Haya: The Saudi Journal of Life Sciences (SJLS)
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

ISSN 2415-623X (Print)
ISSN 2415-6221 (Online)

The Acceptability and Utilization of Cassava (*Manihot esculenta*) in Marigat, Baringo County, Kenya

Violet Kadenyeka Mugalavai*, Eunice Yabann, Miriam G. Kinyua
University of Eldoret, Mussco Towers, Off Elgeyo Road, Eldoret, Kenya

Original Research Article

***Corresponding author**
Violet Kadenyeka Mugalavai

Article History
Received: 03.09.2018
Accepted: 14.09.2018
Published: 30.09.2018

DOI:
10.21276/haya.2018.3.9.1

Abstract: The acceptability and utilization of a newly introduced Cassava (Manihot Esculenta) in Marigat, Baringo County, necessitated this study. This paper is drawn from a study that was conducted on Marigat to establish the level of utilization of the cassava roots. A total of 51 introduced cassava varieties were grown and all harvested at 16 months by KARI-Marigat. The study recommends that there should be greater efforts to promote cassava breeding for better food, nutrition and livelihoods that will enable people to live productive lives since cassava is staple in the diet of 90% of respondents in the study area. Deliberate efforts are necessary for leveraging agricultural research towards improved production of cassava roots with better culinary, nutritional and keeping qualities. This may enable communities in vulnerable areas such as Marigat to benefit from improved cassava varieties towards attaining Kenya's Vision 2030's for sustainable livelihoods and development.
Keywords: Cassava *(Manihot Esculenta*), Utilization, Acceptability, Quality, Marigat, Baringo.

INTRODUCTION

In Kenya cassava processing and utilization is limited to the household level where it is basically regarded as a staple food crop. Most cassava is consumed within the household and little surplus is sold in local markets, especially during maize shortages. Although cassava production statistics in the country are not comprehensive, the data available indicates that the production is declining.

The yield per hectare has been decreasing over the last decade from 11 million tons per hectare in1988 to about 7 million tons per hectare in 1999 [1]. However research has shown that yield as high as 72 million tons per hectare can be achieved with improved varieties and proper crop husbandry [2].

There are a number of stakeholders in the cassava sub-sector in East Africa. The primary stakeholders include farmers, traders, processors, researchers, input suppliers, policy makers and implementers, local authorities, Agriculturists, consumers, donors and Non Governmental Organizations (NGO). In Kenya, collaboration between Kenya Agricultural Institute (KARI) and a number of NGOs, donors and universities has been taking place especially in the western region [3] with the aim of improving cassava productivity and value addition.

It is evident that if cassava is to play a critical role in food and nutrition security, there is need to enhance collaboration among the entire stakeholders together with the private sector to ensure development of specific needs of the communities. The food industries may use cassava in many preparations including, sauces, custard, powders, baby foods, Tapioca products, glucose, confectionaries, bakery products such as a jelly or thickening agents and the manufacture of adhesives and dextrin's.

Food security can be defined as access by all people at all times to enough quality food for productive and healthy life. At household level, food security refers to the ability of the household to secure either from its own production or through purchases or both, adequate foods for dietary needs of its members. Food security therefore depends on availability and accessibility, which are determined by production and ability to purchase food [4]. To achieve and to sustain food security, it is imperative to ensure increased production of food crops to enhance availability or facilitate and empower the people in other income-generating economic activities to guarantee affordability [5].

The main crops that have been produced in the country include maize, wheat, rice and sugarcane, and are called the traditional food crops. Traditional food

crops remain the highest starch producers per unit area with relatively low inputs requirement compared to other crops and hence their importance in food security. For many developing countries root crops have a great potential with cassava being more significant [6] because it can grow and produce relatively good yields under adverse climate and soil conditions. However, despite its importance as a staple crop in many developing countries cassava is neglected in agricultural development policies. Cassava roots when attached to the main stem can remain in the ground for several months without becoming inedible and often farmers leave cassava plants in the field as a food security against drought, famine or other unforeseen food shortages [7]. However quality deterioration starts after the roots have reached maturity e.g. starch content increases while fiber increases. The cassava roots after harvesting starts active deterioration within 2-3days and rapidly become of little value for consumption. This initial physiological deterioration is followed by microbial deterioration thus making it a main problem in industrial utilization. This paper discusses the acceptability and utilization of cassava (manihot esculenta) in Marigat, Baringo County, Kenya.

Literature Underpinning

Lack of clear cut food security and commercialization policies for orphan crops among countries in the East Africa root crop research network (EARRNET) region is partially to blame for the slow development of the cassava sub-sector [1]. Lack of policies indicating government commitment to transformation of traditional crops including cassava into commercial crops is also a limiting factor to their development. Over the last decade research institutes have been working on overcoming the difficulties of pests and diseases in cassava production and on supplying of vegetative material and processes of roots for utilization and marketing. Kenya Agricultural Research Institute (KARI) are on the limelight in trying to develop high yielding, pest and disease resistant varieties and they also collaborate with the Ministry of Agriculture so as to increase overall annual cassava production; whereas Kenya Industrial Research and Development Institute (KIRDI) have focused on development, adaptation improvement and transfer of appropriate cassava processing technologies including new product development [2].

As a crop of resource-poor farmers and a food security crop, cassava has generally been neglected by researchers. Until three decades ago the global knowledge base on cassava was meager. Only through the past three decades has an understanding of the crop been greatly advanced. However, the knowledge base is still much smaller than that of most cereal crops. Gaps in knowledge contribute to a number of the problems or weaknesses [8]. Cassava is a root crop whose vegetative propagation is done using stem cuttings taken at harvest of the previous crop yield. Stem cuttings are bulky, do not store well and are costly to cut and handle. As a root crop, cassava requires considerable labor to harvest. Its roots are bulky and highly perishable and therefore must be processed into storable form soon after harvest. Cassava is often relegated to marginal lands due to competition with higher-value and more respected crops. This trend is likely to continue if this crop is not further improved to adapt it to marginal conditions. Cassava often winds up in hill-lands, lands with low soil fertility, or lands susceptible to periodic or seasonal drought or flooding. Other constraints the farmers face include diseases, lack of planting materials, pests, land shortages, weeds and heavy labour requirement, all of which have resulted into decline in production of cassava in Eastern and Central Africa [7]. In general, stigma in cassava is partly owing to the cyanogenic glycoside, compounds that can be toxic unless removed or detoxified by food preparation processes. "Sweet" varieties are those with low cyanogenic glycoside levels that can be eaten raw or boiled like potatoes although they are often susceptible to attack by pests [7].

Several opportunities exist for cassava utilization, for instance the crop is reported to be consumed in 28 different forms in Cameroon alone [9]. In urban areas of west Africa, widespread development of cassava processing methods (consisting of pounding, soaking, and drying to produce a fermented flake known as “gari” have resulted in cassava becoming an important commercial commodity. Such processing capacity does not exist in East and Southern Africa, and cassava has remained a traditional, rural starchy staple in that region. Cassava is also consumed as a snack food in various parts of the continent and widely grown for its leaves, which are used in making sauces. Once again, leaves from varieties with high cyanic acid content must be properly processed to remove the toxic compounds. Processing of cassava roots and leaves improve palatability and eliminate or reduce the level of cyanide [10]. Cassava flour is sometimes used in making bread for local consumption. Recently, initiatives in West Africa have aimed at developing the export market potential for production of dried cassava chips used as animal feed in Europe [11]. This market is currently supplied by Asian production. Cassava is increasingly becoming important food and cash crop for its multiple use and Kenya will not be exceptional in capitalizing the utility of this wonder crop. In Western part of the country, the households have much benefited from cassava as it is recorded second to maize in terms of importance as a food staple. The form in which cassava roots are consumed normally depends on the country. In Kenya, cassava is either processed or eaten boiled as a snack. But the main method of utilization involves grinding of dried cassava chips/chunks in combination with various dried cereal to make composite flour that is used to prepare hard paste-ugali (Kenyan favorite dish) and uji (porridge). But in general three categories of cooking quality have been recognized among cassava varieties

in Africa [12]. The roots of some varieties are non-cookable (bitter varieties) and are used only in food processing; such roots will never boil soft no matter how long they are heated. In second case, the cassava roots can be said to be glassy such that however cooked after several minutes of boiling, they often are difficult to chew. The last category is that mealy cassava roots. For this case, the cassava cook or boil easily, are floury in texture and can easily be eaten like a cooked potato [12].

Cassava processing procedures vary depending on products, from simple processing (peel, boil and eat) to complicated procedures for processing into gari, for example, which involve many more steps like peeling, grating, pressing, fermenting, sifting, and roasting. Some of these steps reduce cyanide more effectively than others. Processing techniques and procedures differ with countries and localities within a country according to food cultures, environmental factors such as availability of water and fuel wood, the cassava varieties used, as well as the types of processing equipment and technologies available [13].

MATERIALS AND METHODS

The study entailed a cross-sectional survey which was conducted in Marigat of Baringo County and data collected by use of qualitative and quantitative measures [14]. Primary data was obtained from various stakeholders at the rural farm household level, food venders and key informants in the study area while secondary data was collected from the Marigat District agriculture office annual reports and non-government organization within the same District. Other secondary data sources included KARI-Marigat, literary publications and the internet sources. The questionnaires were pre-tested to improve on the validity and reliability.

The target population comprised communities that lived ten kilometers from within Marigat town due to harsh weather, poor road network and the long distance between households. Therefore three villages bordering Marigat town namely Kimalel, Koriema Perkerra and Marigat trading centre were purposively selected to form part of the study because of their proximity to town. Households, who produce, utilize and sell cassava roots and flour formed part of the study. The participants were sorted with the guide of extension officers from the Ministry of Agriculture Marigat. The identification of the household respondents within the ten kilometers was based on simple random sampling and willingness to participate in the study. The research aimed at allowing the respondents to express the intensity of their opinions on various aspects of cassava and food security. It was possible therefore in this research to compute mean scores or sum of individual ratings on various aspects of the cassava crop.

To make valid statistical inferences from the results obtained, it was necessary for statistical tests to have enough power, that is, the probability of finding a difference if in fact the difference existed. The main objective of the study was to determine the utilization of cassava amongst farmers in rural Kenya. Since cassava usage in Kenya is a proportion (farmers either used it or not), the study adopted the formula suggested by Mugenda and Mugenda [15] to calculate the appropriate sample size that was used. The formula is given below:

$$n_o = \frac{Z^2 pq}{e^2}$$

Where,

n_0 = the sample size

Z^2 = 1.96 for a 95 % confidence interval (area under a standard normal curve or a student t distribution with infinity degrees of freedom, which contains 95 % of the observations)

e = the desired level of precision/sampling error, which in this study was +5 %.

p = the estimated proportion of the attribute of interest present in the population, such as cassava utilization. Since, this proportion could not be obtained from previous studies; the study used a proportion of .5, which assumed maximum variability in the population. Thus, the estimated sample size was likely to be more conservative, that is, the sample size was likely to be more than what was required.

$$q = 1 - p$$

Thus,

$$n_o = \frac{(1.96)^2(.5)^2(.5)^2}{(.05)^2}$$

= 385 households/farmers

However, since the number of households within 10 km from Marigat town in the three villages (Kimalel, Koriema, Perkerra and Marigat trading centre) were less than 1000, the following correction for small population was used (this is because a given sample size provides proportionately more information for a small population than for a large one) hence:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where n is the sample size while N is the target population size. Thus:

$$N = \frac{385}{1 + \frac{(385 - 1)}{1000}} = \sim 278 \text{ households.}$$

However, due to the limited time, the long distances between households and the poor road network, this study sought to collect data from 250 respondents.

Thus, all cassava was categorized into the three groups (Mealy, non-cookable bitter varieties and glassy) reflecting the degrees of mealiness. The cooked samples were divided into small pieces and placed randomly on labeled plates. Each panelist was given a glass of water to rinse his or her mouths before the next sample. Each of the samples was rated for surface appearance (surface color); mealy (floury); taste (mouth feel and after taste); texture (feel of the tongue before chewing). A sample of root cassava with a mean score of three and above for a given attribute was considered acceptable and unacceptable if the mean score was less than three for that same attribute.

RESULTS AND DISCUSSION

The study found that respondents utilized cassava in different ways as shown in Table-1. Majority of farmers 119(48.2%)) ate maize as their staple food, whereas 94(38.1%) considered maize and beans as their staple food. Roughly, half of the farmers 116(47%) used cassava together with maize and millet while the others 107 (43.3%) used it when there was no maize. A small proportion of the farmers (4.9%) used cassava as a snack.

The most popular method of preparing cassava was boiling, with 223(90.5%) of the farmers preferring this method, compared to only 12(4.8%) of the farmers who preferred either roasting or grinding it into flour for ugali. Some farmers preferred eating cassava as a snack represented by 118(47.6%), followed by those who preferred it as a meal 82(33.3%) and lastly, for breakfast 47(19%).

Table-1: Respondents' Cassava Utilization Characteristics

Utilization Characteristics		Frequency	Percent (%)
As a staple Food	Maize meal	119	48.2
	Maize and beans	94	38.1
	Others	34	13.8
When is cassava eaten	When there is no maize	107	43.3
	Together with maize and millet	116	47.0
	Alone as a snack	130	52.5
	For breakfast	47	19.0
	As a meal	82	33.3
	Others	12	4.9
Mode of cooking	Boiling	223	90.5
	Roasting	12	4.8
	For Ugali	12	4.8

n=247

Majority of the farmers in Marigat did not produce enough food, forcing them to either purchase or seek for aid to meet their needs. Most of their farm produce was for subsistence and those managing to sell their farm produce on the market mostly earning paltry annual incomes of less than Kshs. 10, 000. A significant proportion of the populace had not planted cassava while those who did mostly allocated less than one acre for the crop. This study found that the wide utilization of cassava was hampered by several constraints: difficulties in sourcing for planting materials, the existence of pests for the crop, and the high cyanogenic glycosides in some varieties. However, the study also found distinct opportunities existing for the crop: easy maintenance, ability of the crop to grow in all seasons and possibility of upstaging maize and beans as the staple food to back up cassava.

It was established that farmers faced difficulties in sourcing for cassava planting materials, with a considerable proportion of them opting to obtain the materials from their neighbours. This constraint may be to large extent due to the nature of the cassava planting material. Cassava, unlike other common crops such as maize and beans, is propagated vegetatively, using stem cutting taken at harvest of the previous crop [16]. Stem cuttings are bulky, cannot be stored for long and are costly to cut and handle. Thus, a farmer cannot walk into an agronomical shop and ask for a cassava cutting, which was developed earlier. This limits most farmers to obtaining the cuttings from their neighbours, a cultural practice which may not be desirable as the planting materials obtained may not be of the best quality. Another downside to using vegetative propagation is that multiplication rates for new improved varieties are slow, which retards their adoption. Plucknett et al., [16] also found out this in their study. There is therefore a need to develop seeds as the chief propagating materials for cassava, which might overcome the difficulties experienced by farmers with stem cuttings.

As found in other studies, notably those of Bokanga [7] and Kariuki [1], this study also found that

pests infesting the cassava crop were a constraint that reduced its productivity. Although not specifically set out to identity the pest species infecting the crop, this papers identifies some pest species found to be endemic in Africa which include; cassava mealybug (Phenacoccus manihoti), striped mealybug (Ferrisia virgata), and cassava green spider mite (Monony chellustanajoa). Others have been found to be cassava scales (Aonidomy tilusalbus), and vertebrate pests such as birds, rodents, monkeys, pigs and domestic animals such as cattle, goat and sheep [17]. These pests damage and cause yellowing of leaves, suck sap, inject toxins, reduces length of internodes, resulting in smaller tubers, poor quality planting materials and in cases of severe attack, death of the plant [18]. Due to their lower cyanogenic glycoside content, the sweet cassava varieties are more vulnerable to pests compared with their bitter counterparts [19]. Therefore, given that the majority of farmers in the study area plant the sweet variety, the problem of pests might be a major one.

Farmers were found to own small land sizes and even to allocate smaller portions to growing of cassava. Given that land is a finite asset, little can be done about expanding the farmers' holdings. However, if the farmers were to find that growing cassava has more tangible benefits than growing other crops or keeping animals, they might be motivated to dedicate more of their land to growing cassava. Thus, it is important for researchers to develop better cassava varieties that can draw more farmers to growing of the crop. The presence of high cyanogenic glycosides in some varieties implies that they cannot be readily eaten unless elaborate preparative procedures have been conducted [16]. This might limit the number of farmers willing to plant such varieties. Although the "Sweet" varieties are more popular and can be eaten raw or boiled like potatoes because of low cyanogenic glycoside level, they are often more susceptible to attack by pests [7]. Thus, it is pertinent for researchers to develop cassava varieties with lower cyanogenic glycosides but which are resistant to pest attack.

The study found that distinct opportunities exist for the crop, which might be leveraged upon to promote the adoption of the crop in hunger-prone areas of the country. The crop is easy to maintain, can grow in all seasons, and can be planted twice in a year, advantages that have been found by others such as Dele et al., [20]. Soil nutritional requirements of cassava per unit of dry matter yield are much lower than of most other crops, except for potassium because the crop is a very efficient user of soil nutrients [21]. The crop also offers unique opportunities of being stored - that of being left underground after maturity, to be harvested by the farmers whenever they wish.

Compared with other common crops such as maize that must be harvested soon after maturing to prevent rotting and destruction by birds, underground storage of cassava will protect it from consumption by herbivorous animals. Given that the crop in the study area, as in many parts of the country, is used virtually as a fresh human food, there are huge opportunities of expanding the crop into an efficient industrial crop for factory processing, such as in animal feed and starch processing.

Fig-1: Alluvial Soils in the Study Area

Fig-2: The All-Time Cassava Plants in Semi Arid Lands

CONCLUSION

Wide utilization of cassava was hampered by difficulties in sourcing for planting materials, the existence of pests for the crop, small farm sizes and the even smaller land area allocated for the crop, and the high cyanogenic glycosides in some varieties. However, distinct opportunities are extant for the crop. These include easy maintenance, ability of the crop to grow in all seasons, possibility of upstaging maize and beans as the staple food, planting the crop twice in a year and banking the crop underground.

RECOMMENDATIONS

The study has indicated that cassava can be used in every meal as raw, boiled, fry or mixed with other cereals. The author therefore recommends use of the improved varieties that are early maturing and resistant to pests, diseases and texture spoilage with longer duration in the ground to ensure all year food supply to the households.

There is need for the Government to adopt a policy on cassava as a food security and industrial crop as it can grow in most types of soil and these includes:

- Policy on post harvest and agro processing handling for better utilization;
- Working with community during breeding to avoid introduction of unsuitable varieties; and
- Production of breeds that is more palatable with length of ground storage capability/characteristics.

REFERENCES

1. Kariuki, G. M. (2002). Necessary Policy Reform for Promoting Cassava as a Commercial and Food Security Crop: A Case for Kenya. Proceedings of Regional workshop; Kenya 98-107.
2. Mbwika, J. M. (2002). Cassava sub-Sector Analysis in the Eastern and Central Region. Proceedings of Regional Workshop Kenya 8-18.
3. Wambugu, S. M., & Mungai. J. N. (2000). The Potential of Cassava as an Industrial Commercial Crop for Improved Food Security, Employment Generation and Poverty Reduction in Kenya. Nairobi: Kenya Industrial Research and Development Institute (KIRDI), Kenya.
4. FAO. (2012). Food systems for better nutrition, the state of food and agriculture. Rome: FAO.
5. IFPRI. (2008). Sustainable Solutions for Ending Hunger and Poverty. International Retrieved 23rd July 2018 from http://www.ifrc.org, accessed on 14-12-09.
6. Donald, P. F. (1998). Changes in the Abundance of Invertebrates and Plants on British Farmland. British Wildlife, 9(5), 279–289.
7. Bokanga, M. (2001). Blueprint for Development of Cassava Industry in East and Central Africa. East Africa Research Root Network (EARRNET) Steering Committee Meeting.
8. FAO. (1999). The state of Food Insecurity in the World: When People Must Live with Hunger and Fear Starvation. Rome: FAO.
9. FAO. (1997). Food Agricultural Organization. Rome: FAO.
10. Cardoso, A. P., Minone, E., Ernesto, M., Massaza, F., Cliff, J., Hague, M. & Branbury, H. (2005). Processing of Cassava Roots to

Remove Cynanogens. Journal of Food composition and Analysis, 18,451-460.
11. Makhoha, A. O. (2004). Potential Use of Cassava in Animal Feeds Manufacturing in Kenya. Research Gate.
12. Ngeve, J. M. (1998). Maize and Cassava in Africa. Proceedings of Phase 1 Completion Workshop of the Regional Research Project for Maize and Cassava. International Institute of Tropical Agriculture (IITA), Ibadan.
13. Hahn, S. K. (2007). An Overview of Traditional Processing and Utilization of Cassava in Africa.
14. FAO. (2000). The State of Food and Agriculture: Lessons from the Past 50 years. Rome Italy.
15. Mugenda, O. M., & Mugenda, A. G. (2003). Research Methods: Quantitative and Qualitative Approaches. Nairobi: ACTS Press
16. Plucknett, D., Phillops, T., & Kagbo, R. (2000). A Global Development Strategy for Cassava: Transforming a Traditional Tropical Root Crop: Global Cassava Strategy.
17. Belletti, A., Smith, L., & Lapointe, S. (1999). Recent Advances in Cassava Pest Management. Annu. Rev. Entomol. 44, 343-370.
18. AIC. (2002). Field Crops: Technical Handbook. Nairobi: Ministry of Agriculture and Rural Development.
19. Plucknett, D. (1995). Cassava Research in China, Washington DC. Available at. http//:www.istrc.org.
20. Dele, R. C. (2001). Foods from Cassava and their Relevance to Nigeria and other African Countries. Agriculture and Human Values, 18(4), 383-390.
21. Howeler, R. (2001). Cassava Mineral Nutrition and Fertilization. In: R. Hillocks, M, Thresh and A. Bellotti (Eds.), Cassava: Biology, Production and Utilization. Wallingford: CABI Publishing.