Van Vlaenderen, H. (1999). Local knowledge: what is it and why and how do we capture it? In: *Proceedings or First National Workshop on Gender, Biodiversity and Local Knowledge Systems (LinKS) to Strengthen Agricultural and Rural Development*, 22 -23 June, 1999 Morogoro, Tanzania, pp. 4 – 9.

Van Vlaenderen, H. and Nkwinti, G. (1993). Participatory research as a tool for community development. *Development Southern Africa* 10(2): 211 - 228.

World Bank (1989). *Sub-Saharan Africa: from crises to sustainable growth.* World Bank, New York. pp. 2 - 7.

APPENDICES

Appendix 1. Dates of focus groups discussion in different wards

Ward	*Date*
Mlali	5/12/002
Bigwa	8/01/2002
Mzinga	7/01/2002
Makambarani	9/01/2002
Mlimani	10/01/2002

Appendix 2. Annual income sources (TSh.) from crop sales (n=87)

Crop type	Household benefiting (%)	Mean	Minimum	Maximum
Maize	26.4	106 434	6 000	600 000
Banana	36.7	60 640	1 500	240 000
Rice/Paddy	6.9	48 666	13 000	120 000
Tomatoes	20.6	85 111	5 000	310 000
Paprika	1.1	16 000	-	-
Vegetables	9.2	85 125	10 000	256 000
Cassava	24.1	30 928	4 000	100 000
Sweet-potatoes	3.4	65 333	20 000	140 000
Oranges	4.6	89 000	15 000	240 000
Simsim	8.0	75 000	15 000	220 000
Beans	12.6	14 727	3 000	28 000
Sorghum	3.4	20 666	14 000	24 000
Cowpeas	6.9	16 166	3 000	35 000
Yams	11.5	26 800	8 000	60 000
Sugar cane	5.7	98 400	2 000	300 000
Coffee	1.1	20 000	-	-
Guava	1.1	1 500	-	-
Avocado	1.1	5 000	-	-
Mango	2.2	6 500	5 000	8 000
Carrot	5.7	73 200	16 000	245 000
Coconut	2.2	110 000	20 000	200 000
Total		**1 055 196**		

-There is no range for single responses.

Appendix 3. **Annual income (TSh.) for households from others sources (n = 87)**

Source	Households benefiting (%)	Mean	Minimum	Maximum
Indigenous				
Tree/shrub fruits	19.5	42 764	1 000	500 000
Timber/wood trees	1.1	40 000	40 000	40 000
Goats	6.8	51 833	8 000	200 000
Pigs	3.4	41 000	5 000	88 000
Chicken	11.5	12 700	4 000	30 000
Ducks	1.1	3 000	3 000	3 000
Local brew	10.3	77 777	15 000	144 000
Labour	27.6	53 666	3 000	300 000
Formal employment	16.1	413 107	1 500	1 200 000
Total		**735 847**		

Appendix 4. **Annual expenditure (TShs.) on food (n = 87)**

Item	Household involved (%)	Mean	Minimum	Maximum
Maize	77.0	30 913	2 800	120 000
Rice	71.2	3 361	2 000	120 000
Beans	63.2	16 785	2 500	70 000
Vegetables	32.2	14 771	1 000	60 000
Cooking oil	98.8	25 930	1 400	336 000
Salt	94.2	5 786	100	48 000
Fish/dagaa	98.8	24 933	500	320 000
Others	12.6	53 127	12 000	90 000
Total		**202 606**		

Appendix 5. Annual expenditure (TSh.) on non food (n=87)

Item	Household involved (%)	Mean	Minimum	Maximum
Health service	89.7	31 442	2 000	200 000
Education	60.9	50 939	1 600	800 000
Clothing	92.0	37 487	4 000	150,000
Taxes	46.0	31 537	1 500	1 000 000
Fertilizer	18.4	20 400	1 000	75 000
Pesticides	23.0	24 195	1 000	100 000
Seed	54.0	10 773	650	50 000
Soap	100.0	17 674	1 000	72 000
Para fruit	95.4	22 246	960	98 000
Benefits	2.3	31 100	28 600	33 600
Others	6.9	75 600	5 000	300 000
Total		**353 395**		

Appendix 6. Annual expenditure (TSh.) on durable items (n=87)

Item	Household involved (%)	Mean	Minimum	Maximum
Hoes	57.5	2 700	300	36 000
Axes	26.4	2 652	1 000	15 000
Radio	49.4	19 330	1 000	100 000
Other	2.3	202 400	4 800	400 000
Total		**227 082**		

Appendix 7

QUESTIONNAIRE FOR DEMOGRAPHIC CHARACTERISTICS AND FOOD SECURITY ASSESSMENT OF FARMERS

Background information and household characteristics

Name of interviewer _____ Code: _____
Date of interview _____
Name of respondent _____
Name of village _____
Name of Ward _____
Name of Division _____
Name of District _____

Household Characteristics

Household member	Gender	Age	Marital status	Education level	Main occupation	Relationship to household head
Person 1						
Person 2						
Person 3						
Person 4						
Person 5						
Person 6						
Person 7						
Person 8						
Person 9						
Person 10						
Person 11						
Person 12						

Code:
Gender: 1= male, 2 = Female
Marital status: 1 = Married, 2 = Single, 3 = Widowed, 4 = Divorced
Main occupation: 1 = No occupation, 2 = Farmer, 3 = Trader, 4=Others specify
Relationship to household head: 1 =Head, 2 = wife, 3 = daughter, 4 = Son, 5 = Relative 6 = Non relative
Education level: 1= Primary, 2= Secondary, 3= College, 4= None

SECTION A: ASSESSMENT OF HOUSEHOLD FOOD SECURITY STATUS

A1:Overview of Household Resources

Resource type	Number of items	Resource type	Number of items
	E.g. 3 acres	Assets	
Land (acres)		Tractor	
Livestock		Bicycle	
- Cattle (cows, etc).		Axe	
- Sheep		Radio	
- Goats		Sprayers	
- Donkeys		Hand-hoes	
- Pigs		Machetes	
- Chickens		Sickles	
- Ducks			
- Other (specify)		Other (specify)	

A2:Source of Income

Source	Amount (Tsh/Year)	Source	Amount (Tsh/Year)
Crop sale (name the crop)		Other sources of income	
		Collected fruits	
		Local brew	
1		Casual labor	
2		Formal employment	
3		Remittances	
4		Others (specify)	
Livestock Sales (name the livestock/product sold)			
1			
2			
3			

A3: Expenditures

Item	Amount (Tsh.)	Item	Amount (Tsh.)
		7. Seeds	
Food purchase/ year		8. Soap	
1 Maize		9. Kerosine	
2 Rice		10. Other (specify):	
3 Beans			
4 Vegetables			
5 Cooking oil			
6. Salt			

7. Fish/dagaa		Durables/year:	
		Hoes	
Non food/year:		Axe	
1. Medicine		Radio	
2. Education		Other (specify)	
3. Clothes			
4. Levies			
5. Fertilizers			
6. Pesticides			

A4: Mix of Food for Household Consumption

Source	Type/Name	Amount (in kg, bags, tins, other)	
		Dry season	Wet season
Own production	1		
	2		
	3		
	4		
Purchased	1		
	2		
	3		
	4		
Gift	1		
	2		
	3		
	4		
Relief Food	1		
	2		
	3		
	4		

A5i: Food Calendar

Rank in order of importance of main type of food eaten	
Dry season	Wet season

A5ii: Food Calendar

Item	Dry season (months)	Wet season (months)
Season duration		

Food surplus (ziada)		
Food deficit (haba)		

A6: Coping strategies with respect to food shortage

Record sequence of response by a tick (v) during the household's latest incidence of food shortage.

	Beginning of crisis (tick)
Adjustment of meals	.....
Labour sale	.....
Community support	.....
Livestock adjustment	.....
Utilisation of wild foods	.....
Buying food	
Other (specify)	.....

SECTION B

Objective 1. To identify indigenous tree/shrub fruits (ITSF) available in Uluguru Mountain areas

(a) Mention the ITSF available in your area and around, identification characteristics and villages where available

	Fruit local name	Identification characteristic(s)	Village(s) where available
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16	Other		

SECTION C

Objective 2: To assess the contribution of indigenous tree/shrub fruits to household food availability and income.

(a) State time (month) for which the fruit is available, where available and distance to fruit source

S/No.	Fruit name	Month(s) available	Where available*	Distance			
1				Less than 100m (1)	100m-1km (2)	1-5km (3)	Over 5km (4)
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

*Where are the fruits available from?

1. deep forest
2. light forest
3. nearby bush
4. in cultivated farm
5. reserved indigenous plant in cultivated land

(a) If collected who collects the fruits

1. Children
2. Children herders
3. Firewood collectors
4. Hunters
5. Other (specify) _____

(b) Number of individuals in the household involved in marketing of fresh/processed fruits.

No.	Product	Number of individuals
1	Fresh fruits	
2	Processed fruits	

(c) Indicate the volume of collected fruit during the past 2 years

S/No.	Fruit (unit)	Collected amount		Fruit use*
		Year 1	Year 2	
1				
2				
3				
4				
5				
6				

*State the use of each of the fruits you mentioned.

1. used in meals
2. used as a snack
3. used only when grown fruits are not available
4. used as a major source of income
5. used as a minor role of income
6. other (specify) _____

(d) If eaten state the contribution of ITSF to fruit portion relative to the cultivated fruits when ITSF
are in season (for all fruits together).

1. Equal
2. Greater
3. Less
4. Not established

(e) If sold where do you sell the fruits

1. villagers
2. town market buyers
3. hotels
4. shops
5. taken around to those who need

(f) Quantities of fruits sold when fresh and processed

No.	Fruit type	Sold fresh		Sold processed	
		Quantity (units e.g. kg, bowl, bucket, tenga)	Unit price	Quantity (units)	Unit price
1					
2					
3					
4					
5					

(g) What are the marketing channels for fruits

No	Fruit type	Handling:	Time to reach destination	Transportation method
1				
2				
3				
4				
5				

*Handling: 01= Source to market, 02 = Source – Home - Market

(h) If consumed in what form do you take the ITSF? (all fruits generally) (tick or cycle)

1. eaten as is
2. made into juice
3. made into jam/jell
4. made into wine/beer
5. made into spirit
6. other (specify)_____

SECTION D

Objective 3: To identify indigenous knowledge and new methods of processing and preservation of indigenous tree/shrub fruit products in the study area.

(a) Name the form of preserving the fruit

S/No.	Fruit type	Method (e.g. drying, ferment)
1		
2		
3		
4		

(b) Describe the steps used in the processing of the fruits (use notebook for additional fruits, not necessarily in table form)

Name of fruit _____

Processing steps (include operation, additions and subtractions and duration of each step and possibly reasons for a certain action.

Name of processed product(s) _____

Step/operation	Addition	Subtraction	Reasons

(c) How did you learn this procedure?

1. From my family
2. From neighbour
3. From outside trainers (specify)----------

(d) Is there any other procedure you know?

Yes/No

(e) Is there any other product you know from the fruit?

Yes/No

(f) Is there any effort from Government or non-governmental organisation (NGO) that come to teach you techniques of handling and processing the fruits?

Yes/No

(e) If yes mention the organisation and the technology learnt?

S/No.	Fruit	Technology learnt	Organisation
1			
2			
3			

SECTION F

Objective 5: To assess the attitudes of consumers towards the consumption of indigenous tree/shrub fruit and fruit products in the study area .

(a) Please state the degree of agreement on the following statement in relation to ITSF using the scale:

1 = Agree
2 = Neither agree nor disagree
3 = Disagree

S/No.	Statement	Degree of agreement
1	ITSF are for children	
2	ITSF are for herders and firewood collectors	
3	ITSF are good for everyone	
4	ITSF are for villagers	
5	ITSF are for animals	
6	ITSF are as good for health as cultivated ones	
7	ITSF are not good for health	
8	ITSF are poisonous	
9	ITSF are for tourists	
10	ITSF are for poor people	

(b) Please indicate your level of willingness to consume ITSF products such as juice, jam, wine, etc. based on the mentioned fruits. Do so by inserting a number that best represents your attitude using the following scale:

1 Willing
2 Indifferent
3 Not willing

Name of most popular fruit	Jam	Juice	Wine		
1					
2					
3					
4					
5					

(c) List the indigenous fruits that you consume

No.	Fruits name
1	
2	
3	
4	
5	
6	
7	

(d) Please also indicate your level of willingness to buy ITSF products such as juice, jam, wine, etc. by ticking (v) against chosen statement

1 Willing
2 Indifferent
3 Not willing

(e) What price would you be willing to pay for ITSF products?
1 greater than cultivated fruits
2 same as cultivated fruits
3 lower than the cultivated fruits

(f) Why would you choose the level of price you have indicated?

(g) What quality factors are you normally interested in when consuming fruit products?

S/No.	Fruit product	Priority quality factor colour = 1, texture= 2, sweetness= 3, sourness= 4 , other=5 (specify)
1	Wine	
2	Jam/jelly	
3	Juice	
4	Squash	
5	Dried fruit	

(h) What quality factor(s) do you normally consider when buying indigenous fruit?

1----------
2----------
3----------
4----------

(i) How do you sell ITSF?
1. Buyer comes for it
2. I take the fruit to the buyer
3. Both

(j) Rank ITSF in terms of demand (start with most demanded) and indicate price

Fruit rank	Name of Fruit	Price (TSh.)
1		
2		
3		
4		
5		
6		

(k) What factors determine the price?

1 quantity available
2 competition among buyers
3 quality of fruit
4 other (specify)

(l) Would you be willing to grow indigenous fruit trees if supplied to you?

YES/NO

(m) What are your top two priority fruit tree types that you would like to be supplied with? Please state reasons for preference?

Fruit tree type preferred	Reason for preference

SECTION G

Objective 6: To identify factors that limit the utilization of indigenous tree/shrub fruits and products in the study area and Morogoro Municipality.

(a) What are the collection constraints? (tick where applicable)

No	Constraint	
1	Time of availability	
2	Distance where collected	
3	Location where available	
4	Quick spoilage	
5	Lack of storage facility	
6	Lack of buyers	
7	Lack of knowledge on use or value	
8	Other reasons (specify)	

(b) Who transports the fruits to market?

1 Collector
2 Buyer
3 Middlemen

(c) Are there any problems in transportation of fruits?

1=Yes
2=No
3= Don't know

If yes state the problem(s) associated with each fruit and how you handle the problem

No.	Fruit	Problem(s)	Problem(s) handling/corrective measure
1			
2			
3			
4			
5			

(d) Losses during transportation/handling practices of fruits

No	Fruit	Type of loss	Remedial practice(s)
1			
2			
3			
4			
5			

(e) Methods of packaging fruits

No	Fruit	Traditional method	Learned/new method
1			
2			
3			
4			

(f) Are there any other postharvest handling practices for fruits 1=Yes
2=No

If yes, mention .....

(g) How much loss (%) do collectors incur for each fruit type and causes for loss? _____

Fruit name	Loss incurred (%)	Causes of loss

(h) What has been the trend of availability of ITSF over the past three years?

1 increasing
2 decreasing
3 not changed

Reason for trend

(i) What has been the trend of price for ITSF over the past three years?

1 increasing
2 decreasing
3 not changed

Reason for trend

(j) What is your view about potential of these fruits for contributing to increased food availability?

1 Great potential
2 Not sure
3 No potential

(k) What is your view about potential of these fruits for contributing to increased income?

1 Great potential
2 Not sure
3 No potential

(l) What are your suggestions for these fruits to contribute substantially to food availability?

I THANK YOU VERY MUCH YOU YOUR TIME AND FRUITFUL DISCUSSION

Appendix 8

CONTRIBUTION AND POTENTIAL OF INDIGENOUS TREE/SHRUB FRUITS TO HOUSEHOLD FOOD SECURITY IN ULUGURU MOUNTAIN AREAS IN MOROGORO DISTRICT

QUESTIONNAIRE

Answering objective 4: To assess the attitudes of women food processors in Morogoro District and Dar es Salaam towards processing of indigenous tree/shrub fruit products.

SECTION A: Identification and Bio-data

A1: Identification Data

Name of interviewer _____ Code: _____
Date of interview _____
Name of respondent _____
Name of group/company_____
Name of village/street_____
Name of Ward_____
Name of Division_____
Name of District_____

A2: Biodata

Gender: Male= 1 Female=2

Age:
Less than 15 years	=1
15-30	=2
30-45	=3
45-60	=4
over 60	=5

Marital status:
Married	= 1
Single	= 2
Widowed	= 3
Divorced	=4

Education level:
None	= 1
Primary	= 2
Secondary	= 3
College	= 4
University	= 5

Main occupation: Farmer = 1
Paid employee = 2
Self-employed = 3
Student = 4

B: Fruit Processing Data

(a) Name fruits that you process and products obtained

Fruit name	Product name(s) e.g. jam, juice, squash.

ITSF = Indigenous Tree/Shrub Fruits

(b) Please state the degree of agreement on the following statement in relation to ITSF using the scale:

1 = Agree
2 = Neither agree nor disagree
3 = Disagree

S/No.	Statement	Degree of agreement
1	It is possible to process ITSF just as it is for domesticated fruits	
2	ITSF are not suitable because they are not available in large quantities	
3	ITSF are not suitable because they are very expensive than cultivated counterparts	
4	ITSF products are not suitable because nobody knows about them.	
5	ITSF products processing methods are not available in literature.	
6	ITSF are for local people use only	
7	Commercialisation of ITSF would lead to competition with outsiders	
8	We do not process ITSF because we know nothing about them	
9	We do not process ITSF because we do not know who will buy them	

(c) Do you process ITSF products? Yes/No If yes go to (f)

(d) Would you like to start processing ITSF? Yes/No

(e) What would you require in order to process ITSF?

(f) What products do you process?

(1)
(2)
(3)

(g) Do you know some one else or somewhere where ITSF are being processed?

Yes/No

(h) If yes, who are they? (1)_____
(2)_____
(3)_____

(i) Do you have the technology to process the fruits?

Yes/No

(j) If no, what do you require to process ITSF?

(k) Do the requirements for processed ITSF differ from those that you currently need for common fruits?

Yes/No.

(l) If you were taught the technology of using ITSF would you be willing to use the fruits for your business?

Yes/No

(m) Indicate the factors that you think would be important for producing the ITSF products
_1_____
_2_____
_3_____

(n) What price for ITSF products would you ask?

1 Same as that for cultivated fruits

2 Higher
3 Lower prices

Comments and reasons----------

(o) If produced where would you sell your products?

THANK YOU FOR YOUR TIME

Appendix 9

CONTRIBUTION AND POTENTIAL OF INDIGENOUS TREE/SHRUB FRUITS TO HOUSEHOLD FOOD SECURITY IN ULUGURU MOUNTAIN AREAS IN MOROGORO DISTRICT

QUESTIONNAIRE

Answering objective 5: To assess the attitudes of consumers towards the consumption of indigenous tree/shrub fruit and fruit products in the study area .

SECTION A: Identification and Bio-data

A1: Identification Data
Name of interviewer _____ Code: _____
Date of interview _____
Name of respondent _____
Name of village/street_____
Name of Ward_____
Name of Division_____
Name of District_____

A2: Biodata

Gender: Male= 1 Female=2

Age:
Less than 15 years	=1
15-31	=2
30-46	=3
45-61	=4
over 60	=5

Marital status:
Married = 1
Single = 2
Widowed = 3
Divorced = 4

Education level:
None = 1
Primary = 2
Secondary = 3
College = 4
University = 5

Main occupation:
Farmer = 1
Paid employee = 2
Self-employed = 3
Student = 4

SECTION B: Fruit Consumption Data

(a) State processed fruit products that you consume

S/No.	Fruit/product	Choice (tick)
1	Fresh fruit	
2	Fermented fruit	
3	Dried fruit	
4	Juice	
5	Jam and jellies	
6	Fruit leathers	
7	Squash	
8	Wine	
9	Spirits	

(b) Please state the degree of agreement on the following statement in relation to ITSF using the scale:

1 = Agree
2 = Neither agree nor disagree
3 = Disagree

ITSF = Indigenous Tree/shrub Fruit

S/No.	Statement	Degree of agreement
1	ITSF are for children	
2	ITSF are for herders and firewood collectors	
3	ITSF are good for everyone	
4	ITSF are for villagers	
5	ITSF are for animals	
6	ITSF are as good for health as cultivated ones	
7	ITSF are not good for health	
8	ITSF are poisonous	
9	ITSF are for tourists	
10	ITSF are for poor people	

(c) Please indicate your level of willingness to consume ITSF products such as juice, jam, wine, etc. based on the mentioned fruits. Do so by inserting a number that best represents your attitude using the following scale:

1 Willing
2 Indifferent
3 Not willing

Name of most popular fruit	Jam	Juice	Wine	
1				
2				
3				
4				
5				

(d) List the indigenous fruits that you consume

No.	Fruits name
1	
2	
3	
4	
5	
6	
7	

(d) Please also indicate your level of willingness to buy ITSF products such as juice, jam, wine, etc. by ticking (v) against chosen statement

1 Willing
2 Indifferent
3 Not willing

(e) What price would you be willing to pay for ITSF products?

1 greater than cultivated fruits
2 same as cultivated fruits
3 lower than the cultivated fruits

(l) Why would you choose the level of price you have indicated?

(m) What quality factors are you normally interested in when consuming fruit products?

S/No.	Fruit product	Priority quality factor colour = 1, texture= 2, sweetness= 3, sourness= 4 , other=5 (specify)
1	Wine	
2	Jam/jelly	
3	Juice	
4	Squash	
5	Dried fruit	

(n) What quality factor(s) do you normally consider when buying indigenous fruit?

1 _____

2 _____

3 _____

4 _____

Appendix 10

CONTRIBUTION AND POTENTIAL OF INDIGENOUS TREE/SHRUB FRUITS TO HOUSEHOLD FOOD SECURITY IN ULUGURU MOUNTAIN AREAS IN MOROGORO DISTRICT

QUESTIONNAIRE

Answering objective 6: To identify factors that limit the utilization of indigenous tree/shrub fruits and products in the study area and Morogoro Municipality.

SECTION A: Identification and Bio-data

A1: Identification Data

Name of interviewer _____ Code: _____
Date of interview _____
Name of respondent _____
Name of group/company_____
Name of village/street_____
Name of Ward_____
Name of Division_____
Name of District_____

A2: Biodata

Gender: Male= 1 Female=2
Age: Less than 15 years =1
15-32 =2
30-47 =3
45-62 =4
over 60 =5

Marital status: Married = 1
Single = 2
Widowed = 3
Divorced =4

Education level: None = 1
Primary = 2
Secondary = 3
College = 4
University = 5

Main occupation: Farmer = 1
Paid employee = 2
Self-employed = 3

Student = 4

B: Fruit Trading Data

(a) How do you sell ITSF?

1. Buyer comes for them
2. I take the fruit to the buyer
3. Both above

(b) Rank ITSF in terms of demand 9start with the most demanded) and indicate price

Fruit rank	Name of fruit	Price (TSh.)
1		
2		
3		
4		
5		
6		

(c) What factors determine the price?

1. quantity available
2. competition among buyers
3. quality of fruit
4. other (specify)

(d) What are the collection constraints? (tick where applicable)

No	Constraint	
1	Time of availability	
2	Distance where collected	
3	Location where available	
4	Quick spoilage	
5	Lack of storage facility	
6	Lack of buyers	
7	Lack of knowledge on use or value	
8	Other reasons (specify)	

(e) Who transports the fruits to market?

1 Collector
2 Middlemen

(f) Are there any problems in transportation of fruits?

1=Yes
2=No
3= Don't know

(g) If yes state the problem(s) associated with each fruit and how you handle the problem

No.	Fruit	Problem(s)	Problem(s) handling/corrective measure
1			
2			
3			
4			
5			

(h) Possible losses during transportation/handling practices of fruits

No	Fruit	Type of loss	Remedial practice(s)
1			
2			
3			
4			
5			

(i) Methods of packaging fruits

No	Fruit	Traditional method	Learned/new method
1			
2			
3			
4			

(j) Are there any other postharvest handling practices for fruits 1=Yes
2=No

If yes, mention .....

(k) How much loss (%) do collectors incur for each fruit type and causes for loss?

Fruit name	Loss incurred (%)	Causes of loss

(l) What has been the trend of availability of ITSF over the past three years?

1 increasing
2 decreasing
3 not changed

Reason for trend _____

_____

(m) What has been the trend of price for ITSF over the past three years?

1 increasing
2 decreasing
3 not changed

Reason for trend _____

_____

(n) What is your view about potential of these fruits for contributing to increased food availability?

1 Great potential
2 Not sure
3 No potential

(o) What is your view about potential of these fruits for contributing to increased income?

1 Great potential
2 Not sure
3 No potential

(p) What are your suggestions for these fruits to contribute substantially to food availability?

_____

_____

THANK YOU VERY MUCH FOR YOUR TIME SPE