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An assessment of post harvest losses in the cassava Value chain in Cameroons' South West region: Processing cassava to garri

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Abstract

Cassava is the only staple crop produced in most agroecological regions of Cameroon. However, despite its vulnerability to postharvest losses producers continue to grow the crop because unlike other root and tubers it can be locally processed into a variety of food items that attract consumer demand in the country's markets. However, cassava production and processing is still a dominantly rural occupation mostly done with rudimentary technologies which are grossly inadequate to sustain growing domestic demand. In addition rudimentary technology used in storage, processing and marketing have increased the prevalence of postharvest losses at all stages of cassava production and distribution; thus affecting marketing of locally processed products in modern retail outlets where the products are unavailable despite growing consumer demand and the ability and willingness of producers to supply. The study is an assessment on various losses incurred and acknowledged by actors during production, processing, and marketing of garri one of the processed products highly consumed in Cameroon. Information was obtained by use of questionnaire, observations, and group discussions with the various actors in the cassava value chain. According to the study cassava production could act as veritable instrument for poverty alleviation if government and its agencies could provide an enabling environment supported by adequate infrastructure for processing, storage, and marketing in other to avoid endemic food and income losses which are deterrent to poverty alleviation to most actors in the cassava value chain.

Keywords: Rudimentary technology, endemic food losses, rural economy, rural poverty cassava value chain.

Introduction

Cassava is a tuber crop with height of about 2-3 meters. It is grown mostly in the tropics and a staple for the populations. During the crop production season cassava is propagated by cutting of its stem. Nigeria is ranked highest producer in the world[1]. Other world producers include Ghana, Thailand, Brazil, Congo Democratic, and Indonesia. During its crop production season the plant is grown as an annual and propagated vegetatively from stem cuttings of approximately 25cm in length. Grown in most ecological zones of Cameroon, cassava remains one of the most important crops produced and consumed in the country. According to Acquah et al.[2] and Aramyan *et al*[3] if adequate attention could be paid in the country's agricultural policies and strategies in production, processing and marketing, cassava will not only be a veritable instrument for poverty reduction but could contribute enormously to the improvement of food security and self-sufficiency in Cameroon. These reasons are obvious because the crop enjoys the advantage of being processed into a variety of locally processed products with significant demand in various socioeconomic and cultural milieus. Some of the locally processed products include *garri, water fufu, cassava flour (Kumkum*), *miyondo,* bobolo *(baton or sticks), matumba* among others. Garri is among the most consumed cassava product due to its relatively longer shelf life and low vulnerability to agents of food losses like bacteria and fungi; unless poorly processed[4]. Garri can be drunk in water mixed with sugar without boiling and is consumed with soup and variety of prepared vegetables.

Garri is obtained as a dry whitish or yellowish semi-powdery product after processing and can be kept for longer periods of time. When kept in a moist environment the product absorbs moisture, becomes wet and losses quality as it is preferred dry before preparation. However, despite the relatively longer shelf life of garri the product is not available in the country for sale in modern retail outlets like super markets and groceries as it falls short of specification and standardization which are conditions required from suppliers by most modern retail outlets. According to Gloria[5] garri and other processed cassava products are unable to meet safety requirements because production, processing and marketing is done with rudimentary technologies which do not take to account these requirements. Secondly production is done mostly by hundreds of smallholders located in rural areas who are not organized into common initiative groups or cooperative societies to take advantage of economies of large scale production to improve on production, processing and marketing of the crop[6].

According to Hansson *et al.*[7], although locally processed cassava products lack safety requirements for modern marketing, garri when adequately processed can be stored for several months under ambient conditions without contamination by agents of food losses; and still maintain its nutritive properties. This property of garri has attracted both traders and consumers; thus justifying its market demand. Garri is easy to prepare, can be soaked in water mixed with salt, or sugar and drank as food; a reason why this product has attracted increasing urban demand[8,9]. Other locally processed cassava products with high consumer demand include flour *(kumkum)* and water fufu. Locally made Cassava flour or *kumkum* equally enjoys a longer shelf life because it is processed dry before marketing but command a relatively lower demand than water fufu as its paste is slimy and difficult to form lumps to ease swallowing by consumers[10]. Urban consumers store water fufu under normal refrigeration conditions without turning into its iced form which makes preparation difficult and also destroys its nutritive properties.

According to Ekwere *et al.*[11], the production and consumption of cassava products in Cameroon is related to the socioeconomic and cultural environment in which production takes place. Whereas garri, water fufu, and *kumkum* are heavily consumed and produced in the Southwest and Littoral regions; Cossettes are largely produced and consumed in the Centre, South and Eastern regions of the country. However, due to internal migration of farmers and other socio professional groups the production of these cassava products are no longer restricted to their areas of origin in the country.

According to Mvodo *et al.*[12] and Njukwe *et al.*[13] garri, is most traded cassava product and is more available in the country's urban markets than cossettes as a result of their high demand and also because the processing of cassava into cossettes is too labour intensive requiring more resources (leaves, stringsetc) than other products. According to Njukwe *et al.*[13] for cassava to guarantee food security and contribute significantly to poverty reduction there is need to transform local processing to industrial processing; together with infrastructure for modern storage methods in most of the cassava producing areas of the country. The dominance of local processing and rudimentary storage systems remains the greatest handicap towards the transformation of the cassava subsector into a veritable instrument for poverty alleviation.

Fresh cassava roots are vulnerable to post harvest loses because they are difficult to preserve especially when wounded in course of harvesting or braised during transportation and packaging. In Cameroon cassava is cultivated under a wide range of ecological environments, from the humid, sub humid and to a lesser extent in the savanna areas[14]. An advantage cassava has over most root and tuber staples like yam, coco yam and potatoes are its adaptability to grow even in areas with low fertility, it's resistant to draught and relatively immune to damage by locusts[15]. Cassava is normally grown in cropping sequences before bush fallow because it does not respond as well as cereals do to good soil. According to FAOSTAT[15] Cameroon produces 4,596,383 tons annually; meaning that the country contributes significantly to African production figures for cassava. According to the same projections Cameroons' production figures for cassava are likely to triple by the year 2020 due to growing number of actors involved in the production of the crop.

According to Atanda *et al.*[16], cassava production has been successfully adapted into farming systems due to the following reasons: i. Its year round availability acts as assurance or protection against hunger. ii. Cassava is adapted to traditional farming and food systems, iii. It can be processed locally and industrially, iv. A relatively high yield of food energy (calories) per calorie of labour input, v. A veritable food crop used to fight against poverty because of its year round availability.

Cassava ability to adapt to short fallow periods has made it a very attractive crop to produce in low land areas. Unlike yams, cocoyam and other root and tubers, the edible part is not utilized for planting and this has resulted to increasing land area being put into cassava cultivation[17]. The only limiting factor however to cassava expansion is that it tends to tie down the land since it is ready for harvest in 12-15 months.

However in recent years research into cassava has produced varieties that can be lifted in six months instead of more than one year[18]. However these research varieties are not as adaptive to traditional farming systems like the unimproved varieties which can be kept underground for more than six months after maturity pending demand conditions[19]. Since there are no efficient storage systems for cassava roots they must be processed or consumed immediately after harvest to reduce postharvest losses including economic and financial losses attributed to deterioration and food losses which have adverse effects on marketing. In the southwest region of Cameroon deterioration of fresh cassava roots and its locally processed products is greatly accelerated by the general absence of infrastructure to facilitate transportation and storage at farm level, processing units, and to consumers[20].

Matured cassava stems are bulky to carry on head loads to urban areas or even within the villages where processing takes place. As a result most of the crop is harvested and processed around farm areas where there are streams for washing and peeling. However due to some improvement in rural transformation of certain cassava producing areas most of the roots are transported by hand driven trucks after peeling and washing in streams and springs while processing is done locally in the villages. Some of the processed products are difficult to transport to markets as road infrastructure and storage systems are grossly inadequate. Locally processed cassava products are more often relatively less expensive in most of the processing areas due to inadequate market access, absence of competition among buyers and sellers the enclave nature of most cassava producing areas[21]. These factors affects commercialization of the crop and its processed products.

The few modern processing units located around some towns are inadequate to meet the growing demand for cassava products due to production and supply constraints attributed to inadequate infrastructure. These problems result to scarcity of cassava products to consumers who are indistant markets from the production centres[22]. The processing of cassava into a wide range of locally consumed products to some extent guarantees the processed products a longer shelf life than the fresh roots, but continuous delays in evacuation and poor handling practices exposes the products to agents of food losses like fungi and bacteria which could have attendant health effects to consumers.

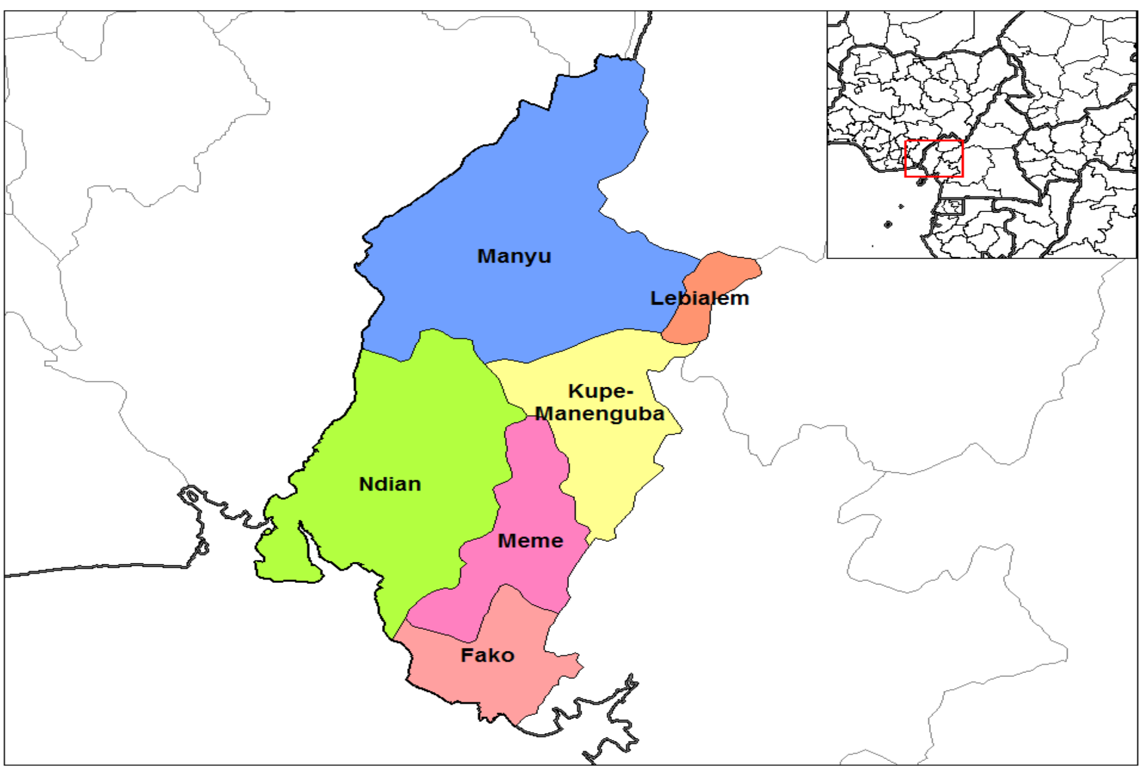
According to Nchachume *et al.*[23] lack of specification for the processed products is another area to question their health effects to consumers since the products are mostly processed without specified standards of hygiene and sanitation. These writers are of the opinion that if an enabling environment for production and processing of cassava could be guaranteed in rural areas, resources used for food imports could be ploughed to productive uses to increase production and productivity of cassava in rural areas.

Materials and methods

Study area: This research was conducted in the South West region of Cameroon. It involved twenty villages selected randomly from three administrative division of Meme, Ndian and Fako divisions. The five subdivisions are and their populations were Mbonge (115,982), Konye (62892), Moyuka (118,770), Ekondotiti (56,509) and Kumba Central (144,268). The population figures were based on statistics of 2009 population estimates for Cameroon. The population was not divided into males and females.

These divisions and subdivisions are rural with agriculture the main occupation. The vegetation of the areas is the equatorial rain forest and cassava is grown in most of the villages and other settlements. Some villages and towns in the study area are undergoing rapid urbanization which has attracted commercial activities and also a high demand for food. The main crops produced in the selected areas are cassava, yam, cocoyam, plantains, banana, oil palm, cocoa and coffee. Other occupations in the study area are petty-trading, hunting, fishing and the civil service.

Objectives of the study: i. Examine the sources of postharvest losses to farmers, processors and marketers of garri, ii. An examination of storage, processing and transportation methods in the study area. iii. Identify the sources of monetary losses at production, processing and marketing of garri.



Source: National Institute of Catography; Ministry of Scientific Research and Innovation, Cameroon
Map-1: Map of South West Region showing some of the study areas.

Methodology: Sampling techniques: A total of 20 villages were randomly selected from five subdivision selected from Meme, Ndian and Fako divisions of the South West Region. A total of 406 respondents (farmers) were selected by purposive sampling because though cassava production is a major occupation of the farmers, not every farmer in the study area produced cassava. The sample size was determined by use of Glenn[24] method for determining sample population given the population of each subdivision as given Cameroon's 2009 population estimates.

Information was obtained from a sample size population of 406 respondents by use of open and close ended questionnaires, observations and group discussion among cassava farmers, stakeholders and other actors in the cassava value chain. About 85.7% of these respondents were farmers engaged in cassava production, local processing and marketing, 10.8% produced and marketed fresh cassava without processing; and while 3.7% were engaged in processing and marketing of cassava. Due to absence of division of labour in the cassava production most farmers were involved in production, local processing and also marketing.

Data collection: Primary and secondary data were used for the study. Primary data were collected by use of structured questionnaires, oral interviews and group discussions among the various actors in cassava production, processing and marketing. The questionnaire was structured in a way that information on loss assessment could be obtained at every stage cassava production including marketing level. Secondary data was obtained from already published literature on magazines, scientific journals, and text books including online publications.

Data analysis: The following quantitative and qualitative techniques were used for data analysis: i. systematic searching and arranging field findings for presentation, ii. Organization and breaking down of data based on research objectives and answers given to research questions, iii. Checking data entry for any entry errors, iv. Quantitative data from close ended questionnaires were analysed using quantitative techniques like frequency tables and percentages: bar charts, histograms, pi charts, v. Qualitative data obtained from open ended questions grouped into themes corresponding to study objectives, vi. Use of SPSS in the analysis of quantitative data.

Results and discussion

Postharvest losses at farm level: The phenomenon of postharvest losses in cassava and other root and tuber crops starts at farm level through harvesting. Harvesting of cassava roots is commonly done manually by digging or uprooting the plant from the soil. The digging process is usually done by use of crude implements like cutlasses and hoes which usually wounds the root underground before they are uprooted. Production of root and tuber crops have not been mechanized and there are no existing production methods or strategies that can be used for harvesting cassava without wounding the tubers. Furthermore are no treatment available to reduce root rot in wounded roots after harvest in the study area. It was further revealed that farmers have no access to extension education meant at reducing postharvest losses at farm level while storage methods in the study area are highly rudimentary. The dominance of rudimentary storage accounts for the enormous food and income losses experienced at farm, and marketing level of cassava in the study area. Food losses are also pervasive because there are neither improved nor modern storage methods in the study area. Figure-1 shows the various losses incurred by cassava farmers in all level of the value chain.

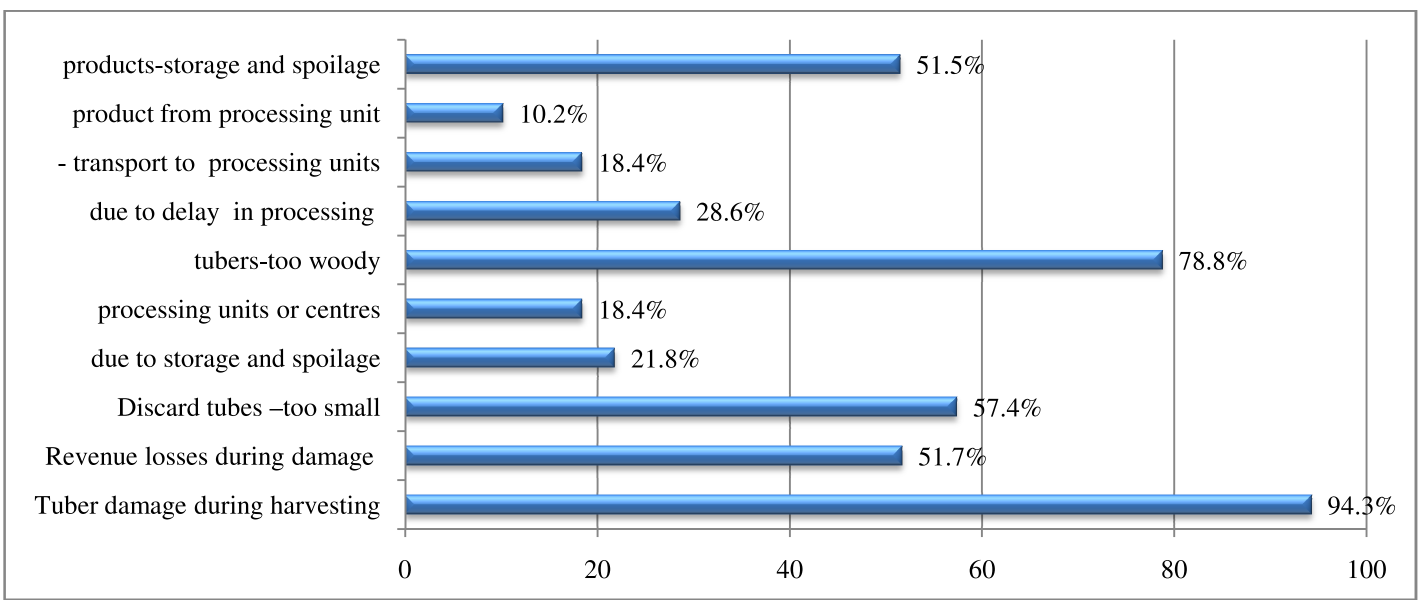


Figure-1: Losses assessment for Cassava farmers.

Farmers acknowledged losses incurred as a result of tuber damage during harvesting (94.3%), discard tubers (57.4%), poor storage conditions (21.8%), transportation to processing units (18.4%), and discard of woody tubers(78.8%), discard of rotten tubers due to delays in processing (28.6%), loss of finished product from processing units (10.2%), and loss of finished products-storage and spoilage (51.5%).

All these issues were admitted as problems among cassava producers and in the value chain. Similar studies carried out by Acquah *et al.*[2], also confirms that tuber damage, discarded tubers and poor storage as the most prominent avenues accountable to postharvest losses in cassava. According to the study the absence of technology to reduce tuber damage during harvesting have been accountable to postharvest losses at farm level. Also discarded roots occur as a result of root rot resulting from postponed harvesting; while poor storage conditions attracts agents of food losses like fungi growth on wounded roots. These sources of food losses in cassava have been prominent in most cassava producing areas and have been revealed by other studies on postharvest losses in the cassava value chain. Figure-1 shows the various types of losses admitted by cassava farmers in the study area. Quantitative estimates have been difficult to obtain from farmers because most farmers are ignorant or have not been educated on the importance of keeping quantitative information on production, food and income losses. This has been compounded by the fact that a great majority of the farmers are illiterates and semi-illiterates and extension education is inadequate to create any impact on agricultural marketing in the study area. Due to the unorganized nature of activities in cassava production, most of the farmers are involved in production, processing and marketing of cassava. There is no division of labour among activities in the cassava value chain as they are carried out by peasants.

These issues mentioned about food losses were considered by farmers in the study area as endemic problems affecting cassava producers. When we compared the various problems affecting cassava farmers it was discovered that the most prominent postharvest problems are root damage during harvesting (93.4%), discard of woody tubers (78.8%), and discarded roots too small to be peeled (57.4%), loss of finished product caused by storage and spoilage (51.5%). Other losses are still significant and constitute problems among actors in the cassava subsector.

According to the respondents the major factors responsible for posth harvest losses during cassava harvesting include soil structure, the season during which harvesting is done, and the equipment used for harvesting. Harvesting of cassava roots as earlier mentioned is done by digging the soil and uprooting or pulling the stem. In all these cases farmers acknowledged broken roots which attracted agents of food losses if the roots are not processed immediately especially as storage structures are largely traditional. Farmers also revealed that in course of harvesting the crop some broken roots are completely lost underground there by incurring both food and monetary losses. It was further revealed that the digging process is more difficult during the dry season than the rainy season when the soil is moist. These reasons help to explain why root damage constitutes the highest proportion among factors responsible for food losses in the study area.

The second proportion of losses admitted by farmers is the discard of woody roots (78.8%) which result when cassava is left underground after maturity for more than the required period pending market conditions. Woody roots are relatively common in traditional variety of cassava than the improved variety which experiences root rot after the maturity. According to respondents most farmers harvest the improved variety immediately after maturity to avoid root rot and consequent food and monetary losses during production and processing of the crop.

The traditional variety though not as vulnerable to root rot develops woody root which are difficult to process, takes longer to boil and develops unusual bitter taste when boiled. Farmers and processors also acknowledged that woody tubers are more difficult to peel and grater and constitutes losses in the cassava value chain. Another pertinent area of food losses identified in the study is the discard of small root (57.4%). Both farmers and processors acknowledged small tubers are discarded because they are very difficult to peel and grater during local and industrial processing of the crop. These revelations were also acknowledged by Tolly[25] in studies on postharvest losses in the cassava value chain.

Storage and marketing of cassava: Marketing of fresh cassava roots: Cassava roots are highly vulnerable to postharvest losses after harvest and securing the crop entails the use of modern or improved storage systems which have been observed absent in the study areas. Fresh cassava roots are sold in the market, farm gate or at home. About 31.2% of the farmers sold cassava roots in the market; 48.6% at farm gate; while 20.2% sold at home.

Respondents testified that due to the neglect of farm to market roads in the study area most dealers on fresh cassava roots prefer to buy the harvested and standing crops during the dry season than rainy seasons when roads become impassable as a way of reducing postharvest losses attributed to delay in transportation and poor storage of the crop.

Figure-2 indicates the various avenues where farmers sell the harvested crop. Selling of fresh cassava roots in the market is common to those areas where cassava farms are nearer the village markets and transportation could be done by head load, hand driven trucks and occasionally by vehicles. Most farmers prefer to sell the standing crops to processors in order to avoid cost and losses incurred during harvesting, storage, transportation and processing of the crop.

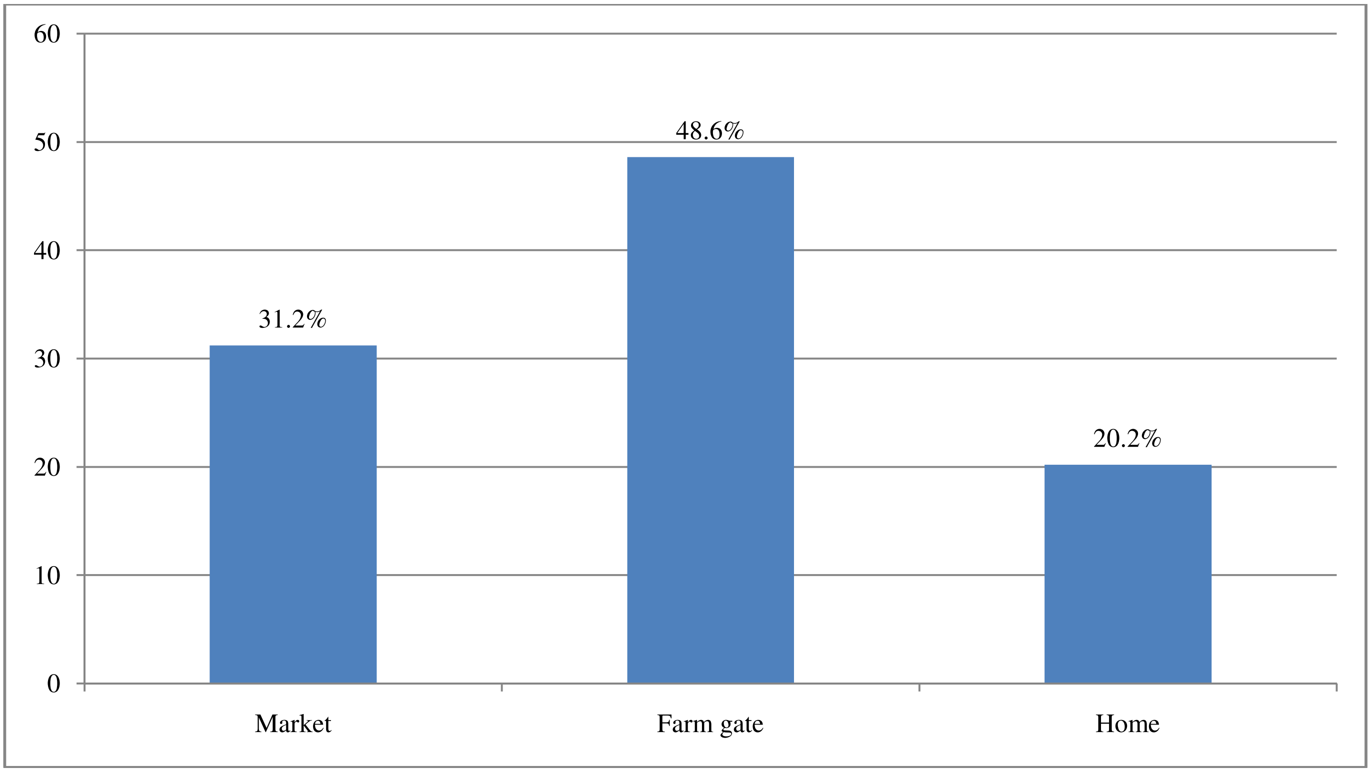


Figure-2: Marketing of fresh cassava roots.

Respondents disclosed that most farmers also sell harvested cassava at farm gate reduce the cost of transportation and storage incurred in processing. Figure-3 shows the various means by which cassava is transported in the study area.

Methods used for cassava storage: Traditional methods of storage were commonly used in preventing fresh cassava roots from postharvest losses as there is general absence of modern or improved methods of storage in the study area. According to the respondents most farmers process the crop immediately after harvest to prevent both food and income losses as traditional methods of storage are inadequate to prevent postharvest losses in fresh cassava roots.

It was observed that some farmers preserve cassava by digging holes and spraying the cassava with gamaline mixed with wood ash to prevent insect pests and growth of fungi. Most of the farmers acknowledged that cassava mixed with wood ash and gamaline lasts for more than seven days after harvest before it could be infected by fungi. According to the farmers most consumers are hesitant to buy fresh cassava sprayed with wood ash mixed with gamaline for fear that the tubers could be poisoned or contaminated by the chemical and could cause health problems to consumers since gamaline is a poisonous chemical. It was revealed that this method of preserving cassava roots was common among local processors when processing equipment becomes faulty or there is inadequate labour to do manual grinding of the root. However to avoid poisoning most farmers testified that before spraying harvested cassava tubers with gamaline and wood ash, a careful selection is always done separating the wounded roots from the unwounded ones. The farmers are aware that spraying the wounded roots with gamaline poisons the tubers and could become a health threat to consumers.

Respondents testified that the absence of modern or improved storage methods was responsible for tuber rot after harvest attributed to invasion by rodents, insects' pests, fungi and bacteria accountable for food losses. A majority of farmers revealed that marketing of fresh cassava for food was not attractive because consumers prefer the processed forms of the crop than the unprocessed tubers which are difficult to handle and prepare. These revelations are in accordance to similar studies by Ekwere *et al.*[11] and Faiz[22] which recommend processing as the only veritable means of making root and tubers crops more acceptable to consumers. According to these studies growing urban populations prefer food items which are relatively easy to prepare than fresh roots whose preparation involves waste of time and energy to most classes of people including farmers themselves.

Methods of transportation: Four methods of transportation common in the study area include head loads (49.2%), hand driven trucks (21.3%), vehicles (10.3%), and use of commercial motorcycles (20.2%). It was observed that the absence of farm-to-market roads in most of the study area including the deplorable nature of the existing roads accounted for the disparity in the various means of transportation.

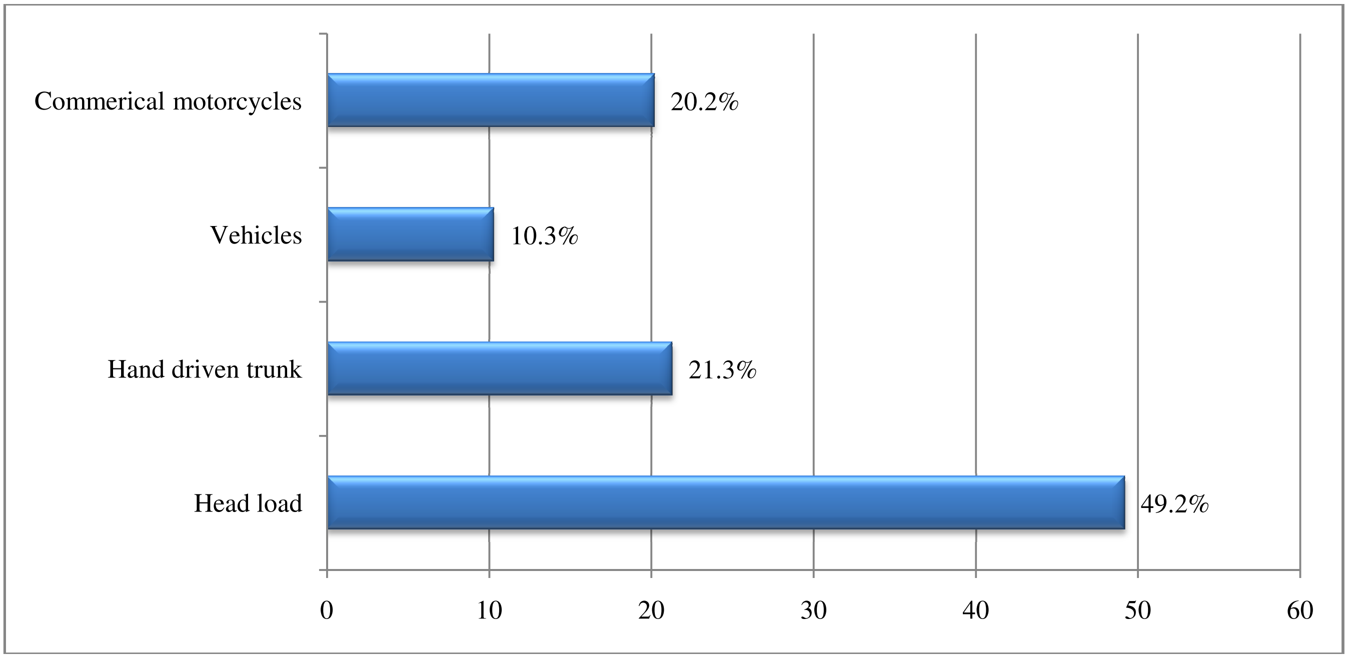


Figure-3: Method of transportation of cassava.

The use of head loads is the major means of transport from the farm to the local market, to farm gate and to the home. Farm to market roads are few and deplorable making transportation by hand driven trucks difficult. Transportation by use of vehicles is seasonal and occasional and is mostly hired to transport fresh cassava or its locally processed products. Delay in transportation is the most common phenomenon experienced by actors in the study area. Roads are generally bumpy and user cost outweighs other production costs making cassava products relatively expensive in urban markets. The transportation system is the greatest cause of postharvest losses in the cassava value chain of the region. The regions agricultural communities are generally enclaved. And most of the farms are linked to village markets by foot paths. Trucks and vehicles are mostly used in some accessible area.

Commercial motorcycles have been highly adapted as means of transport in accessible and inaccessible areas because there is general shortage of transport vehicles. However the quantities of produce transported are always limited though user cost is high due to the poor nature of farm to market road.

Figure-3 indicates the various methods of transportation in the study area. According to respondents farmers and traders transporting cassava and other agricultural produce spend several hours and even days on the way to markets as a result of bad roads. Many vehicles get stuck on the way as a result of mud and deep gallops, while others experience mechanical problems that require repairs in course of transportation. As a result actors experience both qualitative and quantitative losses of cassava products. This constitutes a deterrent to poverty alleviation in most rural areas producing cassava.

Sources of losses in the cassava value chain: Garri processing: Garri is processed from cassava through the following stages in the study area: peeling of the cassava tubers, washing of the peeled tubers, grating or grinding into mash, fermentation of the mash; sieving of the fermented cassava; frying of the sieved part and cooling; and finally packaging into bags which are stored for sale. Local fermentation is accomplished by putting the grated mash into bags and tying between sticks to enable the exit of poisonous fluids and water. According to respondents sieving of the fermented mash is necessary to filter inedible solid particles so that the garri can be eaten or swallowed without any inconveniences. The inedible solid particles are from woody parts of grounded cassava.

The compressed mash is made to dry and kept in local storage system in preparation for sieving. It was observed that most of the storage structures for processing cassava are not protected from insects, rodents and fungi which contaminates the products and affect quantity and quality of garri. Studies by Ima *et al.*[26], equally revealed quantitative and qualitative losses attributed to animals, fungi and bacteria during local processing of cassava to garri among other products. In this study dry cassava mash was stored stored in an open environment prior to frying into garri. Due to the unprotected nature of the environment the dried cassava mash is vulnerable agents of quantitative and qualitative postharvest losses which could likely affect the quality of processed product(s).

Due to poor storage a greenish pigmentation was observed growing on the cassava mash in traditional storage attributed to growth of fungi spores and other pathogens. According to the respondents processors more often remove and discard the contaminated surface of the cassava mash as it could affect the quality of garri processed. This also constitutes a major source of food loss during processing. It was observed that all processes involved in transforming cassava into garri are rudimentary and too labour intensive. In the study area most farmers and processors use locally made graters to produce the cassava mash due to absence of cassava crushing machines. Postharvest losses occur at all stages during local processing of garri in the cassava value chain. These losses have been admitted by most of the actors in the crop value chain. Storage problems have been admitted for as the greatest sources of food and income losses in the cassava value chain. Quantitative postharvest losses are difficult to obtain in the absence of data from actors; while qualitative losses estimates require instruments beyond the scope of the study.

The following avenues of losses were admitted during processing of garri: losses incurred during transportation of cassava tubers, loss of finished product, discard of small tuber, discard of wooden tubers, and loss during storage due to spoilage of the finished product. Figure-4 indicates that the discard of small tubers during processing are acknowledged by (62.7%) of the farmers; followed by losses resulting from woody tubers (47.3%), losses from tuber transportation (27.6%), and losses during storage and spoilage (13.7%), According to the study losses due to discard of small tubers are smaller at farm level than at processors level because farmers are more reluctant to discard their harvest or they apply different techniques or quality standards.

According to Atanda *et al.*[16]; farmers are more reluctant to discard their harvest for fear of losing quantities of produce and income to be paid by processors and other consumers who buy the harvested crop or the standing crop.

Post harvest loss assessment in marketing of garri: Three major sources of food losses were identified in the marketing of garri in the study area, namely; loss of garri during transportation from rural areas to the markets (29.4%), loss of garri during storage due to moisture (54.7%), and loss of garri during storage due to rodents and insects (28.5%) which attack the bags containing garri in traditional storage structures; and loss incurred through unsold stocks (23.7%). According to the respondents loss of garri during transportation to markets occur as a result of poor handling of the processed product, delays in transportation and bad weather conditions. Traders and farmers complained that most of the transportation sources are not protected from adverse weather condition of either excessive rain or sunlight. Respondents acknowledged that food losses occur during rainy season when bags of garri are affected by rain in open and unprotected vehicles which are also used in transporting passengers. Traders and processors also testified that garri affected by rain losses its quality and difficult to market as consumers require mostly the dry product. In the absence of modern dryers and adequate sunlight the wet product attract fungi and other agents responsible for food losses. Garri is also lost in traditional storage structures and warehouses under high relative humidity. Respondents acknowledged that when garri absorbs moisture it becomes unfit for consumption since it losses quality; as consumers prefer mostly its dry form. According to the actors rodents notably rats also compete with humans when garri is kept in traditional storage as these animals cut holes in the bags, contaminate and spill the product; thus causing quantitative and qualitative losses. Studies by Braun[27] have also confirmed that poor atmospheric condition, animals and fungi have also been accountable for qualitative and quantitative losses in cassava products.

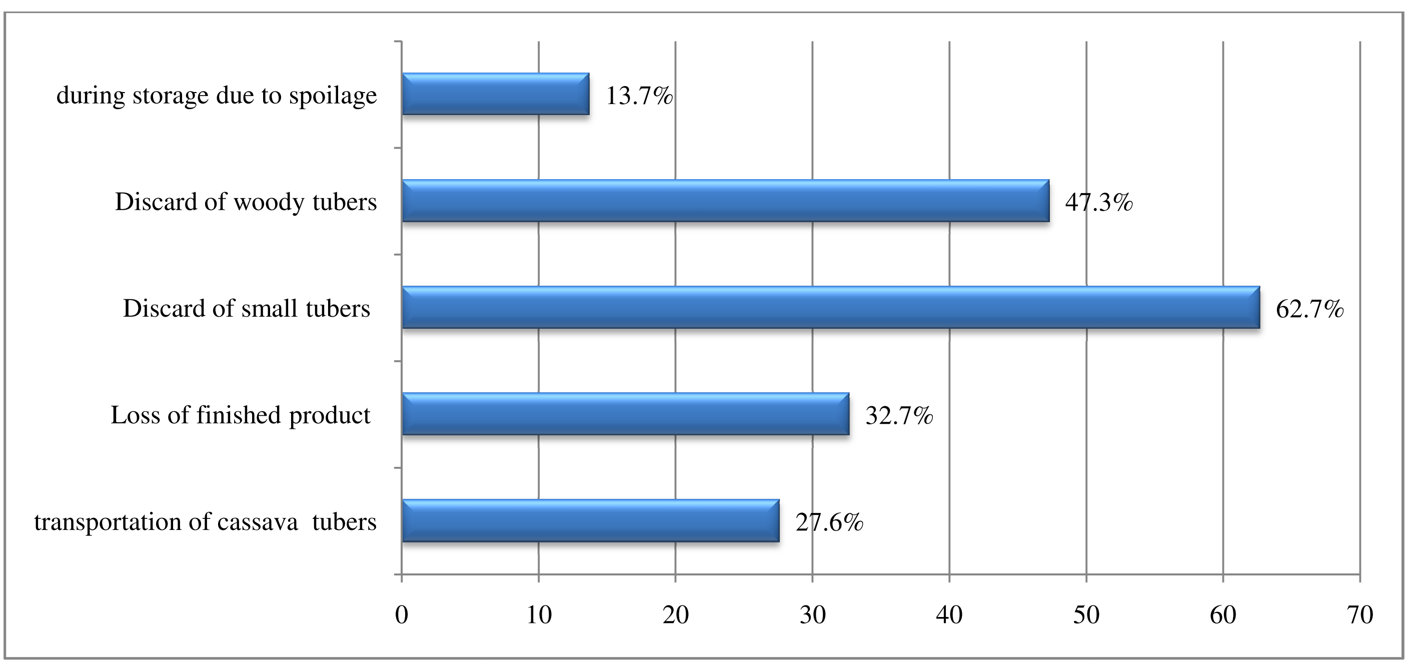


Figure-4: Loss assessment in processing of garri.

It was observed that processed garri is kept in traditional storage where the dry product often absorbs moisture in damp rooms and become and less attractive to consumers. Moisture absorption accounted for the highest source of food losses during marketing of garri. Respondents admitted that poor road infrastructure and delays in evacuation are also accountable to food losses during storage due to rodents and other pests.

Figure-5 indicates that the most significant cause of garri losses due to moisture accounts for losses of about 54.7%, transport losses 29.4%, and storage due to rodent pest 28.5%. Most farmers and traders complained that losses incurred through inadequate storage and transportation delays affect their profit outlay; making it difficult for actors to recover production costs. Although both farmers and traders acknowledged income losses they were unable to provide quantitative evidence on production, output and losses because of generalized ignorance and lack of education on the importance of keeping agricultural statistics. According to studies by Akosua and Bani[28] farmers and processors acknowledge food and income losses from the postharvest phenomenon but quantitative data on production, output and losses are difficult to obtain from various actors though losses admitted are enormous. These studies also admitted generalized ignorance and lack of education on the importance of documenting losses are accountable for farmer's inability to develop quantitative data on agricultural marketing. It was realized that even the educated actrs have no documentation of their farm activities. Hence though losses were acknowledged by significant proportion of actors, quantification of losses in food and monetary terms was difficult at all levels of the cassava value chain. It is largely for these reasons that production and loss values have not been obtained to determine food and monetary losses in the cassava value chain of the study area.

Assessment of monetary losses in marketing garri: The three prominent sources of monetary losses acknowledged by traders include: loss of garri during transportation (35.4%), loss of garri during storage due to moisture (68.5%), and loss of garri during storage due to rodents (34.8%). Garri traders are not organized into common initiative groups or cooperative societies nor are they educated on the importance of keeping statistics on monetary losses and gains. These results are in line with earlier studies by Katinoja[29] and Emmanuel[14] on the cassava value chain Southern Africa and Cameroon respectively. The both studies project the unavailability of data among the various actors in the cassava value chain as the greatest problem encountered at making estimates on postharvest losses in Africa even though actors admit huge food and monetary losses.

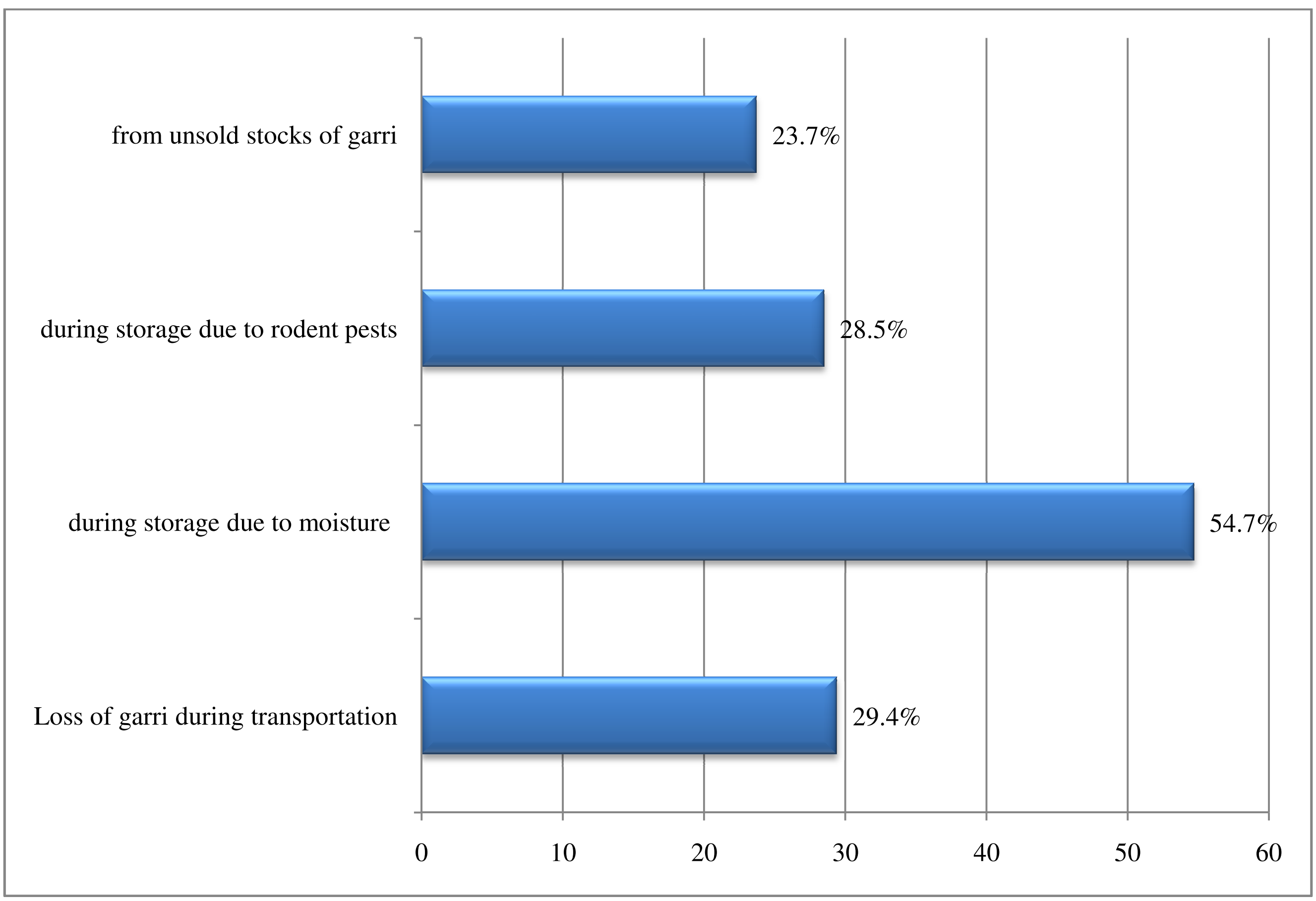
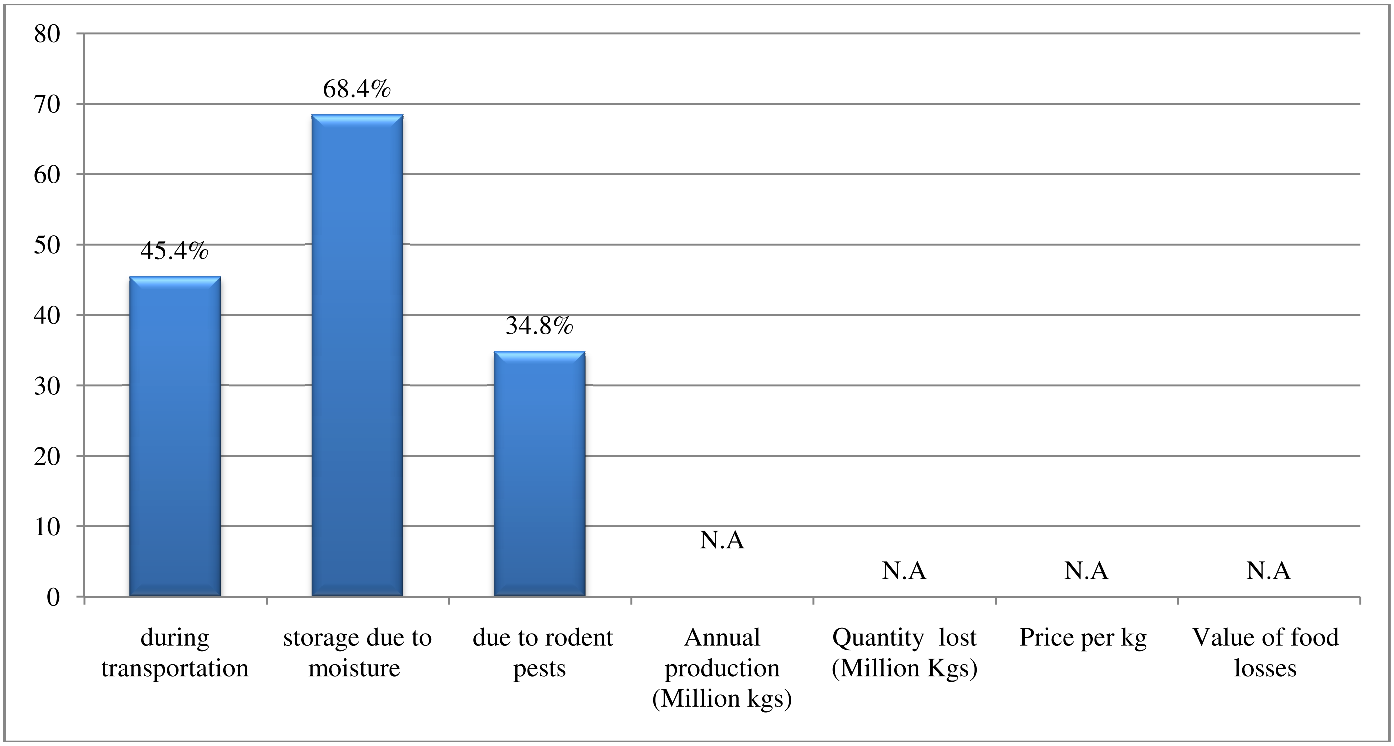


Figure-5: Loss assessment in garri marketing.



Note: N.A in this study means data not available from various actors.

Figure-6: Assessment on sources of monetary losses in marketing garri.

The greatest sources of income losses acknowledged in the marketing of garri are due to absorption of moisture (68.5%) in traditional storage structures or warehouses. Moist garri discourages consumption since consumers desire its dry form which is easy to store and less attractive to agents of food losses. These results have also been confirmed in studies by Kydd *et al*.[30]. Cevero[31] concluding that food and monetary losses could only be prevented by providing adequate infrastructure and facilities for transport and storage in less developed countries. Monetary losses on garri during transportation (35.4%) were attributed to poor handling practices due to lack of specialized containers to protect the products from extreme weather conditions during storage and transportation. Figure-6 is an assessment of the various sources of monetary losses in the marketing of garri.

Conclusion

Cassava remains the most integrated crop in the food systems of most agro ecological regions of Cameroon. In the south west region it is grown by most farming communities as food crop and also for income generation. The crop has advantages over all roots and tubers like yam, coco yam, and potatoes because it can be processed locally and industrially into a variety of food items consumed in most socio cultural settings. In the southwest region one of the most prominent food item processed from cassava is garri. Garri attract high demand in both urban and rural settings because it is easy to prepare and has a relatively longer shelf-life than other locally processed food items. Cassava production in the South West region is dominantly a rural activity though it is also practiced in some peri-urban settings.

Cassava roots are most vulnerable to postharvest losses despite the advantages it enjoys over other roots and tuber crops. The crop must be consumed or processed within four days after harvest due to its vulnerability to postharvest losses; unless there is adequate storage for the harvested tubers. Throughout the rural areas where the study was carried out there are no modern or improved methods for storing cassava and its processed products. Traditional methods which are used in storing cassava products are inadequate to meet the growing urban demand for the products because the products are affected by postharvest exigencies. In addition to poor storage methods abound in production centers for the greatest contributions to postharvest exigencies in cassava is lack of infrastructure for transportation, processing and marketing of the crop. As a result the cassava value chain is plagued with the problem of food losses from farm, processing and marketing levels. Farmers, processors and traders acknowledged quantitative and qualitative losses affecting both food and income generation and thus a deterrent to poverty alleviation. These enormous losses also remain a deterrent to achieving food security and self-sufficiency in the Cameroon. Unless reducing these losses become a focus for government agricultural policy and strategy aimed at improving production and processing in the cassava value chain, rural poverty will remain endemic despite the potentials available for production of the crop.

Recommandations: i. A system of production cannot be efficient if goods and services produced do not reach the final consumer. In the south west region producers of agricultural products are mostly rural dwellers who are inadequately served with infrastructure to guarantee efficient marketing. Endemic rural poverty attributed to lack of market access among producers; calls for the necessity for the government to provide an enabling environment supported by basic infrastructure like farm to market roads, communication and incentive packages to encourage production, processing, and marketing of cassava. In the absence of these infrastructure rural poverty could remain endemic with no foreseeable solution. ii. There is need for government and its agencies to provide infrastructure and facilities for storage as this will help to reduce food and income losses among actors in the cassava value chain. It will be virtually difficult for government to embark on poverty alleviation when the bulk of rural producers lose food and income due to the continuous use of rudimentary technologies. Poverty alleviation strategies could be meaningless when farmers are not provided with modern or improved storage systems for their produce. iii. Cassava processing is dominantly a rural activity largely done with rudimentary technologies which are inadequate to meet with growing food demand. There is need to transform the local cassava processing sector to a modern sector. This is difficult in the present setting as basic infrastructure for transformation of the sector to modern sector is grossly lacking. There is an urgent need for government to provide infrastructure such as farm-to-market roads, electricity and water supply which are basic infrastructure and facilities for modernization of the cottage industry to modern industry. This is because general absence of modern processing facilities and infrastructure in rural areas remains an impediment for large-scale processing which could meet growing demand for locally processed products like garri among other food items. Cassava processing and marketing can only be a vital instrument for poverty alleviation if the activity is modernized as modernization of the sector will create linkages with other sectors of the economy, create employment, increase income generating activities thereby improving living standards and reducing rural poverty. iv. There is also need for farmers and other actors in the cassava value chain to be organized into common initiative groups and cooperative societies. The unorganized nature of cassava farmers makes it difficult to pull resources and engage into large-scale production, processing and marketing of cassava products. The inability of cassava farmers to develop these vital organisations will make it difficult to enjoy from the benefits of large-scale production even with the availability of infrastructure for production, processing and marketing.

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