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Assessment of Orange Losses and Existence of Post-Harvest Methods (PHM) Along the Coast Belt of Tanzania

Muyengi Zakaria Ezekiel[1*] Rehema Mzimbiri[2] Mariam Kom Mtunguja[1]
1. Mikocheni Agricultural Research Institute, PO box 6226, Dar es Salaam, Tanzania
2. Tanzania Food Nutrition Center, PO box 977, Dar es Salaam, Tanzania
* E-mail of the corresponding author: muyengi@yahoo.com
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Abstract
An assessment of orange fruits losses and investigating of post-harvest methods was conducted in Mkuranga district which is situated along the Coast Belt of Tanzania. The district is among of the producer of orange fruits in the country. The study discovered that an average of 9,889 tons of pieces of orange fruits are produced mainly by small holder farmers in the district per year and about 3.9 tons (39.7 percent) of the produced orange fruits found to be wasted per year. The study analysis indicates that about 15 percent of the orange fruits wasted during harvesting process, 18 percent loss of orange fruits occurred during handling process, 50 percent of orange fruits lost at a storage places and 17 percent lost during transportation from farm to the market place. At a household level, the analysis indicates that an average of 70 of orange trees owned per household and that at a moment of harvesting process each orange tree bears an average of 400 pieces of orange fruits. About 25,000 pieces of orange fruits investigated to be harvested per household per year where by an average of 19,000 pieces of orange fruits are sold per year per household at an average price of 30 TSH (equal to USD 0.018) per piece. About 3,000 piece of orange fruits found to be consumed by family members, relatives and friends per year per household and an average of 3,000 pieces of orange fruits found to be wasted per year per household. The study revealed that an existing methods and facilities for harvesting (orange smashing), handling and storage (nylon and plastic bags) are poor and are main causes of the orange waste or loss in the district. Moreover, poor transportation infrastructures such as road is noted to contribute in fruit loss. Improved methods and facilities for harvesting, handling, storage and transportation are suggested to be commenced in the district for orange loss reduction. Trainings, awareness and skills at each point of post-harvest chain (PPHC) starting from primary to secondary actors should be collectively emphasized by both government and non-government institutions in Tanzania.
Keywords: Orange losses, Existing-post-harvest methods, Coast Belt of Tanzania

1. Introduction

In Tanzania the production of orange fruits is largely concentrated in the Coast Belt and/or North Eastern part of the country that includes Tanga, Coast and Morogoro regions. It estimated that in 2008, a total production of orange fruits by small holders in Tanzania was around 194,978 tons per annum, harvested from 23,062 ha at an average yield of 8.5 t/ha . About 109,413 households in Tanzania are estimated to be involved in orange production, with an average of 0.4 ha per household (MMA, 2008). The main producer regions (tons/ha/year) in the Tanzania includes Tanga (22.41), Coast (18.31), Morogoro (10.9), Mwanza (6.9) and Ruvuma (6.8) whereby Arusha region is the least orange producer (0.1) in the country.

1.1 Importance of orange fruits

Orange fruit production as an important part in horticultural industry has emerged as a major economic activity in developing countries, especially those which were hitherto heavily dependent on agricultural production, often at subsistence levels. Horticultural producers in developing countries are mostly small farmers, and they are rarely organized into a formal cooperative or association. It is estimated that 10 to 20% of all farmers are producers of horticultural crops, sometimes in combination or rotation with field crops (FAO, 2010). Despite of economic importance, horticultural crops including orange fruits are important sources of plant nutrients, vitamins and minerals that are essential for human health and well-being, particularly for children and pregnant or nursing women (WFLO, 2010).

1.2 The Level of Orange Losses

Post-harvest losses in tropical fruits vary widely from 10 percent to 80 percent in both developed and developing countries (FAO, 2006). These losses occur all along the supply chain, beginning from the time of harvesting right up to packing, storage, transportation retailing and consumption (WFLO, 2010). In most developing countries, this is mainly due to the combination of poor infrastructures and logistics, poor farm practices, lack of post-harvest handling knowledge and a convoluted marketing system (FAO, 2006). Kitinoja (2002), Ray and Ravi (2005) and WFLO (2010) observed that 40 to 50 percent of horticultural crops which includes, fruits and vegetables are lost before they reach consumers. Main reason for waste is due to high rates of bruising, water loss and subsequent decay during postharvest handling (WFLO, 2010). In Agriculturally developed countries

such as Japan, the Republic of Korea and Taiwan province of China, it has been reported that the post-harvest losses for fruits are about 10 percent. In Philippines, generally, post-harvest losses could range from 15 to 35 percent (SBG, 2004). In Tanzania the post-harvest losses has been reported to range from 30 to 40 percent (URT, 2006).

1.3 The Postharvest and Marketing Situation in Tanzania

In Tanzania, the post-harvest orange fruit chain i.e. harvesting, handling, transportation, processing and marketing are uncertainty due to poor facilitates and methods for harvesting, handling and packages which mainly includes sacks and baskets. This allows the produce to be bruised, squashed and receive abrasions from farm to market, and this damage allows postharvest decay organisms to gain easy entry (WFLO, 2010). Lack of markets for horticultural products in Tanzania could be among of the obstacle to developing the horticulture sub-sector in the country. This is because the orange fruit markets is largely linked to seasonality production particularly in the peak production and scarcity period. Because of the limited capacity for processing the horticultural produce relative to surplus production in the peak harvesting period, coupled with unavailability of technologies for storing surplus perishable horticultural products, most of the produce gets spoilt hence causing great losses to producers (URT, 2006). However, few studies have been conducted in Tanzania to investigate the level of orange which are wasted at each point of post-harvest chain (PPHC) which includes harvesting, handling, storage, transportation and what could be a sustainable way-out. Therefore, this study aimed to identify the current status of orange losses at each point of PHC and identifying an existing post-harvest techniques and suggesting the way-out of the losses at PPHC.

2.0 Methodology

2.1 Study area

The baseline survey was conducted in Mkuranga district located in Coastal region along of the coastal shores of Indian Ocean and boarded with one of the biggest city in Tanzania called Dar es Salaam. The district has two distinct rain seasons namely short and long seasons (Majule, 2012). The district is one of the popular orange fruits producer in Tanzania. Two famous producers of orange fruits wards namely Mkamba and Nyamato were visited. At each ward, two villages were randomly selected and these were, Mkamba, Mkerenge, Nyamato and Kilamba villages.

2.2 Sampling procedures and sample size

The study adopted a cross sectional research design where by data were collected once. The study employed random techniques for selection of farmers for interview and employed purposive sampling technique to select middlemen, transporters and processors and service providers (including DALDO (District Agriculture and Livestock Development Officer), WAEO (Ward Agricultural Extension Officer), SMS (Subject Matter Specialist) and VAEO (Village Agricultural Extension Officer). The total of 100 respondents were sampled and interviewed. These included 49 farmers, 25 middlemen or buyers, 11 transporters and 15 processors.

2.3 Data collection and analysis

The respondents were interviewed using a semi-structured questionnaire, while for service providers the checklists of questions were employed. Prior to data collection in the field the questionnaire was pre-tested at Nyamato village to evaluate the validity, clarity, relevance and the sequence of questions. After the pre-testing the questionnaire was revised and finalized for the survey. Relevant documents such as research reports, proceedings, journals, articles, and reports were reviewed to obtain secondary information. The collected information were sorted, cleaned and coded followed by data entry and analysis. A software called SPSS (version.16) was used for data analysis. Information from each village i.e. on socio–economic, crop production, harvesting, and handling and storage practices were analyzed and documented. Cross tables, figures and graphs were developed to supplement, clarify, compare, and acclaims of obtained information.

3.0 Results and Discussion

3.1 Age of actors

The findings revealed that the active age group involved in farm activities along the coast belt of Tanzania is between 41 to 60 years old which is equal to 58 percent of the interviewed farmers. Only 18 percent of farmers of age of 30 to 40 are actively involved in agricultural activities.

Table 1: Age groups and percentage of stakeholders

Age groups	Farmers (n=49)	Buyers/middlemen (n=25)	Transporters (n=11)	Processors (n=16)
20-30	2	20	36	20
31-40	18	56	36	40
41-50	31	8	18	33
51-60	27	8	10	7
61-70	9	8	-	-
71-80	2	-	-	-

The study identified that the group of young (70 percent) with age of 20 to 40 years are worked as middlemen i.e. selling agricultural yields and also involved in transporting fruits from farm place or rural area to market place or urban area. This means that young people (20-40 years old) do not prefer to participate in agricultural activities which is a primary and key activity rather they participating in secondary activities such as middlemen and transportation of agricultural produces. This suggests the need of having proper strategies and initiatives in order to make young people to be attracted in agriculture. As the farm size cultivated along the coast belt is 3.0 acres and about 25,000 to 26,000 pieces of orange fruits produced per household with farmers of age 41 to 60, if more workforce from young people of age 30 to 40 attracted in agriculture it assumed that the production can double. According to FANKPAN (2012), youths in Tanzania are likely to be employed in subsistence agriculture , however, due to unfavorable several factors including low productivity, overdependence on rain fed agriculture, low use and high costs of agricultural inputs and poor marketing systems the youth are forced to move from rural to urban for informal activities. The government therefore, should establish a friendly environmental which will attract the youth to invest in agriculture. This study suggests an entry point is to review the existing policies on land and loan acquisition so as to be accessible and available to the youth. Moreover, stakeholders such as agricultural institutions and universities should assist the government to come up with youth programs on agriculture and create opportunities and facilitate awareness, training and entrepreneurship skills to the youth.

3.2 Gender involvement and decision making

The analysis indicates that about 93 percent of women are involved in small scale processing such as juice making while only 7 percent of men found to be involved.

Table 2: Indicates the ratio of gender involvement in orange post-harvest activities.

Stakeholders	Gender involvement in %	
	male	female
Farmers (n=49)	90	10
Buyers/middlemen (n=25)	96	4
Transporters (n=11)	100	0
Processors (n=16)	7	93
Mean (n=100)	73	27

There is no large scale processing activities found in the district. Moreover, 90 percent of the interviewed farmers were male and are the owner of land and orange tree. This could be among of the reason for most women to engage in small scale processing activities as most of the farms/ lands are owned by men and also the decisions on selling oranges and use of the income is mostly done by men.

3.3 Education level

The majorities (70 percent) of orange actors have primary education while only 16 percent of actors have secondary education. About 7 percent and 1 percent of actors have attended Islamic and adult education as shown in table (3) below.

Table 3: Education level for different stakeholders

Education Level	Orange stakeholders (%)				
	Farmer(n=49)	Buyers(n=25)	Transporter(n=11)	Processors(n=16)	Mean (n=100)
Primary	71.4	84	63.6	60	70
Secondary	4.1	na	18.2	40	16
Islamic	20.4	na	9.1	na	7
Adult Education	1	1	na	na	1
Non Education	2	12	9.1	na	6

na=not available

This implies the need of more skills facilitation particularly on basic knowledge of agricultural husbandry and postharvest technologies to the actors. Business people take advantage of the farmers' ignorance and enter into contract farming by paying for the orange trees when the fruits are in farms and still immature.

3.4 Orange fruits production and productivity at a household (farm) level

The study revealed that the average farm size that cultivated per household is 3.0 acres. Four major tree crops namely oranges, cashew, mangoes and coconuts dominates the farms. The tree crops are intercropped with annual crops like maize, legumes and cassava. The study indicates that there is no proper spacing considered by farmers in growing crops. Also there is indication of limited use of inputs such as fertilizers and manures in the farms as 80 percent of farmers are neither using fertilizer nor improved seed varieties. Orange population per acre per household range from 20 to 26 trees and average of 74 of orange trees are owned per household. Before harvesting, the tree bears between 350 to 450 pieces of orange fruits.

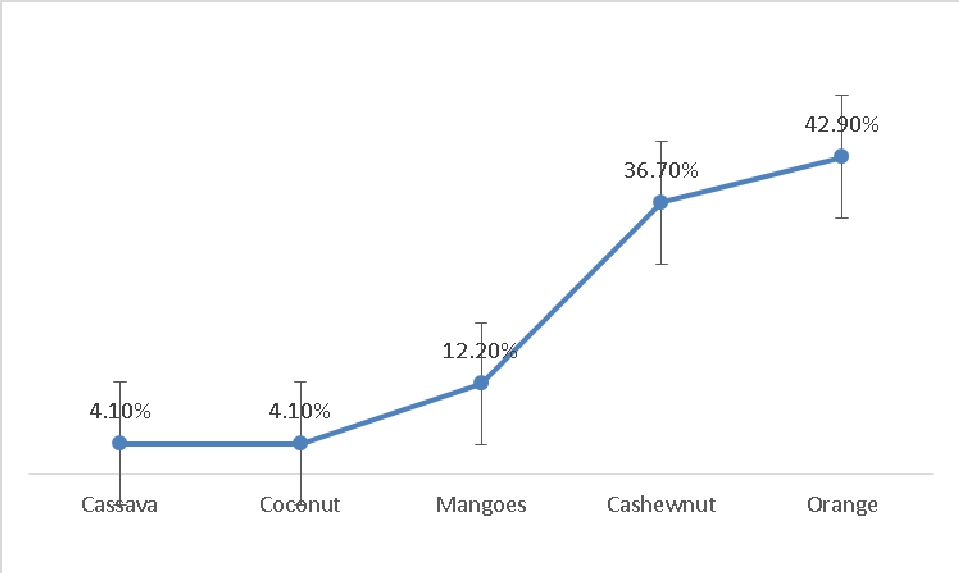
Table 4: Production and productivity of orange per household in study area

	Minimum	Maximum	Average
Total farm size owned (acre)	1.0	22	6.7
Total cultivated farm size(acre)	0.25	22	3.0
Total orange Trees/hh	7.	546	74
Total orange harvested(PCs) per Season/hh	500	150,000	26,764
Total orange sale per season/hh	320	100,000	19,144
Number of oranges per one Kg	5	12	7

About 25,000 to 26,000 pieces of orange fruits are harvested per household per year where by an average of 19,000 pieces of orange fruits are sold per year per household. The study found that an average price per piece at peak period range from 25 to 35 Tsh and at the scarcity period the farm gate price ranges from 100 to 150 Tsh .

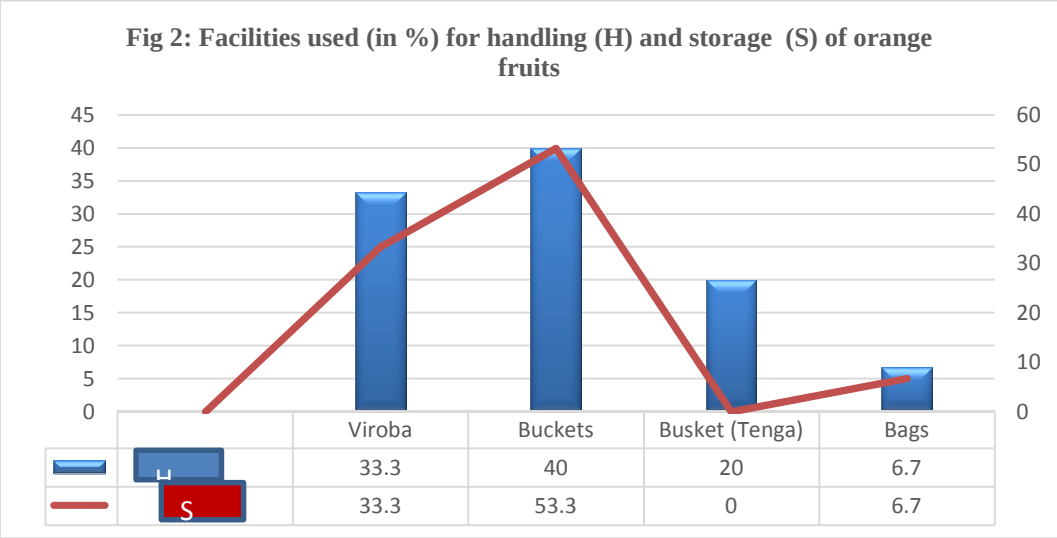
3.5 Source of income generation at a household

The study revealed that agriculture is main stay of the household income in the study area. Figure 1 below indicates that most of the interviewed farmers (42.9 percent) are growing oranges tree as one of their major income generating farming enterprise followed by cashew nut (36.7 percent), mangoes (12.2 percent), coconuts (4.1 percent) and annual crops such as cassava and paddy (4.1 percent). Figure 1 below indicates the percentage household income generation from different crops.



3.6 Post-harvest techniques at a farm level

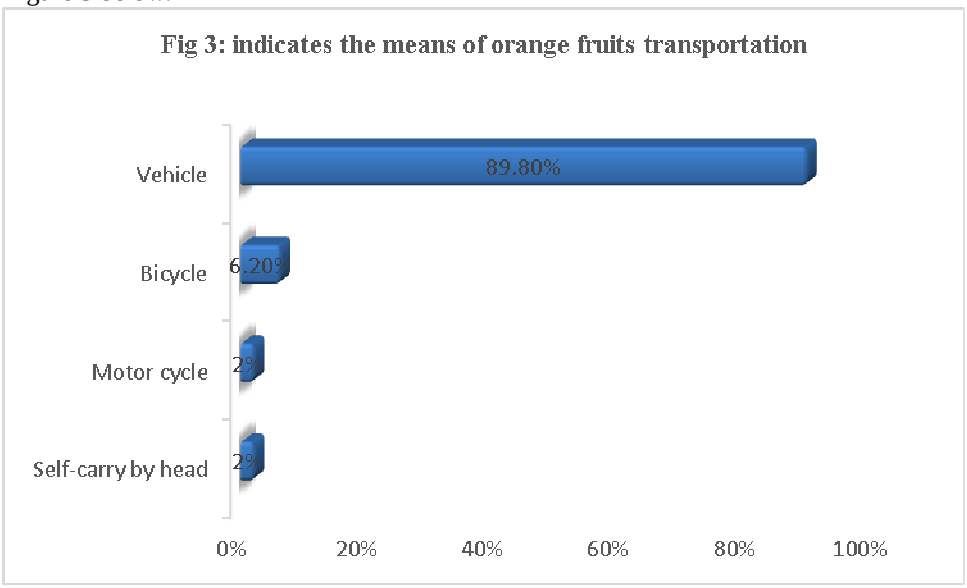
The study found that there are three main methods used by harvesters in harvesting orange fruits. The identified methods were hand picking, tree shaking and hooking. It found that harvesters, normally use baskets, buckets and nylon, plastic or sisal bags (*known as gunia/viroba in the visited area)* to collect and carry oranges and hip (bulk) them under tree shades near the roadside. They use the same baskets and bags during loading into trucks. Figure 2 below indicates the facilities and equipment used for handling (H) and for storage (S) in the visited area.



The study by WFLO (2010) observed the presence and use of bags by farmers and transporters in fruit handling and that the use of plastic bags tend to increase temperature within the bag then lead to water loss and high respiration and weight loss and hence the price per unit decreases. Also according to (El Assi, 2004; Kader and Rolle, 2004) it has been revealed that harvesters tend to congest many fruits in bags which increases heat which in turn lead to physiological damages then easily to be affected by microbial. In that case the traders prefer to sell oranges immediately while oranges are still in the vehicles parked at market places or spread oranges on the market floor cushioned by thick layer of grass.

3.7 Means of transportation of orange fruits in the study area

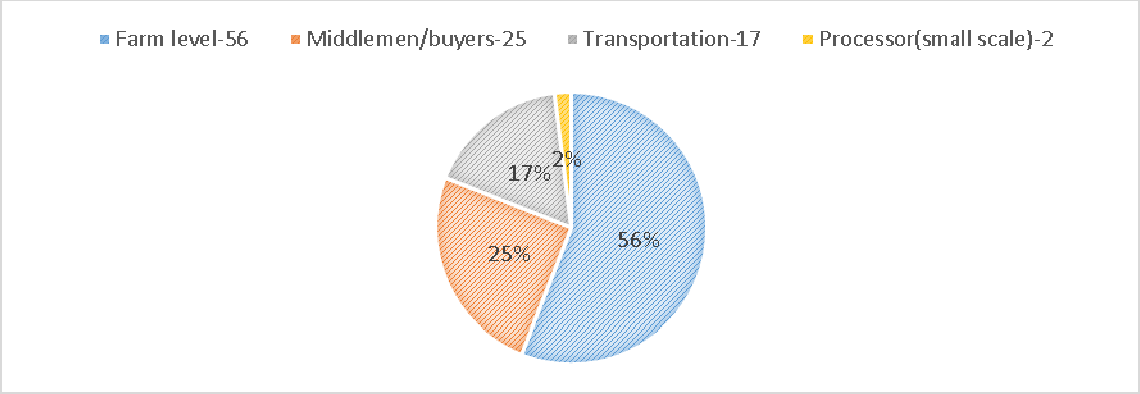
The study found that main means of orange fruits transportation from farm to the village and peri urban markets were; vehicles (89.8 percent), bicycles (6.1%), motorcycles (2%) and self-carrying by head (2 percent) as indicated in figure 3 below.



3.8 The level of orange losses to different actors

In Tanzania the post-harvest loss of fruits is so enormous (Kereth et al., 2013). It found that the loss differs to different actors (figure 4).

Fig 4: Levels of orange loss at different actors

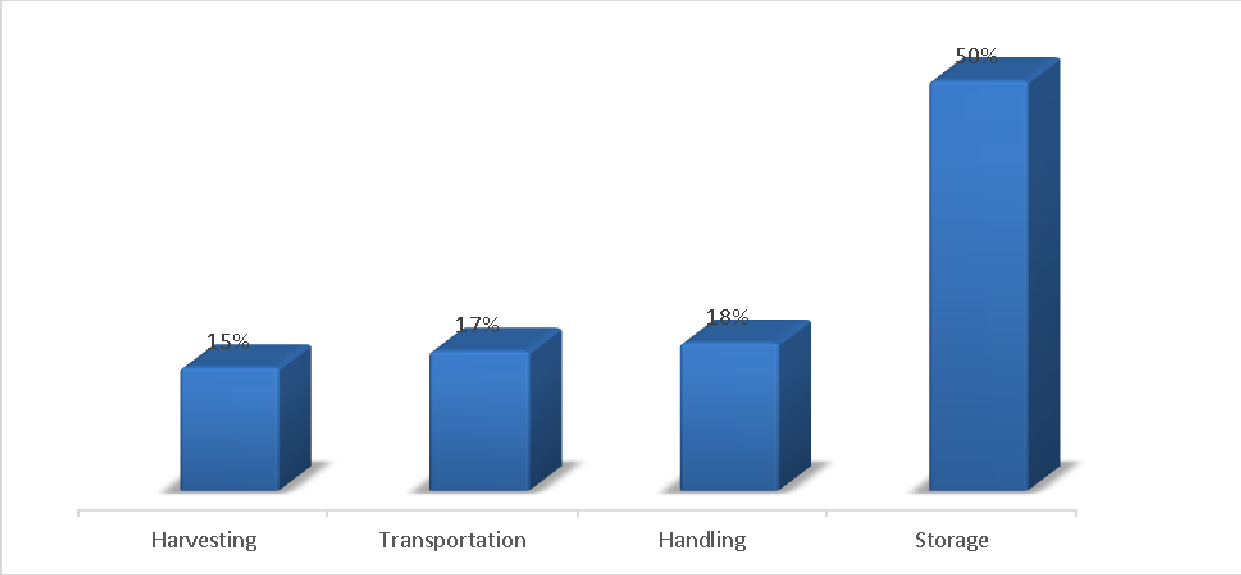


The findings indicates that the district has high level of loss of orange fruits at farm level (56 percent) which caused by farmers and harvesters due to poor practice and facilities in harvesting, handling and storage. This results is similar with the one found by USAID study in 2007. The study also revealed that about 25 percent of orange fruits are wasted at hand of a middlemen particularly at moment of waiting customers and 17 percent occur during transportation particularly from farm or middlemen place to the market. Very low (2 percent) observed to lost during small scale processing.

3.9 The level of orange losses at different points of post-harvest chain (PPHC)

The study found that 15 percent of orange fruits wasted during harvesting process, 18 percent of the fruits lost during handling process, 50 percent of the fruits lost at a storage places and 17 percent lost during transportation from farm to the market place.

Figure 5: Indicates the level of orange losses in percent in the study area



Poor harvesting methods and poor facilities for handling, storage and transportation of oranges were mentioned by farmers and middlemen as the main cause of orange fruits losses. According to (Annabel, 2008) women and boys along the roadside with buckets of oranges on their heads are walking several kilometers to look for market. Therefore, looking a market and a place to sell fruits for long time could be a cause of orange loss as it observed in the district.

3.10 Cross-cutting issues observed

3.10.1 Market and marketing information

Farmers complained about market reliability and low prices for their produce including orange fruits. The study noted that a farm gate price of a piece of orange fruit ranges from 25 to 35 Tsh (0.015 to 0.02 USD) at pick period and increased between 100 to 150 Tsh (0.06 to 0.09 USD) at scarcity period. However, at a market place particularly in city center i.e. Dar es Salaam the price range from 100 to 200 Tsh (0.06 to 0.125 USD) at pick period and 200-400 Tsh (0.125 to 0.25 USD) at scarce period. Moreover, the interviewed farmers said that there is no information or indicative prices for their produce which they can use as a reference to set price.

3.10.2 Infrastructure

Rough road was observed in the study area. The interviewed middlemen and transporters of orange fruits mentioned that their business is highly affected by poor rough roads which limit them to travel to various villages to buy oranges from farmers. The rough road also makes high transportation cost.

3.10.3 Financial support

Both farmers and buyers interviewed in the study area mentioned that there was a serious lack of financial support for orange investment from the local financial institutions. In their opinion this limits their ability to expand their farms and business.

4.0 Conclusion

The study was conducted as a reconnaissance research into the orange post-harvest chain in one of area along the coast belt of Tanzania and found that there is a potential features which including weather condition and presence of market (demand). However, it has been also noted that the sector is affected by a number of constraints which need to be addressed. Among the major challenges include the use of poor post-harvest handling techniques and lack of appropriate storage facilities which contribute to higher percentage of orange losses. Others include marketing information, extension services and low investment capital. Moreover, it observed that the magnitude of post-harvest losses differs among the chain actors. The losses at each level is associated with low knowledge on postharvest techniques. Following this investigation, observations, analysis and discussion on the post-harvest losses therefore, the study recommend the following;

i) There is a need of a collective efforts from both government and non-government organization to create awareness on the importance of PPHC among of the stakeholders who deals with orange fruits. Stake holder should be made aware on the magnitude of losses occurring at each stage of the supply chain and their role to reduce or eliminate these losses.

ii) There is a need to improve the existing PHM. This will include of designing, developing, testing and disseminating appropriate and affordable technologies such as small scale handling and storage structures and facilities. It therefore important to promote the development and utilization of appropriate and affordable pre and post-harvest handling methods and packaging materials to be used by farmers and other actors to gradually replace local technologies.

iii) Farmer's cooperatives, associations and societies in Tanzania should be encouraged, facilitated and sensitized as could be used as a credit medium and could provide higher bargaining power during selling of farmers' products in the markets.

vi) The government and the privates sector should review the existing credit system in the country and seeing a possibilities of introducing innovative credit schemes that would enhance credit availabilities and promoting credit access to small holder farmers and youth. This could be done in close collaboration with financial institutions, farmer associations such as Savings and Credit Association (SACAS), farmer cooperatives such as Savings and Credit Cooperatives Societies (SACCOS).

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Author Biography

Mr. Muyengi Z.E is a Tanzanian born in 1972. He holds BSc. Food Science and Technology, Masters in Rural Development from Sokoine University of Agriculture in Tanzania. He is a PhD student majored in Agricultural Economics. He is a member of TWG (Thematic working group) and NFT (National Facilitator) for a program known as ASDP (Agricultural Sector Development Program) in Tanzania. ASDP overseas the development of agricultural sector in the country and it comprised by Five Agricultural Lead Ministries (ASLMs) in the country. Mr. Muyengi, works at Mikocheni Research Institute (ARI-Mikocheni) of the Ministry of Agriculture, Food Security and Cooperative (MAFC). As an Agricultural Research Officer at MARI, Mr. Muyengi majored in Post-Harvest Technology and Socio-economics.