Original Research Article

Analysis of the cassava value chain in reference to smallholder farmers in Busia County, Kenya

Abstract

A survey was undertaken in Busia County, Kenya to obtain data for the situational analysis of the cassava value chain. Two hundred and forty-five households were sampled and interviewed in the months of August and September 2021 in Teso South Sub-County, Busia County. Descriptive statistics methods were used to analyse data using Statistical Product Service Solutions (IBM SPSS) version 20 Software. The results showed that the average land size in the study area was 2.7 acres. The mean land allocated to cassava was 0.25 acres. Those interviewed grew cassava mainly for subsistence while the surplus is marketed. Results also showed farmers preferred to grow local varieties (68.4%), improved varieties (21.6%) and a combination of improved and local varieties (10%). The adoption of improved cassava varieties in the study sites was still low. Most of the farmers obtained their income from on-farm sources (71.8%). The major source of information was the farmer-to-farmer extension approach with approximately 66% of respondents obtaining information from other farmers. The farmers like growing local varieties as they have traits that make them preferred to the farmers. The adoption of the improved varieties was still low. More needs to be done on both production; processing and marketing if cassava is to contribute to the food security and income of the households in Busia County.

Keywords: Smallholder farmers, cassava, Busia County, descriptive statistics, Kenya

1. Introduction

Food security is a major concern in Kenya where agricultural production does not meet the demand of a growing population. The struggle for attaining food security has continued to get worse in the face of climate change, which has further constrained rain-fed agricultural production. Cassava (*Manihot esculenta* Crantz) is one of the climate-smart crops, which has the potential to serve as a food security crop. This is because of its ability to tolerate poor soils, and ability to withstand prolonged periods of drought and pest attacks by reducing biomass production and later remobilizing photosynthate reserves in the stems and roots [1], [2], [3]. It is less affected by climate change compared to other crops like maize, wheat, and rice [4]. Cassava is an important food crop in marginal and semi-arid areas of Kenya [5], ranking second in importance to the Irish potato (*Solanum tuberosum*) among other root crops in Kenya. It has the ability to thrive in poor soil conditions, requires low inputs, which makes it favourable for the resource-poor farmers, and is a good climate change adaptation crop in smallholder farming systems. In Kenya, cassava is grown on approximately 90,394 ha with an annual production of 1,112,000 tonnes and an average yield of 12.3 tonnes per hectare [6].

Due to its importance in the face of climate change, the government of Kenya has earmarked cassava as a crop that can be improved and commercialized in order to increase food security at household level in many parts of Kenya especially the arid and semi-arid areas of Kenya. Cassava can contribute to rural household food security and incomes. It is ideal to combat climate change due to its ability to thrive in variable climatic conditions, which has become the norm in many parts of Kenya. Cassava has the potential to produce high yields with minimum inputs, which makes it ideal for resource-poor farmers in smallholder production systems [7]. Cassava roots can be used for human food, livestock feed and making industrial products such as starch. Young cassava leaves are an important source of proteins and vitamins [8]. The roots can be used in diverse forms such as freshly boiled roots and eaten as a snack or roots prepared into crisps or dried chips. Dried chips are milled into flour for the *ugali*, porridge and confectionery industries. Cassava can also be used as a raw material in making starch, paper, alcohol, pharmaceutical products and animal feeds [9]. Cassava roots have a long-period underground storability that can take up to 24 months. The underground storability enhances continuous food supply which gives women an assurance of household food security especially in cases where the surplus is sold to enable the household to buy other diverse foods.

Both Busia County and the national government of Kenya have prioritized cassava as an important crop. Currently, cassava is produced in the region for subsistence but has also been prioritized for commercialization and value addition to expanding its utilization and contribution to the agricultural gross domestic product. In order to combat climate change, the government of Kenya has also prioritized cassava improvement as one of the projects being undertaken by the "Kenya Climate Smart Agriculture Project (KCSAP)". Through the KCSAP, funding was acquired to carry out research on the status of the cassava value chain in Busia County. To determine the status of the cassava value chain, a household survey was carried out in Busia County. The objective of the survey was to determine the status of the cassava value chain at the production or farm level. The findings from the survey would be used to determine the entry points to improve cassava production in Busia County with a view to enhancing the food and income security income of households.

2. Methodology

2.1 Study sites selection in Busia County

Busia County was purposively selected because the county is among the leading cassava-growing counties in Kenya. The multi-stage sampling procedure was used to obtain the sample. The county lies between latitude 0^{o} and 0^{o} 45 North, and longitude 34^{0} 25 East, and covers an area of 1,694.5 km^2. Busia County is administratively divided into 7 sub-counties and 35 wards, where most of the area falls within the Lake Victoria basin. It lies between an altitude of 1130M and 1500M above sea level and receives an annual rainfall ranging between 750mm to 2000mm, which falls in the long rains (March-May) and short rains (August to October). The annual maximum mean temperature ranges between 26^{o} C and 30^{o}C while the mean minimum temperature ranges between 14^{o}C and 22^{o}C. The soils are mostly sandy loam, but dark clay soils are found in the northern and central parts the county [10].

The smallholder households in Busia County grow cassava as one of the main crops for subsistence and for sale. After conducting the Key informant interviews (KIIs) Teso South Sub-county was selected for the study. Four out of the six wards; Chakol South, Amukura Central, Amukura West and Amukura East were selected for the study as shown in Figure 1.

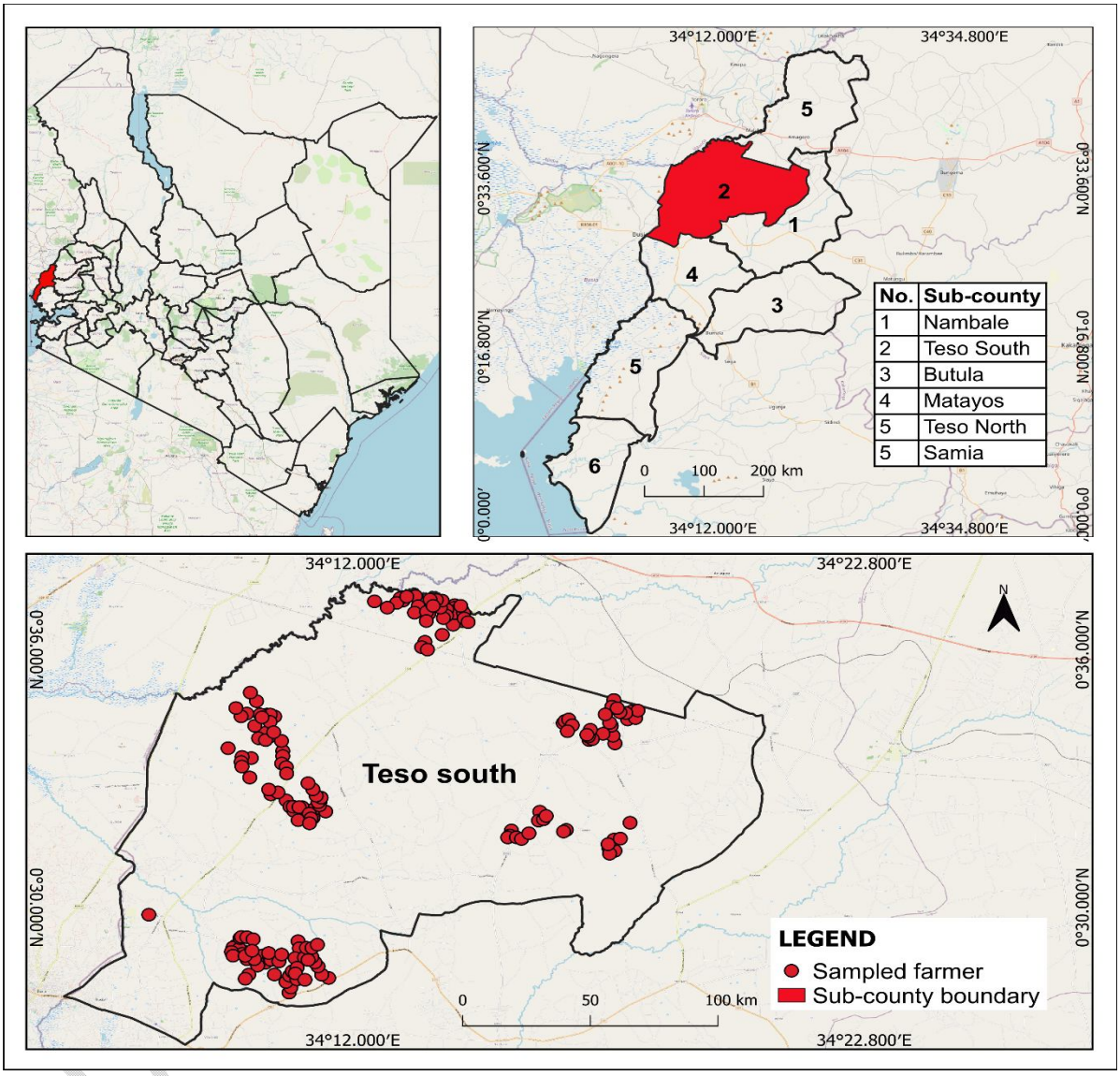

Figure 1: Map of Busia County Showing study sites and sampled households.

2.2 Sampling and data collection

2.2.1 Sample size determination

An estimate of the sample size was obtained by dividing the population in each sub county by the average household size. The population in each sub county and average household size was obtained from KNBH 2019 by use of Yamane's formula [11]:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size of farmers,
e is the level of precision (taken as 10%).
The minimum sample size determined was 100 households. From the discussion with KIIs, it emerged that there was variability among the households growing cassava so 145 more households growing cassava were added, making the total sample to be 245 households.

2.2.2 Data sources and collection

The study used both secondary and primary data. Primary data were collected from sampled households using face-to-face interviews with the selected household heads or their representatives as well as from key informants. Farmers were selected using a systematic random sampling procedure, where a main landmark such as a road, church, or school was used to walk along the transect and select every 5th farmer for interview on the alternative side of the road or path. Farmers were interviewed using a structured questionnaire mounted on Open Data Kit (ODK). The questionnaire was administered to 245 households by trained enumerators and supervised by the research team. All the electronic questionnaires were sent to a central server. Data from the questionnaire was transferred from the ODK to the Statistical Product and Service Solutions [12] SPSS version 20.0 where qualitative and quantitative data analysis were carried out.

2.3 Data Analysis

Data analysis was carried out using descriptive statistics, which was generated using SPSS version 20. The descriptive statistics generated included means, and frequencies that were used to give a description of the households and status of the cassava value chain in Busia County.

3. Results and Discussion

3.1 Characteristics of households that grow Cassava in Busia County

The mean land size in South Teso Sub-county was 2.71 acres with a standard deviation of 3.94 as shown in Table 1. According to the results of the key informant interviews, agricultural land in Busia County has been declining due to sub-division resulting from inheritance. The mean land allocated to cassava pure stand was 0.25 acres and cassava intercropped with other crops was 0.33 acres. Approximately 80% of the household heads were male. The gender of the household head might influence production as gender has implication on the ownership of production resources such as land. A study by Owuor, Mulwa and Openda [13] showed that there was disparity in access to cassava production resources skewed towards the men. The mean age of the household heads was 51 years meaning that the farming population in the study sites was aging. Most (80%) of the households obtained their income from on-farm sources. The rest (20%) obtained income from off-farm sources. In Busia on average one person in the household belonged to a community group. This clearly shows that the respondents had not fully embraced the idea of joining groups to enhance their social capital.

Table 1: Household Characteristics in Teso South Sub-county, Busia County, Kenya

Household characteristic	Teso South Sub-county, Busia County	
Land		
Mean land size (acres)	2.71	
Mean land size under pure stand (acres)	0.33	
Demographics		
Gender of household head (%)	Female 20%	Male 80%
The mean age of household head (years)	51.3	
The mean number of people in the household (18-55 years)	Female 2.3	Male 2.3
Main Income source		
On-farm (%)	71.8	
Off-farm (%)	28.2	
Level of Education of household head (%)		
Non Formal Education	11.4	
Primary	58	
Secondary	24.5	
Tertiary	9.2	

Source: survey data 2021

3.2 Agronomic practices in cassava production in Teso South Sub-County, Busia County, Kenya

3.2.1 Varieties grown and preferred by farmers in Busia County

Approximately 68.4% of farmers grew local cassava varieties, 21.6 % improved varieties and 10% both local and improved varieties as shown in Table 2. This implies that the adoption of improved cassava varieties was still low in Busia County. For farmers to adopt the new varieties they need to be aware of the existence of the new varieties through the creation of awareness. Increased adoption and higher yields were found among farmers who had access to extension services (14)

Table 2: Varieties of Cassava grown by farmers in Busia County

Type of Cassava varieties grown (n=190)	Percentage of respondents
Local	68.4
Improved	21.6
Both local and improved	10
Types of improved varieties grown	Percentage of respondents
MH95/ series	21.2
MM98/series	0.4
MM97/ series	0.4

Source: survey data 2021

The farmers (21.6%) who grew improved cassava varieties preferred the MH95 series. The reasons why the respondents preferred MH95 series were because it is high yielding (24.1%), early maturing (21.2%), pests and disease tolerant (12.2%) and drought tolerant (8.2 %) as shown in Table 3. These results concur with those of [15] carried out in Ghana which showed that the adoption of new cassava varieties resulted in higher yields compared to non-adopters. This shows that one of the main reason for adopting new cassava varieties was to increase yields of cassava on farmers' fields as indicated by the respondents in Busia County.

Table 1: What makes the variety most preferred?

Reasons why variety is preferred	Frequency	%
high yielding	59	24.1
early maturing	52	21.2
drought tolerance	20	8.2
pest and disease tolerance	30	12.2
low cyanide levels	16	6.5
market preference	1	0.4
Other	5	2.0
Total	245	

Source: Survey data, 2021

3.2.2 Institutional aspects of the cassava value chain in Busia County

Sources of information for cassava farmers are critical if farmers were to improve their production. When respondents were asked where they obtained information for cassava production, several sources were enumerated as shown in Table 4. Farmer to farmer approach (65.7%) was the most used, followed by Research (4.5%), public extension (2.9%), private extension (2.4%) and NGOs (1.2%). Approximately 89.3% indicated that the information they received was not adequate. More effort is needed to improve extension services to enable farmers get adequate information on cassava production and related issues. Farmer to farmer dissemination approach was highly ranked in Busia County. These results agree with another study in Kenya, which showed that the extension services trained lead farmers who disseminated information to fellow farmers [16]. This method has also been applied in other parts of Africa such as Malawi [17] and has been found to be effective.

Table 4: Sources of cassava information for farmers in Busia County

Source of information	Frequency	%
Farmer to farmer	161	65.7
Research	11	4.5
Public Extension	7	2.9
Private extension	6	2.4
NGOs	3	1.2
Mainstream media	1	0.4
Social media	1	0.4
Total	245	

Source: Survey data, 2021

3.2.3 Markets for cassava in Busia County

For the commercialization of cassava to be achieved, efficient markets for the product are required. In order to establish the state of the markets respondents were asked where they sold their cassava. The respondents indicated that they sold their cassava on the following markets: primary markets (local market near the farm) (44.1%) and farm gate (7.8%), the buyer comes to buy from the farm directly. Even though some mentioned selling on secondary markets (markets at the nearest town within the county), the percentage who did this was negligible. The actual buyers of cassava from farmers were consumers (41.2%) followed by middlemen (4.5%),

followed by retailers (2.9%), and contract buyers (1%) as shown in table 5. There was little or no cassava processing in the study sites.

Table 5: Category of buyer for cassava from farmers in Busia County

Who buys Cassava from the farmers	Frequency	Percent
Consumer	101	41.2
Middlemen	11	4.5
Retailer	7	2.9
Wholesaler	0	0.0
Contract buyer	2	0.8
Processor	0	0.0
Total	245	

Source: Survey data, 2021

4. Conclusions and implications

The paper used household surveys, key informant interviews, and secondary data to examine the status of cassava in Busia County. The aim of the study was to analyse the cassava value chain in Busia County. The information could help to identify the entry points for the development and commercialization of cassava in the study sites. The results add to the body of knowledge on the cassava value chain that will help research scientists, policymakers, and other stakeholders to use the information in the improvement of cassava production by smallholder farmers leading to improved cassava productivity.

The descriptive analysis results showed that the average land allocated to improved cassava in the interviewed households was 02.5 acres, which was small. Farmers overwhelmingly continue to grow local cassava varieties that are low yielding and prone to disease and pest attacks. The farmers like these local varieties as they have traits that make them preferred by the farmers. The adoption of the improved varieties was still low. Those who had adopted the improved varieties indicated that they preferred variety MH 95 series. The improved cassava varieties were preferred because they were high yielding, early maturing, disease and pest resistant as well as drought- tolerant. These traits are desirable in the face of climate variability and climate change, which is affecting many smallholder farmers in Kenya.

Markets for surplus cassava were at the farm gate and the local markets in the form of dried chips. Very basic value addition was undertaken and large-scale processing of cassava to more profitable products was non-existent in Busia County. More needs to be done both on

production; processing and marketing if cassava is to contribute to food security and income of the households in Busia County.

5. Limitations of the study

The study used cross-sectional data that were collected in the year 2021. The data were specific to Busia County conditions, therefore caution should be applied if the results of this study are to be applied in other parts of the world that are not similar to the agroecological and socioeconomic conditions found in Busia County.

References

1. J.H. Cock, D. Franklin, G. Sandoval and P. Juri, 1979. The ideal Cassava plant maximum Yield. Crop Science Vol 19 Issue 2 March-April 1979. Pgs. 271-279 https://doi.org/10.2135/cropsci1979.0011183X001900020025x
2. Mbanzibwa DR, Tian YP, Tugume AK, Mukasa SB, Tairo F, Kyamanywa S, Kullaya A, Valkonen JP. 2011. Simultaneous virus-specific detection of the two cassava brown streak-associated viruses by RT-PCR reveals wide distribution in East Africa, mixed infections, and infections in Manihot glaziovii. J Virol Methods. 2011 Feb;171(2):394-400. doi: 10.1016/j.jviromet.2010.09.024. Epub 2010 Oct 13. PMID: 20923689.
3. Kengkanna Jitrana , Phissinee Jakaew , Suwaluk Amawan , Natalie Busener , Alexander Bucksch and Patompong Saengwilai, 2019. Phenotypic variation of cassava root traits and their responses to drought. Appl Plant Sci 2019 Apr 10;7(4):e01238. doi: 10.1002/aps3.1238.
4. Jarvis A., Julian Ramirez-Villegas, Beatriz Vanessa Herrera Campo and Carlos Navarro-Racines 2012. Is cassava the answer to African Climate Change Adaptation? Tropical Plant Biology 5(1):9-29. DOI: 10.1007/s12042-012-9096-7. https://www.researchgate.net/publication/. Accessed on 24th February 2022
5. Government of Kenya (2014). Kenya 30,000 Hectare Cassava Plantation Development Project. Government Printers
6. FAO, IFAD, UNICEF, WFP and WHO, 2017. The state of food security and nutrition in the world. Building resilience for peace and food security. Rome, FAO.
7. Parmar, A., Sturm, B. & Hensel, O., 2017. Crops that feed the world: Production and improvement of cassava for food, feed, and industrial uses. Food Sec. 9, 907–927 (2017). https://doi.org/10.1007/s12571-017-0717-8.
8. Waluchio C.N. 2016. Nutrient and Antinutrient Content in Leaves of Selected Coastal Kenya Cassava Varieties as Affected by Maturity Stage, Leafage and Preparation Method. http://erepository.uonbi.ac.ke/handle/11295/97238. Accessed on 24th January 2022..
9. Mulu-Mutuku M. W, Dolphine A. Odero-Wanga , Adijah M. Ali-Olubandwa , Joyce Maling'a & Amos Nyakeyo 2013. Commercialization of Traditional Crops: Are Cassava Production and Utilisation Promotion Efforts Bearing Fruit in Kenya? Journal of Sustainable Development; Vol. 6, No. 7; 2013 ISSN 1913-9063 E-ISSN 1913-9071 Published by Canadian Center of Science and Education

10. Republic of Kenya, 2013. Busia County Integrated Development Plan (2013-2017). Government Printer
11. Yamane, T., 1967. Statistics. An Introductory Analysis.. Second ed. New York: Harper and Rao.
12. IBM SPSS Statistics 20
13. Owuor J.O., Mulwa R.M.S and Openda, N.O., 2021. Gender disparity in Cassava farmers' access to agricultural resources in Rongo Sub-county, Migori County, Kenya. African Journal of Agricultural Research, Vol 17(9) pp.1161-1171 September 2021. Doi: 10.5897/AJAR 2021.15624 ISSN: 1991-637X
14. Onyemauwa, C. S. 2012. Analysis of women participation in Cassava production and processing in Imo State, Southeast Nigeria. Agricultura Tropica Subtropica, 45(2), 72–77. https://doi.org/10.2478/v10295-012-0012-9
15. Patricia Pinamang Acheampong, Monica Addison & Camillus Abawiera Wongnaa, 2022. Assessment of impact of adoption of improved cassava varieties on yields in Ghana: An endogenous switching approach, Cogent Economics & Finance, 10:1, DOI: 10.1080/23322039.2021.2008587
16. Franzel S, Sinja J, Simpson B. 2014. Farmer-to-farmer extension in Kenya: the perspectives of organizations using the approach. ICRAF Working Paper No. 181. Nairobi, World Agroforestry Centre. DOI: http://dx.doi.org/10.5716/WP14380.PDF.
17. Khaila S, Tchuwa F, Franzel S, Simpson S. 2015.The Farmer-to-Farmer Extension Approach in Malawi: A Survey of Lead Farmers. ICRAF Working Paper No. 189. Nairobi, World Agroforestry Centre. DOI: http://dx.doi.org/10.5716/WP14200.PDF