



The status of cassava production and markets in Sierra Leone

Production potential and profiling
cassava farmers in Bo, Moyamba &
Tonkolili districts

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About the paper

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Acronyms

BAFS	Boosting Agriculture and Food Security Project
CBO	Community Based Organizations
FBOs	Farmer Based Organizations
GAP	Good Agricultural Practices
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practices
HH	Households
HQCF	High Quality Cassava Flour
IITA	International Institute of Tropical Agriculture
ITC	International Trade Centre
MAF	Ministry of Agriculture and Forestry
MoTI	Ministry of Trade and Industry
MOU	Memorandum of Understanding
MT	Metric Tonnes
NGOs	Non-governmental Organisations
PC	Process Control
PMB	Produce Monitoring Board
R4D	Research for Development
SCADEP	Smallholder Commercialization and Agribusiness Development Project
SLARI	Sierra Leone Agricultural Research Institute
SLICASS	Sierra Leone Improved Cassava
SLSB	Sierra Leone Standards Bureau
SME	Small and Medium-sized Enterprise
UNIDO	United Nations Industrial Development Organisation
VSLA	Village Savings and Loan Associations
WACOMP	West Africa Competitiveness Programme

Executive summary

In Sierra Leone, the national agricultural development focus is to increase and sustain production, productivity, processing, marketing and utilization of home grown crops. The Ministry of Agriculture and Forestry (MAF) and Ministry of Trade and Industry (MoTI) are implementing field programmes with the potential to boost food security and income from agriculture, especially smallholder agriculture. The realization of this expectation hinges on inclusive partnerships (e.g., MAF and MoTI with their development partners such as World Bank, SCADEP, BAFS, UNIDO, ITC) that enable farmers to engage in competitive farming and formally link up with value chain actors to achieve significant benefit from agricultural market opportunities. Towards this end, cassava is one of the priority crops targeted by multi-stakeholders, including ITC, on the Sierra Leone component of the West Africa Competitiveness Programme (WACOMP) to facilitate shifts from the traditional subsistence production, processing and marketing techniques associated with low value and poor quality products to value added processing for markets.

Contrary to its popular image as a poor man's crop, a famine reserve crop and a rural food staple, cassava has diverse food and industrial utilization pathways with foreign exchange earning potentials. Thanks to the access of many households to basic, mostly rudimentary, cassava graters for processing cassava into fufu and gari (for both domestic and commercial purposes), cassava is gradually becoming a cash crop in Sierra Leone: agricultural households sell all or part of the crop. Processing it into fufu and gari appeared to be a profitable business for farmers, traders and processors

However, cassava production is yet to realize its full potential in Sierra Leone, and this is particularly the case for the 3 districts Bo, Moyamba and Tonkolili analysed by this report.

The cassava sub-sector development currently emphasizes on-farm production with less attention to diversification of product range, quality and value addition for market outreach.

Poor coordination among value chain actors and limited efforts to improve knowledge and application of Good Agricultural Practices (GAP) act as bottlenecks to the development of the value chain. Even though the farmers are mostly members of FBOs and rural based organizations, they would need to be organized into functional platforms that help to increase their access to inputs, technical services and more profitable markets. In 2019 this has led to average yield that were 50% lower than commercially viable yields under good agricultural practices.

To date it does not even exist in the country a **standardized yield assessment protocol** that is used by all the different agencies and farmers in the value chain.

Survey data collected for 105 farmers and 23 traders, reveal challenges at the production, processing and market entry level. Among the main findings:

- Only 29.5% of the farmers indicated they were linked to cassava factories
- The majority (78.1%) of the farmers have not received formal training in cassava production practice
- Only half of them having received visits from extension agents
- the timing of weeding was haphazard and not in line with recommended agronomic practice for higher yields
- Plant protection problems accounted for 52% of the problems, followed by labour cost problems
- Farmers are ambivalent on the benefits of fertilizer and Insecticides use to tackle rodents pests (specifically the glasscutter) and insects pests (mostly variegated grasshopper) and relied on inadequate cultural control measures (incl. limiting the production to disease resistant varieties)
- The vast majority of farmers interviewed do not receive cash credit (97.1%) or in-kind inputs (96.2%) to help with labour costs. As a result, the main motivating factor to join associations is access to credit.

- Input dealers have difficulties accessing formal credit sources to expand their services
- Traders face main constraints in high transportation cost, frequent price fluctuations by suppliers, lack of convenient storage facilities for fresh products, and poor quality of the products.

However, the report indicates that there is room to address agronomic and organizational inefficiencies through improved cassava production techniques and inclusive partnership of technical support services.

There is a need to expand cassava market beyond the traditional cassava fresh-boil-and-eat food products through the design of tailored capacity building programs on value added products such as those made from High Quality Cassava Flour (HQCF). This will include:

- Undertaking comprehensive market studies to identify and analyse sectors with potential to create incentives for scaling up the cassava quality
- Institutionalizing standards for quality management in processing, cassava product development and food safety compliance
- Increasing farmer access to improved and adapted cassava varieties and sound crop management practices
- Promoting cassava-soyabean rotation on same farmland to improve and maintain soil fertility
- Delivering district level project implementation planning workshop will be required to specify and recommend action on key need areas in line with identified constraints

Shortage of suitable land, low access to planting materials of improved cassava varieties and the absence of specific stem multiplication farms owned by farmers/farmer based organizations, demand to:

- Renovate the support the efforts done by only SLARI to invests in purposeful cassava stem multiplication plots
- Elevate farmer groups need into formal cooperatives that engage in expanded on-farm productivity of the crop and maximize agronomic efficiency
- Invest in scaling out approaches to strengthen community capacity and trigger positive changes (e.g. selecting operation sites)

It is of the utmost importance to address ineffective control of pests and water quality controls and improve irrigation system to ensure steady and predictable flows to processing sites by that are not affected by sudden increase of competing food usage during rainy seasons. This will require:

- Undertaking area-wide biological control of the variegated grasshopper between October and December each year to limit the spread of the pests from their hatching sites to new areas
- Improving predictability by produce market data guidelines on market locations, preferences, opportunities, constraints and standards compliance to sell cassava products,

Inadequate harvesting procedures, equipment and packaging solutions lead to low yield products. In most of the cases lack of knowledge on best harvesting (e.g. appropriate plant spacing, appropriate time and frequency of weeding) and processing (quality, process control, good manufacturing, hygiene, waste disposal) practices prevent small holders from smallholder accessing to new and profitable cassava markets. Among the farmers interviewed, none of them prepared stem cuttings with research recommended smooth edges that contributes to high cassava yield. The report therefore recommends:

- Equipping farmer groups and processor groups with knowledge, technology, skills and market connectivity
- Elaborating plan for repurposing, re-tooling factories and constructing new multi-purpose cassava factories

- Create an inventory of the specific standardized equipment needed (secateurs or hand-held rotary cutter to cut stems; energy friendly dryers; packaging materials)
- Establish cassava production pilot sites in a number of villages per Chiefdom to augment on-going efforts to increase farmers' ability to boost yields
- Supporting inter-institutional partnerships are needed to deliver hands-on training in improved cassava planting and crop management, especially in line with GLOBAL G.A.P principles and practices to boost yields and certify farms and products for wider market access.

Focus on access to credit constraints faced by the actors in the value chains by:

- Training value chain actors on business records to provide clear picture of business operations and a basis for credit worthiness.
- Linking FBOs and processors to single digit credit sources, e.g. Community Banks linked to the Apex Bank for the purchase of raw materials, machinery and packaging materials

It will be also important to work on macro interventions that might include:

- Developing and promoting national policy positions to enhance the development, organization and management of cassava enterprises
- Lobbying for a Presidential Initiative on Cassava that could give a boost to implementing public awareness campaigns, incentivizing the sub-regional harmonization of standards for equipment, using memorandum of understandings (MoUs) to link cassava factories to FBOs, among other activities.

This report is part of ITC contributions to understand and plan to increase market interest in diverse cassava utilization pathways, which had hitherto been very low. The report provides an overview of the cassava production and related bottlenecks and and proposes solutions to address the challenges along the value chain.

1. BOTTLENECKS AND CHALLENGES OF THE CASSAVA SUBSECTOR IN SIERRA LEONE

1.1. Introduction

Cassava is the second major staple after rice in Sierra Leone. Farmers use two cassava production systems, a) sole crop production systems in which cassava is the only crop grown and as a commercial crop and b) intercrop production systems (more common than sole cropped cassava) in which cassava is in association with at least one other annual crop grown for food and sale. ITC recognizes cassava as a major food security and income generating crop needing improvement and commercialization; and realizes that to transform the sub-sector from subsistence to commercial level will require comprehensive sector information to:

- Specify and analyze constraints, needs, opportunities
- Facilitate improvements in cassava value chain activities towards market-oriented production, processing and marketing systems
- Create and support linkages to major cassava products demand sources
- Propose areas for technological, institutional, organizational and policy interventions which can, collectively, contribute to higher and sustainable productivity, utilization and marketing of cassava.

This report is based on long standing cassava value chain development knowledge and experience of the consultant in Sierra Leone and elsewhere in Africa¹. The consultant also used secondary data and information in the exercise. The report provides an overview of bottlenecks and challenges in the cassava sub-sector and proposes opportunities and solutions to address the challenges along value chains.

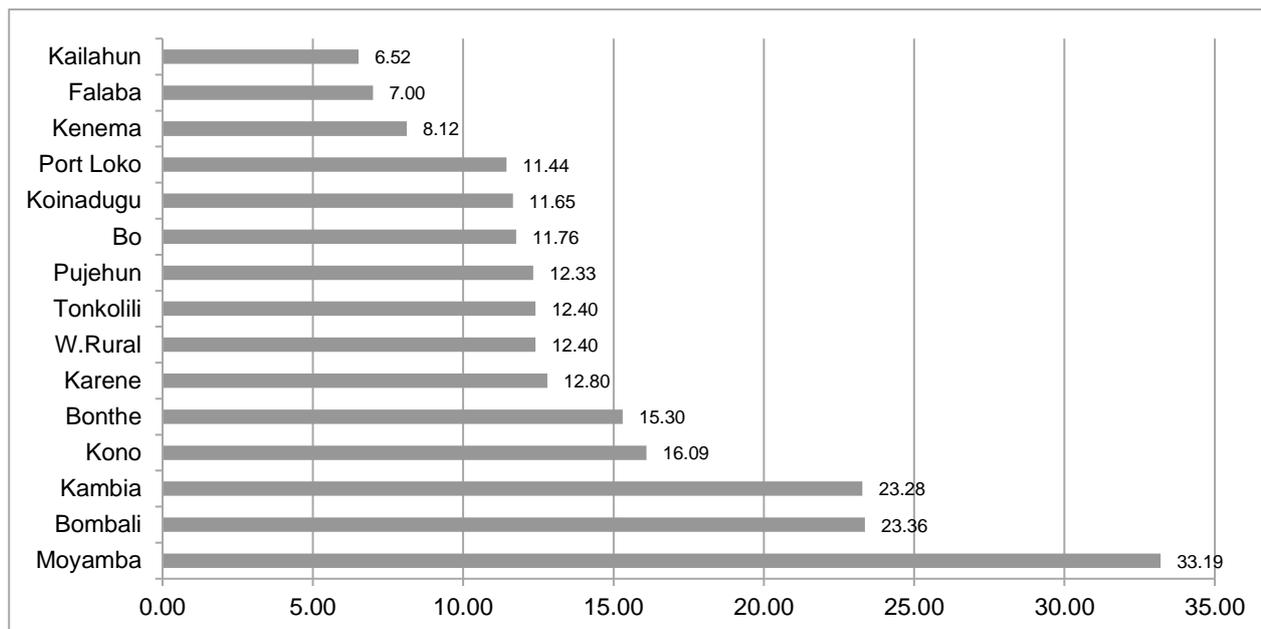
1.2. Bottlenecks

The key actors in cassava businesses are the producers, processors, traders and input providers e.g., transporters, Government extension agents, financial services providers, researchers, NGOs and policy makers. An overarching bottleneck to the full development of the cassava sub-sector in Sierra Leone is that actors along the value chain are poorly organized, connected and supported to apply components of the production, processing, marketing systems required to boost competitiveness of the sub-sector. Apart from research for development (R4D) activities by research groups (SLARI and IITA), cassava development efforts by most of the wider group of actors emphasize production with limited efforts to improve knowledge and application of Good Agricultural Practices (GAP) required for high cassava storage root yield. Consequently, on-farm cassava yields are significantly below commercially viable yields of at least 25t/ha expected of improved varieties used. In 2019, for example, 59,660ha were cropped to cassava by 101,021 households, producing 817,342 MT with an average yield of 14.5 MT/ha². The yield varied widely and ranged from 6.5 MT/ha to 33.9 MT/ha (Figure 1). The average yield is 50% less than commercially viable yields under good agricultural practices.

¹James B. D, Bramel, I., Witte, E. Asiedu, R., Watson, D, and Okechukwu, R. 2011. Expanding the application of cassava value chain technologies through UPoCA project; African Journal of Root and Tuber Crops Vol. 9 No. 1: 38-49

² MAF National Agriculture Survey (NASS), PEMSD/MAF 2019

Figure 1: Cassava yield variation across districts in Sierra Leone, 2019



Source: MAF National Agriculture Survey (NASS), PEMSD/MAF 2019

Additionally, the country is yet to industrialize the cassava subsector through value added processing of the crop. Cassava processors are yet to fully understand and implement the principles and practices of Process Control (PC), Good Hygiene Practices (GHP) and Good Manufacturing Practices (GMP)³. Also, there is poor knowledge of Critical Control Points at factory operations. Cassava product development efforts are weak, and the product and market/utilization base is narrow. Efforts to expand cassava market are yet to look beyond the traditional cassava food products, boil and eat of the harvest, gari and fufu. Capacity building in product development is focused almost exclusively on gari⁴ and fufu flour. There is minimal focus on cassava-based food products such as those made from High Quality Cassava Flour (HQCF), which has wide utilization pathways. As a result beneficiary groups lose out on significant wider cassava market opportunities.

1.3. Challenges

The cassava sector in Sierra Leone has been and continues to be constrained by low on-farm productivity, weak product development and marketing difficulties. The persisting challenges relate largely to lack of sustainable mechanisms for scaling-out of proven research and extension results.

1.3.1. Cassava production challenges

The desired shift towards increased on-farm productivity of cassava faces a number of challenges which act in concert to halt progress. A vital step to increase on-farm yields/productivity is to promote value addition targeting diverse markets in schemes to enhance cassava yield stability and productivity, and reduce devastating losses caused by poor soils and pest infestations.

Shortage of suitable land: Available land for cassava is mostly smallholder fallow plots which are mostly far away from small and medium-sized enterprise (SME) cassava processing factories. Soils are not analyzed to guide choice of suitable sites for cassava production. Only a few processing factories own nucleus cassava farms on own or leased land; but even those factories cannot guarantee availability of the volume of roots required for year-round processing in response to demand for products, e.g., gari. Even where large scale cassava production is considered, there will be challenges associated with mechanization for production and processing. For example, large available land would likely be in remote areas requiring importation of labour

³ Adebayo B. Abass, Nanam T. Dziedzoave, Bamidele E. Alenkhe, and Braima D. James. 2013. Quality management manual for the production of gari. IITA. Ibadan, Nigeria 48 –pages

⁴ James, B., Okechukwu, R., Abass, A., Fannah, S., Maziya-Dixon, B., Sanni, L., Osei-Sarfoh, A., Fomba, S. and Lukombo, S. 2012. *Producing Gari from Cassava: An illustrated guide for smallholder cassava processors*. International Institute of Tropical Agriculture (IITA): Ibadan, Nigeria.

and planting material, investment in road and other basic infrastructure and probably degraded soils needing intensive fertilization for year round cassava production for significant profit.

Insufficient stem planting material: Each year farmers have low access to planting materials of improved cassava varieties. Problems with distributing planting material of elite varieties mean that farmers continue to grow local, low yielding varieties. This contributes to slow down horizontal spread (from farmer to farmer) of improved cassava varieties. Variations in farmer and consumer preferences influence uptake of new varieties. Orange fleshed cassava varieties which have higher nutritional value than existing varieties are lacking on farmers' fields. MAF and NGOs are the main input dealers for cassava stem planting materials, which they collect and aggregate randomly from farmers' fields. Only the national research organization, SLARI, invests in purposeful cassava stem multiplication plots. There are no specific stem multiplication farms owned by farmers/farmer based organizations (FBOs) and farmers lack good post-harvest handling practices to preserve stem planting materials. Where input dealers are contracted to supply the planting materials, they usually have difficulties accessing formal credit sources to expand their services and overcome the willingness of farmers to pay for such services.

Non-mechanized farming: Subsistence cassava production practices predominate in the cassava sub-sector. Availability and cost of labour is a major challenge for land preparation, planting, weeding and harvest. Mechanized cassava farming practices are rare. Stem cuttings for planting are prepared by hand using cutlasses, which cause jagged edges of the cuttings; this is associated with low yields. Secateurs or hand-held rotary cutter to cut stems into cuttings are unknown to farmers. Also, appropriate equipment for roots harvesting are absent. There are no irrigation systems to support dry season cassava production. Mechanized production seems to be limited to research station plots and a few large commercial farms for which labour-intensive farming is impractical, and access to and retention of skilled labour in sufficient number are major challenges.

Low skills in crop management: Generally, knowledge and practice of basic soil test prior to planting is lacking. Most farmers adopt ridges, mounds (made by hand) or plant on the flat more out of tradition than knowledge of soil type. There is lack of knowledge and practice of improved methods to prepare cassava stem cuttings and cassava planting techniques for high yield. Most farmers plant more than the research recommended one stem cutting per hole. Appropriate plant spacing is not a widespread practice. No planters or mechanical harvester are available or used. Knowledge and implementation of GAP is rare. There is a general lack of knowledge and adoption of appropriate time and frequency of weeding to assure high yield. Under the Sierra Leone WACOMP, efforts are being made to enhance the knowledge and implementation of the GAP. For example, farmers' representatives from Northern, North-West, Sothern and Eastern provinces were introduced to the basics of the industry GloBAL G.A.P standards⁵.

Pest/disease/weed infestation and management: Pest, disease and weed infestations and management pose an additional challenge that would require contractual services by technical agencies not resident in the vicinity of the localities where cassava is produced. Cassava pests and disease management is rare on farmers' field. Cassava farms are infested by the variegated grasshopper and rodents each year but there is ineffective control of the pest. Disease control is left to the resistant characteristics inherent in varieties planted. Application of improved post-harvest storage techniques for fresh cassava roots is rare.

Yield data collection: Farmers in Sierra Leone reported an average root yield of 8MT/ha⁶ and 14.5 MT/ha⁷ in 2014 and 2019 respectively. Each of both of the yield levels are below the expected commercial yield of 25 t/ha and above. In addition to poor agronomic practices, a standardized yield assessment protocol is not used by different agencies and farmers to assess on-farm cassava farm outputs at different locations and years in Sierra Leone. The lack of wider institutionalization of a yield assessment protocol agreed upon by key stakeholder groups continues to undermine accurate updates of the national database on cassava production and yield.

⁵B James 2019: Introductory GLOBAL G.A.P training. Farmer training in competitive cassava production and processing. UNIDO SL WACOMP.

⁶ Coulibaly, O, Arinloye A.D., Faye M D and T. Abdoulaye (2014). Regional Cassava Value Chains Analysis in West Africa: Case study of Sierra-Leone. Working Paper. September 2014. West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Dakar, Senegal

⁷ MAF National Agriculture Survey (NASS), PEMSD/MAF 2019

1.3.2. Cassava processing and quality compliance

A number of key challenges act in concert to undermine cassava value chain development and cause/aggravate inefficiencies in market oriented processing of cassava.

Weak fresh root supply lines: Organizing cassava supply lines to processing sites and other market outlets is hindered by factors such as availability, steady and predictable flow to processing sites; ease of access to fresh marketing channels. Competing uses of cassava where cassava acts as a food security reserve (especially during peak rainy season months of July and August) can limit root supply to cassava processing. Additionally, seasonal supply variations including transportation difficulties, pose serious challenges during the rainy season months.

Processing: The key challenges are non-availability or insufficient volumes of cassava for processing, lack of knowledge/trained staff, capital and appropriate processing equipment and slow adoption of new technology to process cassava into diverse value added products. Processing cassava into diverse products requires a reliable source of energy to dry and roast the products. Cassava factories relying on sun drying to produce commercial volumes of cassava flours face the problem of peak season root availability coinciding with periods of wet/cloudy weather. The other readily available energy source for producing dry cassava products is firewood. As market demands for cassava products increase, deforestation of the landscape in search of firewood will be a negative consequence of cassava processing. Environmentally and economically, energy sound solutions including long-term use of forests are needed.

Quality compliance: Sub-standard processing equipment predominates in most cassava factories. Cassava graters, pressers and gari patching trays are mostly made of mild steel plates or old vehicle parts, which rust easily. Currently only a few cassava factories use processing equipment made of stainless steel, which does not rust. There are currently only two indigenous well-known and trained cassava processing machines fabricating companies in Sierra Leone. The use of mild steel and scrap metals in processing machines impacts negatively on processing efficiency, consumers' health and repeat-buys of the products.

Operational compliance: Cassava processors lack knowledge, understanding and compliance with Process Control (PC) and Good Manufacturing Practices/Good Hygiene Practices (GMP/GHP), which act together to ensure consumer confidence and long-term willingness to purchase cassava products. Water quality is of sanitary significance in processing cassava into cassava products, but water quality testing to ascertain microbial, chemical and physical quality is rare at cassava factory sites. Waste products and by-products abound in cassava processing, but waste disposal technologies and practices are lacking at most cassava processing sites.

1.3.3. Market challenges

Cassava utilization pathway is narrow, traditionally focusing on fresh-boil-and-eat storage roots, *gari* (grated and roasted grits from raw cassava storage roots) and traditional cassava paste known as *fufu*. The utilization pathway is yet to fully embrace cassava flours, chips, starch and their respective derivatives. The untapped business opportunities e.g., wheat flour import substitution with High Quality Cassava Flour and industrial use of starch, are huge potential markets that can bring significantly increased trade opportunities leading to economic revolution in Sierra Leone's cassava sub-sector. Also, cassava peels tend to accumulate as waste products at cassava processing sites, but economic use of the waste is yet to be mainstreamed in activities to produce new set marketable products of cassava. An underlying challenge is lack of easy access to improved packaging solutions in terms of fit-for purpose packaging equipment and materials to facilitate smallholder access to new and profitable cassava markets.

1.4. Technical assistance areas

1.4.1. Enterprise opportunities

To upscale the cassava sub-sector, the focus shall be on equipping farmer groups and processor groups with knowledge, technology, skills and information and market connectivity required for them to contribute to significant local and national economic growth. In line with non-homogeneity of cassava farmer groups and processors for whom different processes and products are needed to move from subsistence to commercial agriculture, the following different enterprise opportunities can be improved for specified groups:

- **Gari:** In addition to domestic market opportunities, there is sub-regional (cross-border) trade in the product and a growing overseas market opportunity. Gari producers can be assisted to build reputation as reliable suppliers of quality gari for export markets.

- **HQCF:** High Quality Cassava Flour (HQCF) is an ideal substitute for imported wheat flour in bakery and pastry products. HQCF is a relatively new introduction to Sierra Leone and its market opportunities that focus on bakeries and caterers. HQCF utilization pathways need country-wide demonstration and publicity in order to boost its rapid uptake.
- **Starch:** Starch is an important raw material for a number of industries including food (e.g., sausages), adhesives and textiles. Starch is known in Sierra Leone but produced only by rudimentary practices and mostly in small quantities as by-products of cassava processing. There is yet no cassava starch factory in Sierra Leone.
- **Odourless fufu:** Odourless fufu is a relatively new formulation of a traditional cassava food product in Sierra Leone. The production technology needs to be introduced to SME factories wishing to enter into that product's value chain.
- **Cassava chips:** Dry cassava chips have diverse uses. Certain communities grind them into powder for use as *fufu*-based food known as *toi*. However, dry chips have wider commercial value as export products. There is yet no factory producing cassava chips in Sierra Leone.
- **Economic use of cassava waste:** A focus on the production of livestock feed and use of cassava waste to produce edible mushrooms needs to be mainstreamed in cassava processing activities.

1.4.2. Increased on-farm productivity

For competitive cassava agribusiness to thrive profitably, farmer groups need to be elevated into formal cooperatives that engage in expanded on-farm productivity of the crop. Farmer groups/cooperatives opting to invest in commercial production of cassava can operate as out-growers to provide regular supplies of raw materials in high volumes for specific cassava factories and other raw material market outlets. This will require a focus on maximizing agronomic efficiency needed to significantly increase farm productivity highly above current district level data. This will involve mass distribution of healthy planting materials of improved and adapted cassava varieties in the SLICASS series coupled with Good Agricultural Practices including environmentally sound crop management practices to increase and sustain cassava root yield to at least 25MT/ha (at least 40% higher than current average baseline figures). The SLICASS varieties have high dry matter content (31-40%) and starch (50-75%), making them very suitable for commercial production of gari, cassava flours, chips and starch. To tackle pest, disease and weed problems non-chemical control options (e.g., biological control agents, resistant cultivars, bio-pesticides and habitat management) which conserve biodiversity and safeguard the environment and human health should be applied.

1.4.3. Enhanced value-added processing

The focus needs to be on the introduction and management of improved processing techniques and guidelines. This will involve support in the following key areas in line with traceability rules needed for export products:

- Appropriate designs focusing on re-tooling factories and constructing new multi-purpose cassava factories,
- Standardized equipment and hands on training in their use to process cassava into various products and adhering to functional linkages in equipment assembly within the factory,
- Affordable and energy friendly dryers required in the production of commercial volumes of cassava flours, chips and starch, in ways that do not rely on sun-drying,
- Establishment of wood lots of fast growing tree species as energy source to limit de-forestation for firewood needed in the production of gari,
- Hands-on training to strengthen processors' understanding and ability to integrate compliance with PC, GMP and GHP, Critical Control Points, water quality and waste disposal systems in value added cassava processing to help pave the way for food safety compliance in health and trade,
- Provision of quality water sources free of contaminants, especially biological contaminants (e.g., thermotolerant coliform bacteria) which pose health risks in processed cassava products,
- Food-to-food fortification techniques and skills to formulate nutritionally improved cassava-based products such as *gari* and *fufu*-flour fortified with protein-rich legumes (e.g. soybean),

- Improved and fit-for-purpose packaging equipment and packaging materials backed by hands on learning of product packaging and labeling
- Conversion of cassava waste and byproducts into economically useful products such as commercial volumes of oyster mushrooms, and
- Formulation of appropriate cassava-based livestock (pig and poultry) feed.

1.5. Organizational assistance

The key intervention is to strengthen organizational skills of FBOs/producers and SMEs/processors in ways that enable them to manage large input supply and marketing activities and thereby guarantee regular supply of good quality cassava products. Inclusive partnerships will build strong collaborative linkages with pertinent stakeholder groups to evolve the linkages into a district level cassava partnership platform. Such platform will promote timely and quality responses needed by farmer groups/cooperatives and their linked SME cassava factories to achieve productivity and marketing efficiencies that will help to move cassava from subsistence to commercial agriculture. This will require investment in a set of activities to:

- Mentor area-wide application of improved production techniques to boost national average yields toward proven on-farm potentials of at least 25t/ha of the varieties promoted, and much in line with market demands,
- Undertake comprehensive market studies to identify and analyse sectors with potential to create industrial pull for cassava (e.g., feed industries, wheat flour substitution with HQCF) and thereby enable farmers to tap into the high income generating potential of the crop,
- Organize and facilitate linkages enabling cassava value chain actors to increase their competitiveness and ensure safety and quality of cassava products, and
- Institutionalize standards for quality management in processing, cassava product development and food safety compliance in health and trade.

1.6. Policy assistance

Policy assistance will be required to enable cassava value chain actors and business houses to operate in ways that help to expand farm gate productivity, assure quality compliance, increase competitiveness and efficiencies. For example, a ready-made market exists for High Quality Cassava Flour/HQCF to substitute imported wheat flour in bakery and pastry products. This provides a great opportunity for a large number of farmer cooperatives with guaranteed links with SME cassava factories to participate strongly in an expanding cassava trade.

Towards policy assistance, a Presidential Initiative on Cassava (such as those like in DRC, Nigeria and Ghana, for example) will provide opportunities for higher order interventions to ensure that components of cassava production to consumption systems are in place to help increase private sector competitiveness to commercialize the crop. Key focus areas of such a Presidential Initiative would be to:

- Implement public awareness campaigns to promote production and domestic consumption of cassava products and thereby boost sustainability of cassava value chain linkages,
- Develop and promote national policy positions to enhance the development, organization and management of cassava enterprises,
- Assure quality compliance to increase market access, e.g., through sub-regional harmonization of standards for products and equipment, routine GMP/GHP, appropriate packaging and labelling.
- Use formal agreements/memorandum of understandings (MoUs) to link cassava factories to FBOs within 20km radius of the factories for supply of high volumes and sustainable of cassava roots for processing,
- Link FBOs and processors to single digit credit sources, e.g. Community Banks linked to the Apex Bank for the purchase of raw materials, machinery and packaging materials,
- Promote demand-driven research to generate long-term solutions on natural resource fragility, market options, and local capacity building to boost competitive advantage of value chain actors, and

- Ensure that constraints outside cassava production to consumption system are undertaken by appropriate line Ministries and institutions to enhance operational efficiencies in the cassava sub-sector; e.g., timely access to market information, inputs and services; feeder road networks; policy framework.

1.7. Proposed Solutions

There is a strong need to invest in scaling out approaches to strengthen community capacity and trigger positive changes in the cassava sub-sector performance. Selecting operation sites would best be based on a combination of criteria including:

- Availability of prior cassava R4D results,
- Existing cassava processing activities,
- Probability of synergies through partnership with other agricultural development agencies, especially those with ongoing funded activities,
- Beneficiary interest in either or all of cassava production, processing and marketing,
- Participation of target groups in prior baseline surveys.

For operations, the project would need to stress capacity devolution interventions that include:

- Support FBOs with knowledge, skills and equipment to apply improved agronomic techniques required to boost and sustain storage root yields towards and above 25MT/ha for factories,
- Assist FBOs and factories growing cassava on a commercial scale to analyze soil samples collected at sites and advice on the application of organic and inorganic fertilizers,
- Provide advice on management and technical issues to FBOs in cassava production and cassava processing especially in the areas of: a) type and capacity of intended production and processing systems; b) standardized equipment list for cassava production and processing; c) appropriate designs for civil works structures housing facilities for cassava processing; d) PC, GHP, and GMP; and e) mainstreaming livestock feed production into cassava processing,
- Link processors to registered processing equipment fabricators in Sierra Leone for the manufacture of quality and high output cassava processing machines, especially flour dryers,
- Produce market data guidelines on market locations, preferences, opportunities, constraints and standards compliance to sell cassava products,
- Initiate and promote economic use of cassava waste to produce marketable food and livestock feed,
- Assist cassava factories to adopt improved packaging solutions to access to wider cassava market opportunities,
- Build cadres of national expertise comprising change agents with primary responsibility to facilitate experiential/hands-on learning and informed decision making in cassava production, value added processing and marketing,
- Build end-user ownership of processes by direct beneficiary groups and individuals associated with partner stakeholders group in community outreach activities,
- Facilitate factories to assess and correct quality and safety problems encountered in line with and factory and products quality standards compliance, e.g., adherence to GHP, GMP.
- Assist the Sierra Leone Standards Bureau (SLSB) to draft standards for the new cassava products for consideration by the appropriate technical committee of SLSB,
- Disseminate technologies and related information resources for increased cassava productivity, value-added cassava processing and marketing,

- Promote interconnectivity between value chain actors, especially between producers and processors, in attempts to encourage the development of formalized cassava cooperatives out of existing FBOs,
- Produce a set of new learning materials to help improve skills of end-users,
- Conduct mass media communications to increase national visibility of cassava utilization pathways, the nature of constraints and “best-bet” available interventions, and
- Increase national and global visibility of the project through web news, print articles, radio, TV broadcast, field days and dignitary site visits covering project activities across the countries.

1.8. Conclusion

Currently, the cassava sub-sector development emphasizes on-farm production with less attention to diversification of product range, quality and value addition for market outreach. The desired shift towards market-oriented production and processing systems will require interrelated interventions to overcome the challenges of low productivity, weak processing capacity and inefficient marketing. The improved practices presented in this report will act in concert to underpin strong market linkages by ensuring consumer confidence and long-term willingness to purchase cassava products.

The breakthrough sought will emanate from a programmatic approach in which available and new research results on cross-cutting issues will support location-specific activities in rural communities that will be targeted. To help achieve this, project implementation will be inter-institutional, participatory and consultative with other rural development programmes/projects on cassava so as to avoid duplication of efforts. Through such an inclusive partnership, efforts will be aligned with national priorities.

The success envisaged will depend largely on how well the target activities enable and capitalize on inter-institutional linkages to increase end-user access to and adaptation and adoption of technical, organizational and policy interventions and innovations to expand cassava businesses in Sierra Leone. Overall, this will require harmonization of approaches, facilitated information exchange, expertise/technical resources, and extrapolation of proven results and experiences to new locations.

The expected broad outcome areas will include:

- Enhanced application of technologies to drive down costs of production, processing and marketing,
- Strengthened stakeholders’ capacities and skills to produce quality cassava products in quantities that respond to competitive market opportunities,
- Rural-based private sector partnerships to promote collective action on the ground for value addition for higher profitability,
- Increased domestic utilization of cassava products, and
- Increased export volumes of cassava products.

2. PROFILING OF CASSAVA FARMERS IN BO, MOYAMBA AND TONKOLILI DISTRICTS

2.1. Introduction

The foundation of the Sierra Leone economy is agrarian. Approximately 58% of the population is engaged in agricultural production⁸. In 2004, the gender distribution of households in agriculture was 42% and 16% male and female headed households (HH) respectively. By 2015 that contribution changed, and there were more female headed households (52%) than male headed households (48%) engaged in the agricultural sector. The Thematic report on agriculture for Sierra Leone indicated 3,244,214 ha under food crops with 35% of the land cropped to upland rice, 17.3% to lowland rice, 10.6% to cassava, 9.2% to groundnut and 2.4% to sweet potato and maize. The Agricultural survey report indicates that in 2015, Sierra Leone produced total of 761,073 MT of upland rice, lowland rice, cassava, sweet potato, groundnut and maize. Rice and cassava accounted for 504,293 MT (66.2% of total food production) and 217,359 MT respectively (28.6% of total food production) respectively. Cassava remains second to rice in importance as a staple food crop. Across the country, the southern province leads in cassava production with 15.1% of food produced nationwide, followed by 9.6% and 3.5% for Northern (which now includes Karene district that is in current North Western province) and Eastern provinces respectively.

Cassava production historical profile shows that in 2015, Sierra Leone had 342,507 ha under the crop, representing 10.6% of total land cropped to food crops; 115,947 ha representing 34% of the total was cropped to cassava in Bo, Moyamba and Tonkolili districts at 44,601 ha, 40,379 ha and 30,967 ha in Moyamba, Bo and Tonkolili districts respectively. A total of 147,936 HH representing 20.2% of the farming population was engaged in cassava production in the country; Moyamba, Bo and Tonkolili contributed 16,592, 16,336, 12,185 HH respectively, representing 11.2%, 11.0% and 8.2% respectively of total HH in cassava⁹. Table 1 indicates age groups of the cassava farmers.

Table 1: Age groups of cassava farmers in Bo, Moyamba and Tonkolili districts¹⁰

Age group (years)	% of cassava farmers in the age groups		
	Bo district	Moyamba district	Tonkolili district
15 - 24	0.4	0.4	0.4
25 - 34	1.7	1.4	1.9
35 - 44	2.4	1.9	2.5
45 - 54	1.9	1.5	2

Male headed households predominate in the farming population in each of the three districts. The percentage of male and female HH heads were 3.6% and 1.4% in Bo district; 3% and 1.1% in Moyamba district, and 3.7% and 1.5% for Tonkolili district.

2.2. Methodology

The study area for the assessment was chosen by ITC to be Bo, Moyamba and Tonkolili districts which have the following agricultural features:

- Average rainfall in mm/year: 742 in Bo and Tonkolili district and 522 in Moyamba districts
- Mean maximum temperature: 27°C in each district

⁸ Gboku, M.L.S; Davowa, S.K; Gassama, A., 2017: Thematic report on agriculture: Sierra Leone 2015 Population and Housing Census. Statistics Sierra Leone (SSL), October 2017

⁹ Table 9.4a Households engaged in crop farming by type of food crop, region and district in Statistics Sierra Leone, 2015 Population and Housing Census

¹⁰ Source: Statistics Sierra Leone, 2015 Population and Housing Census

- Mean minimum temperature: 10°C in Moyamba and 12°C in each district Bo and Tonkolili districts
- Soil types: Suitable for cassava production and probably of Cambisols, Vertisols, Luvisols soil types in each of the districts¹¹

A key informant interview questionnaire (Annex 2) comprising 73 questions was delivered to a total of 105 farmers in Bo, Moyamba and Tonkolili districts. There were 30 respondents from Kakua and Jiama Chiefdoms in Bo district; 60 farmers from Fakunya and Kowa Chiefdoms in Moyamba district; and 15 from Mayeppoh Chiefdom in Tonkolili district. Jiama Chiefdom is one of two new Chiefdoms which used to make up the then Jiama Bongor Chiefdom; and Mayeppoh Chiefdom is one of two new Chiefdoms which used to make up the then Gbonkolekeh Chiefdom (Annex 1).

The questionnaire was in four subsections with 7 questions on individual respondent profiles; 14 on organizational linkages and technical services received; 47 on cassava production experiences; and 5 on postharvest storage of roots. Thirteen of the questions¹² were repeated to know each respondent's views on a) what obtains in his/her village, and b) what obtains in his/her own cassava farm. This was to know if each respondent's views were similar or markedly different from common cassava production practices in his/her community.

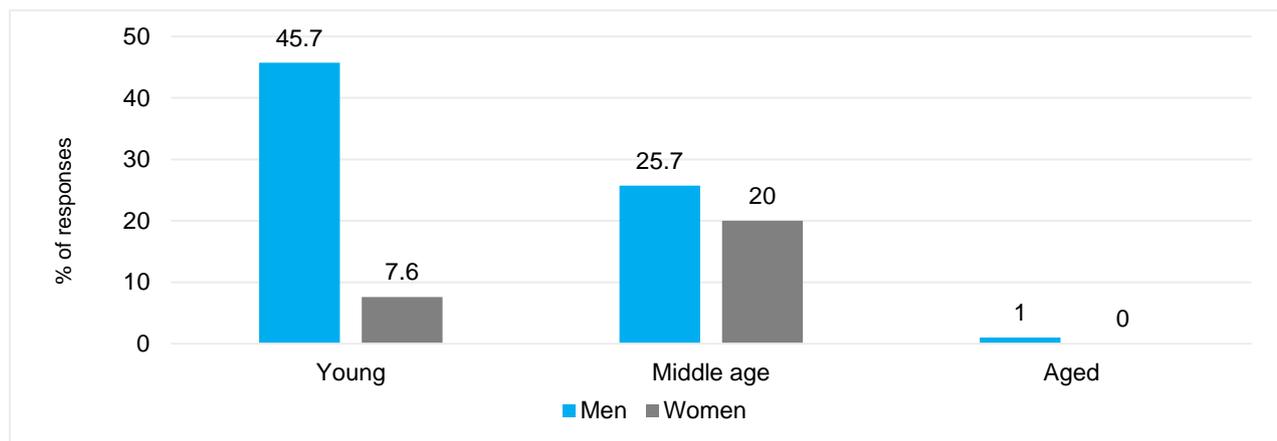
Farmers had an option to provide multiple answers to most of the interview questions. The data of frequency counts were transformed into relative percentage frequency occurrences of total responses per question. In one case, the raw data appeared to be more appropriate than percentage frequency occurrences because only 9 responses were provided to that particular question.

2.3. Results

2.3.1. Demography and basic activities

The 105 cassava farmers interviewed comprised 72.4% men and 27.6% women. The respondents were mostly young men and women (Figure 2). Middle aged farmers (between 30 and 55 years) did not differ much in terms of gender distribution, but the aged were men only. Approximately 58% of the respondents was illiterate; 23.8% and 10.5% had secondary and primary school education respectively, and 7.7% had higher level education (Figure 3). The farmers participated actively in the interviews and spoke up frankly leaving room for clarifications and questions and answers. The responses showed that 34.4% of the farmers also engaged in marketing of fresh cassava harvest. The men were more engaged in cassava crop protection (10.3%) than were women (2.6%).

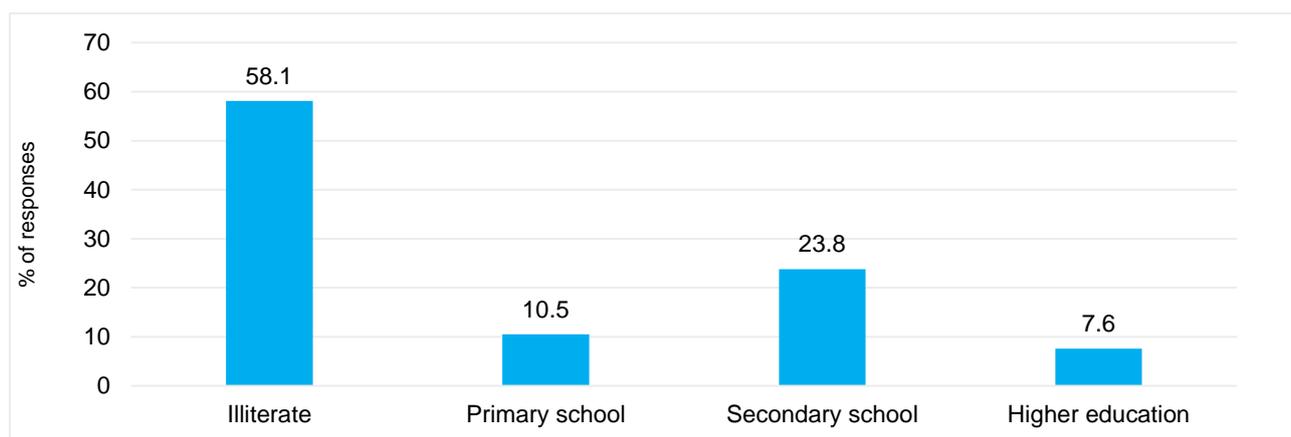
Figure 2: Cassava farmers by age and gender



¹¹ Personal communication with Prof T. B. R. Yormah, a national soil scientist

¹² 1) Cassava production problems; 2) sources of cassava stem planting materials; 3) land clearing methods; 4) labour sources; 5) cassava planting date; 6) methods used to prepare cassava stem cuttings; 7) planting mode for cassava stem cuttings; 8) fertilizer use; 9) weeding methods and frequency of weeding; 10) cassava pest and diseases problems; 11) cassava crop protection practices; 12) age of cassava crop at harvest; and 13) post-harvest storage methods

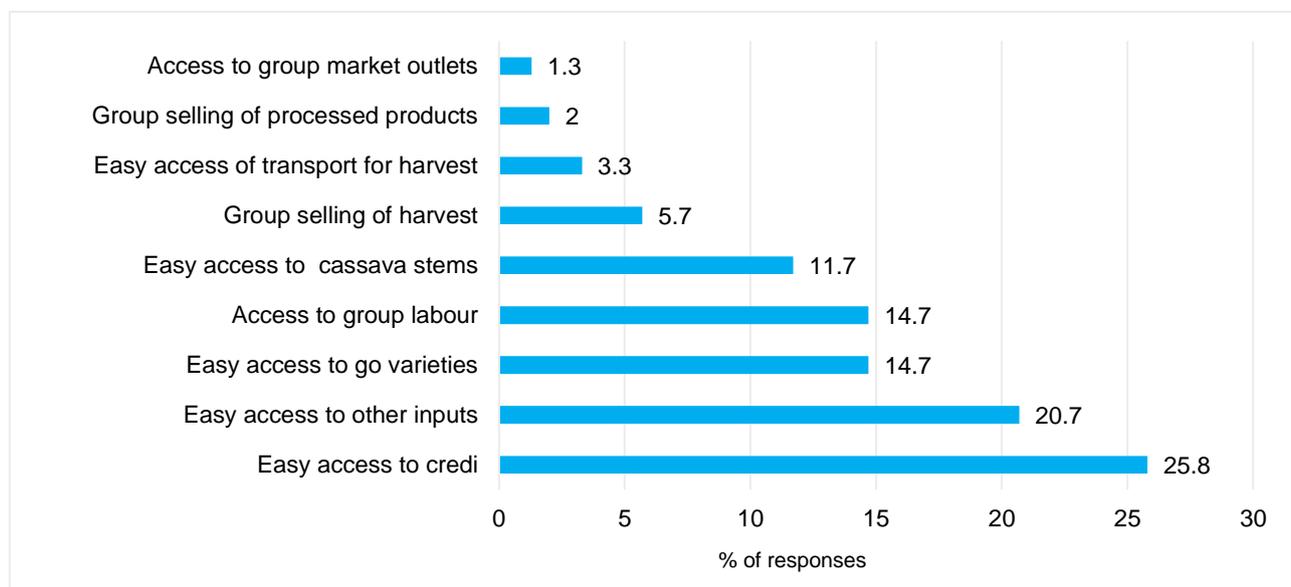
Figure 3: Educational level of cassava farmers



2.3.2. Membership of organizations

The responses indicated 56.3%, 16.8% and 11.8% of farmers were members of Farmer Based Organizations/FBOs, Community Based Organizations/CBO and Village Savings and Loan Associations/VSLA respectively; 15.1% of them were not members of any association. Figure 4 indicates their motivating factors to join associations. The main motivating factors indicated were easy access to credit, inputs and group labour, improved cassava varieties and stem planting materials. Opportunity for group sale of harvest, easy transportation of harvest and access to market outlets were less frequently indicated. Only 29.5% of the farmers indicated they were linked to cassava factories. The farmers rated Ministry of Agriculture and Forestry (56% of the responses) and NGOs (42.9% of the responses) as the organizations that best served them. Fertilizer dealers and dealers in cassava stems were not part of the organizations that served the farmers.

Figure 4: Reasons for membership of organizations



2.3.3. Training and extension

The majority (75.2%) of the farmers (comprising 64.8% men and 13.3% women) have received no formal training in cassava production practices. Training frequency was rated as rare for those who have been trained, and 13.3%, 7.6% and 3.8% received training once, twice and more than twice respectively (Figure 5). Field

plot demonstrations of cassava production techniques have also been rare; 83.8% of the farmers have not participated in the field activity, and 9.5%, 3.8% and 2.9% learnt from the field demonstrations once, twice and more than twice respectively (Figure 6). Figure 7 shows that participants' expectations were met mainly in training sessions on improved production techniques and cassava pest control.

Figure 5: Frequency of training

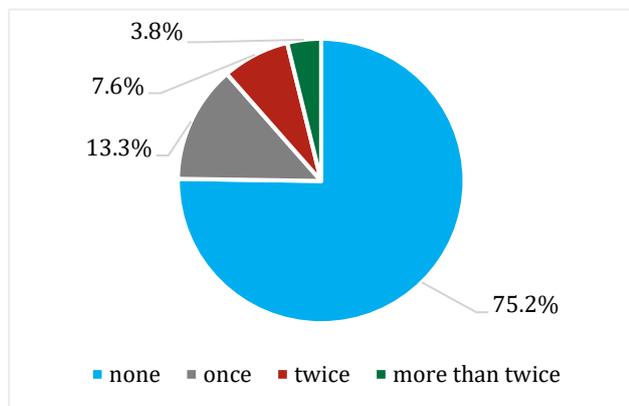


Figure 6: Prior field plot demonstrations

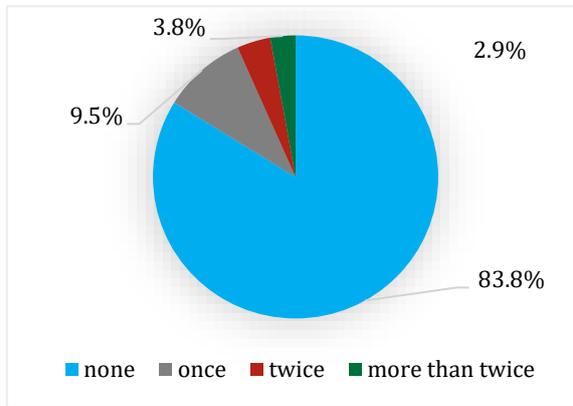
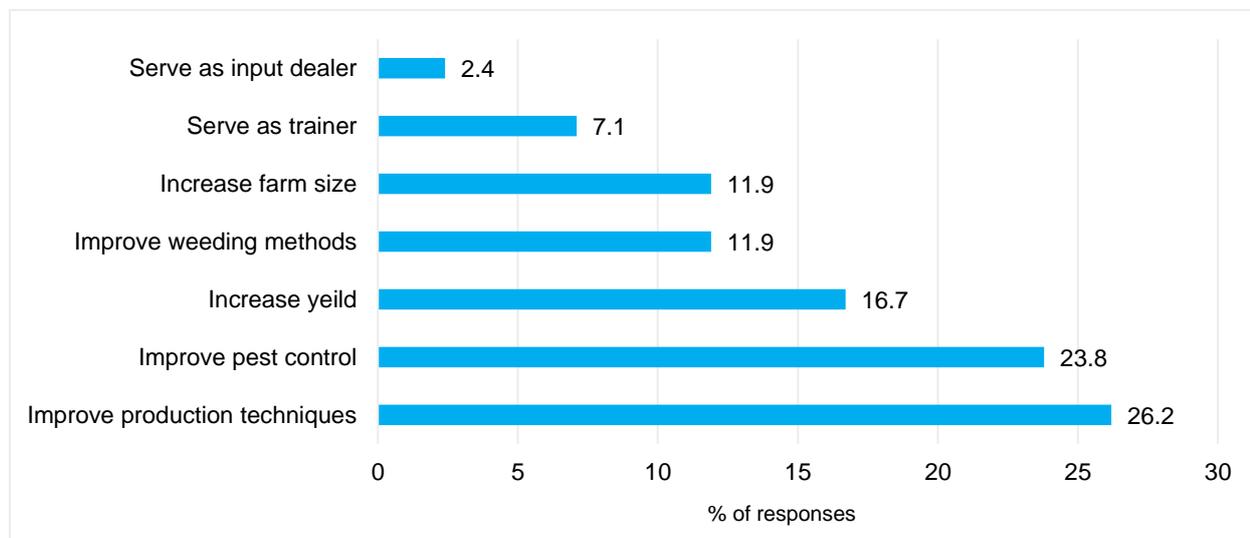
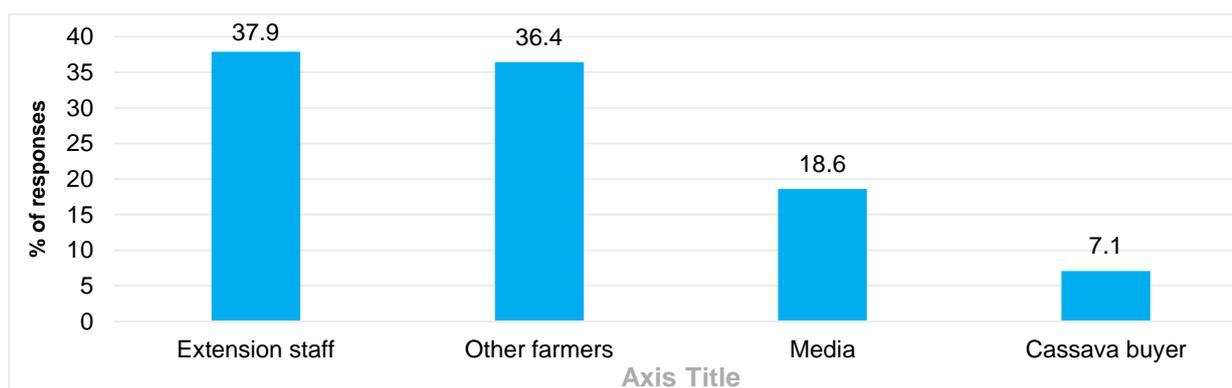


Figure 7: Level at which training expectations were met



Visits by extension agents were indicated as never, not often and very often by 49.5%, 38.1% and 12.4% of the farmers respectively. However, the most reliable sources of information for the farmers were cited as extension agents (37.9%), other farmers (36.4%) followed by media outlets (18.6%) and buyers of their harvest (7.6%).

Figure 8: Farmers' indications of reliable sources of information on cassava production



2.3.4. Cassava production and crop management practices

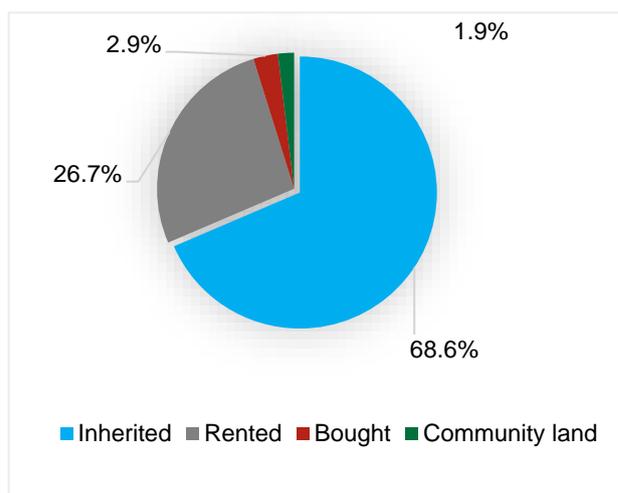
2.3.4.1. Cropping systems and land acquisition

The farmers are engaged in sole (49.5%) and mixed (50.5%) cropping systems for cassava. Maize, rice and *Cajanus cajan* beans are the common intercropped crops. The majority of farmers (68.6%) plant cassava on inherited land, 26.7% on rented land, and 1.9% on community land whilst 2.9% farmers buy land for cassava production (Figure 9). Except for 1 out of the 105 farmers contacted, all farmers stated their respective lands were suitable for cassava production.

Across localities, the large majority of farmers (97.1%) planted at the beginning of the rains (in June/July) while only 2.9% of the respondents practiced late planting (at end of the rains, start of the dry season) but for second crop of cassava. None of the farmers interviewed prepared stem cuttings with research recommended smooth edges that contributes to high cassava yield. A large majority (89.5%) of the farmers planted stem cuttings on the flat. Planting on ridges and mounds

was not common and accounted for only 8.6% and 1.9% of the responses.

Figure 9: Land used for cassava production



2.3.4.2. Cassava production problems

Figure 10 shows cassava production problems cited by the farmers. Key problems were cost of labour, rodent pests (specifically, the grasscutter, insect pests (mostly, variegated grasshopper) and lack of transport facilities.

In relation to the cost of labour, hired labour (74.3%) and family labour (23.8%) were the most frequent options for farm labour (Figure 11). This trend applied to each farm work from land clearing to crop harvest.

Two land clearing methods were cited: a) brushing by hand using cutlasses was the predominant method (at 61.9% of the responses) and b) use of fire to burn grassland (38.1% of the responses). No mechanical or chemical/herbicide methods were indicated.

The vast majority of farmers interviewed do not receive cash credit (97.1%) or in-kind inputs (96.2%) to help with labour costs. Figure 12 shows that the most frequent reason provided for not receiving credit was the lack of credit sources in their respective vicinities (79.1%). Minor reasons were that they do not look for credit (10%), high interest rate (5.5%) and 2.7% indicated "lack collateral" and "do not need credit" for each of these reasons.

Figure 10: Cassava production problems

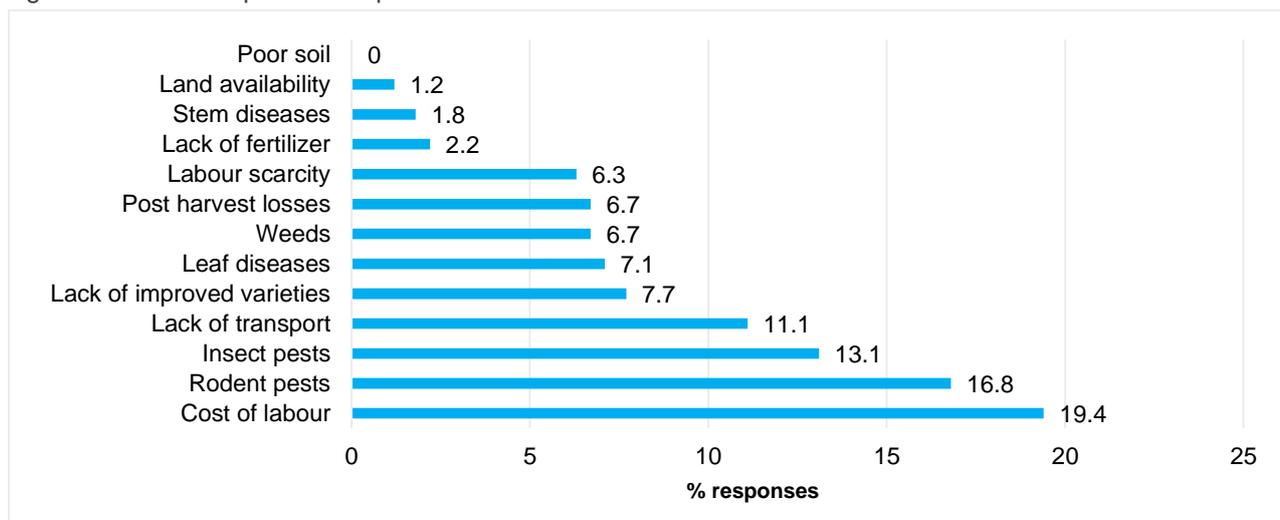


Figure 11: Labour sources for cassava

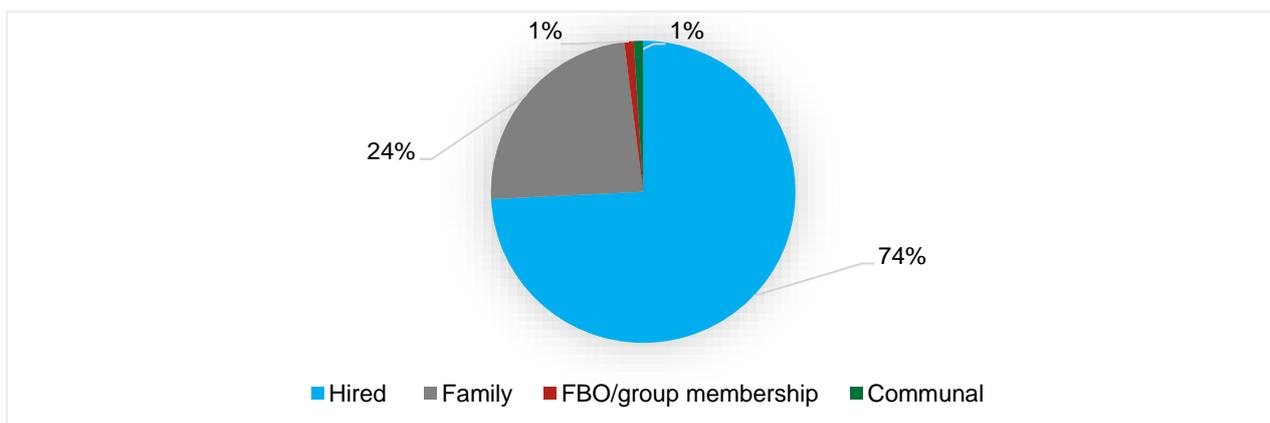
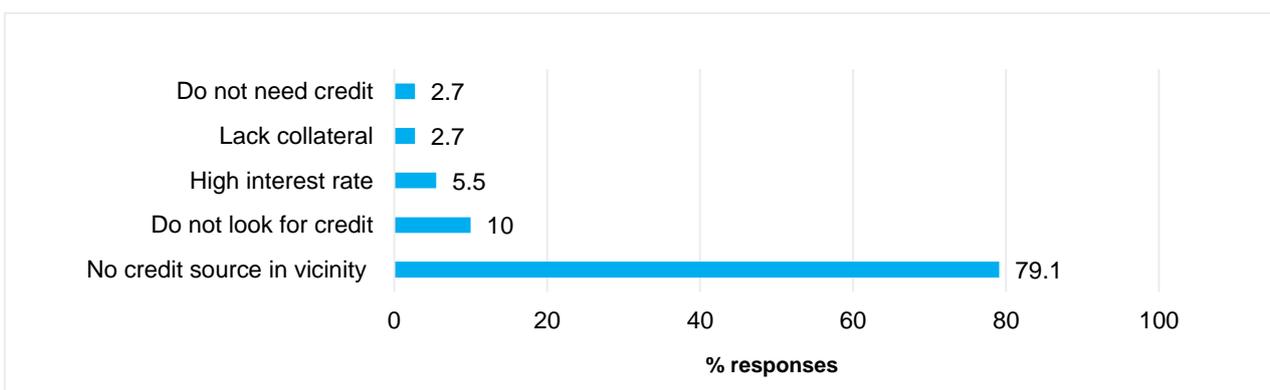


Figure 12. Reasons for not using credit



Plant protection problems accounted for 52% of the problems indicated in Figure 10. The major plant protection problems were rodents, specifically the glasscutter (*Thryonomis swinderaianus*), and insects, mostly variegated grasshopper (*Zonocerus variegatus*). Insecticides were hardly used on the farms. Farmers adopted cultural control measures against rodents (e.g. fencing) and relied on disease resistant varieties and nature to manage insect pest problems. For pest and disease control 21.2%, 51% and 27.9% of farmers rated their practices as not very effective, partially effective and effective, respectively. Cassava leaf diseases were mainly related to African Mosaic disease affecting local cassava varieties.

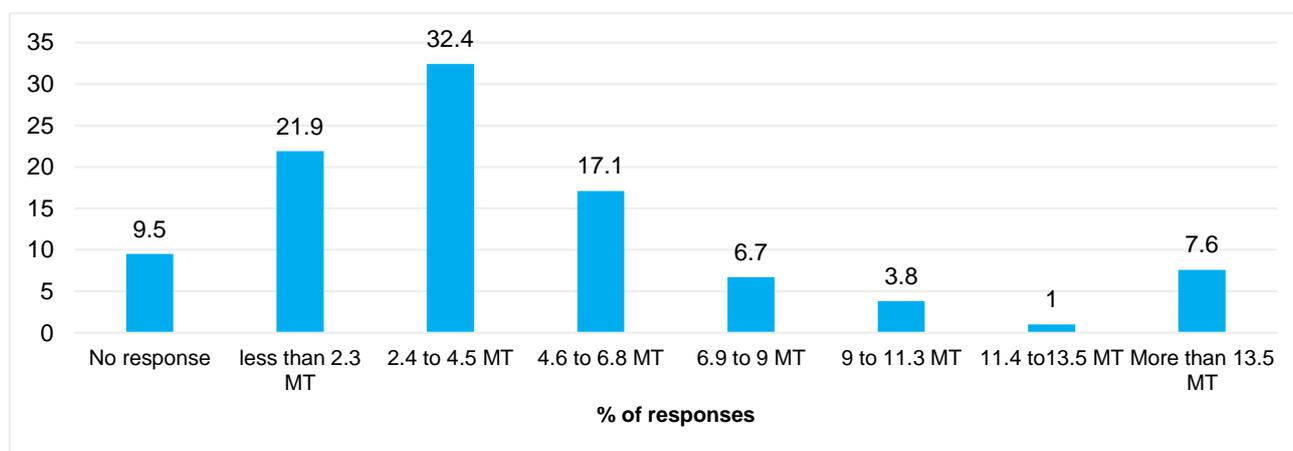
Another set of problems were lack of improved varieties, post-harvest losses and labour scarcity. Lack of chemical fertilizers (96.2% of the farmers did not use mineral fertilizers on their cassava farms), land unavailability and poor soils were minor problems to the farmers. For varieties and stem planting materials adopted, 63.1% of the farmers planted improved cassava varieties (SLICASS varieties) and the majority (80.8%) of farmers planted same varieties each year, 93.9% of the farmers have never changed the varieties they plant; and 39.4% of farmers face difficulties acquiring cassava stems for planting. Frequent sources of cassava stem planting materials were fellow-farmers (65% of the responses) and cassava stems saved during previous harvests and stored in the farms (28.7%)¹³. NGOs and Ministry of Agriculture and Forestry were minor suppliers of cassava stem materials. Herbicides were hardly used on the farms. Sixty-six percent (66%) of farmers rated their weeding practices as successful. Even though they weeded the farms at least 3 times before harvest, the timing of weeding was haphazard and not in line with recommended agronomic practice for higher yields.

Problems related to lack of fertilizers, cassava stem diseases, land availability and poor soils were of relatively minor importance to the farmers. Only 9 farmers responded to questions on the effect of fertilizer on cassava harvest. Their responses were a mixture of “no major increase in harvest” by 5 farmers, “major increase in yield” by 3 farmers and “fertilizers increase weed problems” by 1 farmer.

2.3.5. Crop harvest and postharvest storage practices

Farmers started to harvest cassava at widely different months after planting (MAP). 15.2% at 6 MAP; 41.9% at 12 MAP; 22.9% at 14 MAP; and 20% at or after 18 MAP. Figure 13 shows annual volumes of cassava roots harvested by farmers in the last harvest. The volumes of roots harvested are a reflection of small cassava farm sizes and/or poor planting and crop management practices in the communities. Even the largest volume harvested (13.5MT) is well below an expected 20MT to 25MT/ha. Farmers harvested cassava roots in bits and mainly in response to market demand during the crop life, e.g., 47.6% of farmers interviewed harvested their cassava farms 5 times; 46.7% and 5.7% harvested the farms for up to 10 and 20 times respectively. Frequent buyers of cassava roots were market traders (69%), cassava processors (26.1%) and passer-by’s (4.9%)

Figure 13: Reported annual harvest of cassava roots



The farmers did not use any special structures for post-harvest storage of cassava roots. The most popular postharvest practice was “leaving the roots unharvested until needed (83.5%), followed by re-burying unused roots in trenches covered with plant material and soil (7.7%); keeping small quantities of cassava in water for a few days (4.4%); piling the roots in heaps and watering the pile of roots daily (3.3%), and applying a thick coating of soft clay or mud on the root surfaces (1.1% of the responses). The main sources of postharvest storage information were fellow farms (53.5%) and parents (43%), and to a far smaller extent, research/extension staff (2.8%).

¹³ Cassava stems are the planting material from the crop. Cassava stem planting materials and cassava stems are often used interchangeably.

2.4. Conclusion and recommendations

There are no well resource-endowed farmers amongst those interviewed. The farmers are severely resource constrained, with small size farms characterized by low output and weak access to profitable markets. Boosting farm outputs and factory linkages will improve profitability of farmers and that of cassava factories that are frequently starved of large volumes of fresh roots. Even though the farmers are mostly members of FBOs and rural based organizations, they would need to be organized into functional platforms that help to increase their access to inputs, technical services and more profitable markets.

Currently, FBO access to improved cassava planting materials of SLICASS varieties are being increased by an IFAD/AVDP project which has provided the materials to each of 150 FBOs of 30 members each in each of 15 provincial districts. This would enable each of the FBOs to plant at least 1ha cassava farm. Inter-institutional partnerships are needed to deliver hands-on training in improved cassava planting and crop management, especially in line with GLOBAL G.A.P principles and practices to boost yields and certify farms and products for wider market access.

Cassava producing households certainly need to access to grant and affordable credit sources that can enable them to engage hired labour and access basic mechanical equipment needed for higher on-farm productivity. Of primary need are secateurs to prepare quality stem cutting for planting, machinery (e.g., power tillers) for land preparation, ridging and root harvest. This will enable large-scale commercial farming at less manual labour input.

Farmers are ambivalent on the benefits of fertilizer use on cassava. This needs focused attention especially through field plot demonstrations but bearing in mind sustainability of fertilizer availability and affordability. Cassava crop rotation with nitrogen fixing leguminous food crops, especially soybean, could be a sustainable soil fertility improvement practice. The variegated grasshopper is another problem in cassava crop management. A microbial control option based on commercial formulation known as Green Muscle had been demonstrated in Sierra Leone but its adoption would appear to be dependent on regular imports of the product from the International Institute of Agriculture (IITA).

The various constraints faced by farmers can be grouped into agronomic and organizational inefficiencies. A facilitated district level project implementation planning workshop will be required to specify and recommend action on key need areas in line with identified constraints. As the envisaged success is to expand cassava businesses in Bo, Moyamba and Tonkolili districts, the interventions needed are those that will increase agronomic and organizational efficiencies.

To increase agronomic efficiencies, the project should focus on improved cassava production techniques as basis for higher cassava productivity, namely:

- Increase farmer access to improved and adapted cassava varieties (e.g., SLICASS varieties 4, 6 or 7) which when coupled with environmentally sound crop management practices will increase cassava yield to at least 25MT/ha. The SLICASS varieties are high yielding. Their storage roots have high dry matter content and are mealy and therefore ideal for home consumption and commercial processing into diverse products. Farmer access to the varieties will be achieved by supporting FBOs to establish 1ha community stem multiplicand plots of the varieties. The community stem multiplication strategy will assure self-supply of the materials, enable the farmers to serve as input suppliers of quality cassava planting materials, and minimize costs of distributing the stems within the project's operational districts.
- Provide FBOs with basic field tools, especially manual secateurs, to prepare stem cuttings with smooth edges which increase the number of storage cassava roots that can be produced per plant.
- Conduct hands-on training of farmer groups in improved cassava production techniques. This will ensure appropriate planning mode, ideal plant spacing, time and frequency of weeding, and root harvest techniques. In combination, these practices will increase yield to at least 25MT per ha (more than double existing yields of most farmers), and significant reduce yield variations between farm sites.
- Undertake area-wide biological control of the variegated grasshopper between October and December each year to limit the spread of the pests from their hatching sites to new areas. This will require annual

importation of Green Muscle microbial insecticides from the International Institute of Tropical Agriculture in Cotonou, Benin.

- Demonstrate and promote cassava-soyabean rotation on same farmland to improve and maintain soil fertility, and thereby limit slash and burn practices on new lands for cassava production.

Towards organizational efficiencies, an overarching focus is to support competitiveness of beneficiary groups to exploit market opportunities of the crop. The project will require an inclusive partnership of technical support services (including, extension agents, crop protection agents, cassava researchers, farm input suppliers, credit agencies, transporters and community facilitators) to:

- Provide a common platform through which they will harmonize approaches, exchange information, expertise, technical resources, and extrapolate proven results and experiences to new locations.
- Ensure that project implementation will be multi-disciplinary, inter-institutional, participatory and consultative with other funded cassava programs so as to avoid duplication of efforts.
- Capitalize on inter-institutional linkages to: a) increase smallholders' access to technical innovations developed elsewhere, and b) Increase access of farmers/FBOs to affordable credit for large-scale commercial production of cassava.
- Organize farmers/FBOs¹⁴ into out-grower schemes of geo-referenced clusters for sustainable raw material supply to cassava factories and other markets for fresh roots.
- Harness international collaboration for more effective contributions to raise the profile of the cassava farmers on the agenda of national policy makers.

Through improved agronomic and organizational efficiencies, there will be enhanced application of technologies to increase on-farm productivity of cassava and the farmers will aim cassava production at specified market outlets. A number of participating farmers will become trainers of other farmers whilst others will serve as input dealers of cassava stems of improved varieties.

¹⁴ Especially FBOs with business links with existing cassava factories and other development agencies already engaged with those FBOs

3. CASSAVA PRODUCTION POTENTIAL IN BO, MOYAMBA AND TONKOLILI DISTRICTS

3.1. Introduction

Contrary to its popular image as a poor man's crop, a famine reserve crop and a rural food staple, cassava has diverse food and industrial utilization pathways with foreign exchange earning potentials. A vital first step to create wealth from the crop is to increase on-farm productivity and trigger shifts from traditional production and processing techniques targeting diverse markets. To help expand on-farm-productivity of cassava, the Ministry of Agriculture and Forestry (MAF) and its development partners facilitate area-wide spread of elite cassava varieties in the SLICASS series. Another trigger to increase cassava production is farmers' training in improved production techniques to increase yields to 25MT/ha expected of improved cassava varieties. An Africawide cassava development project¹⁵ had undertaken comprehensive cassava root yield assessment exercise using a standardized protocol across countries. In Sierra Leone, yield data was collected from 240 farmers' fields in 12 districts and the data showed:

- Average farm size of 1.2ha (range: 0.1ha to 18.2ha)
- Plant density averaged 12,986 crop stands per ha (range: 2,800 to 35,520 plants per hectare)
- Root rot incidence averaged 2.3% and varied widely from none to 25.4% roots lost to the disease
- Root yield averaged 13.8MT/ha and varied widely between 1MT/ha to 36.6MT//ha. The higher yields were recorded on loamy soil of the rain forest regions in the East and Southern Regions

3.2. Cassava production potentials

Cassava production is yet to realize its full potential in Sierra Leone. Data from a few samples (e.g., 105 farmers interviewed in 3 target districts) cannot correctly express true cassava production potentials compared to national agricultural census figures. Nationally, it is estimated that 342,507 ha cropped to cassava produced 217,358 MT of roots, with 0.64MT/ha¹⁶. The land area cultivated to cassava by the number of households engaged in producing the crop is a key determinant of the potential of cassava production per district. Based on that data (Table 2) cassava root yield was 0.63MT/ha, 0.59MT/ha and 0.51MT/ha in Bo, Moyamba and Tonkolili districts respectively. These are as low as the national root yield/ha. Where farm level capacity enables the realization of 25MT/ha root yield across districts (e.g., large-scale area-wide dissemination of improved cassava varieties backed by hands-on training in production techniques), Bo, Moyamba and Tonkolili districts would be expected to produce 1,009,475 MT; 1,115,025MT and 774,175MT roots respectively. The districts certainly have a high unmet potential to produce high commercial volumes of cassava. However, meeting those expectations would need to go hand-in hand with increased farmers' access to guaranteed markets that can avoid gluts in supply of easily perishable fresh roots.

Table 2: Cassava production level in Bo, Moyamba and Tonkolili districts

District	HH in agriculture	Number of HH in cassava production	Ha cropped to cassava	MT cassava roots produced	MT cassava roots per ha	Cassava production potential (assuming a 25MT/ha root yield) *
Bo	63,850	16,336	40,379	25,548.38	0.63	1,009,475
Moyamba	52,263	16,592	44,601	26,443.72	0.59	1,115,025
Tonkolili	66,170	12,185	30,967	15,751.07	0.51	774,175

Adapted from: Sierra Leone 2015 Population and Housing Census. Statistics Sierra Leone (SSL), October 2017.

* Production potential figures calculated based on 25MT/ha root yield.

¹⁵ B. James and P. Bramel, 2011; UPoCA Project Terminal Report, March 2011

¹⁶ Gboku, M.L.S; Davowa, S.K; Gassama, A., 2017: Thematic report on agriculture: Sierra Leone 2015 Population and Housing Census. Statistics Sierra Leone (SSL), October 2017

3.4. Recommendations

Cassava production pilot sites can be established in a number of villages per Chiefdom to augment on-going efforts to increase farmers' ability to boost yields. Pilot site activities can be designed to focus on field-level collaboration between pertinent stakeholder groups required to enable farmers make informed decision in solving location-specific production problems. At each site, research-farmer-extension teams would agree on 'entry points', i.e., pressing crop production problems for which research can offer 'plausible promise' of a solution, and then select 'best-bet' options to evaluate with farmers on their own fields. The pilot site initiatives would not only introduce improved crop management options to farming communities but will be useful to:

- Increase farmer knowledge and application of sustainable cassava production crop practices
- Organize smallholder groups of farmers into competitive schemes capable of matching production to market needs and to avoid production gluts
- Create noticeable shift in farmers' practices in order to achieve higher on-farm cassava productivity
- Remove communication bottlenecks between researchers, extension agents and farmers
- Mainstream a number of activities across each district in order to achieve the higher volumes of cassava roots in response to increased demand
- Organize and apply community-wide containment and control campaign against key pests

4. DOMESTIC AND EXPORT MARKETS FOR CASSAVA

4.1. Introduction

Cassava has long been recognized as a staple food crop with potentials as a raw material base for a wide range of processed products. For many decades cassava sub-sector development in Sierra Leone emphasizes production technologies with relatively lesser focus on product development and markets. Within the past decade, national agricultural development attention has focused on the potential of the crop to make significant contributions to household and national economic growth. Efforts to expand cassava market are now looking outside the value of the crop a subsistence food source.

Cassava is gradually becoming a cash crop in Sierra Leone: agricultural households sell all or part of the crop. A factor that has increased sale of cassava is the access of many households to basic, mostly rudimentary, cassava graters for processing cassava into fufu and gari for both domestic and commercial purposes¹⁷. For instance, by 2020, 55% of households in the Southern Province owned graters compared to 15.7% for Western region, 8.9% for Northern region and 6.6% for Eastern regions. This has enabled the Southern province to become the main source of gari supply for export and cross-border trade. The majority of agricultural household (HH) reportedly sold 63.8% of the cassava crop they produced; 23.3% of the HH did not sell any part of their cassava harvest, the crop was solely a subsistence crop for HH consumption.

4.2. Assessment methods

There is need to facilitate cassava value chain actions to new cassava market opportunities. Towards that end, this report provides information on domestic and export markets for cassava as a means to orient value chain actors and their support agencies towards wider utilization/market pathways of the crop. Primary cassava market information was collected from 23 traders in Bo, Moyamba and Tonkolili districts in Key informant interviews (Annex 3). Additionally, discussions were held with the Sierra Leone Produce Monitoring Board (Ministry of Trade and Industry) and National Revenue Authority (Ministry of Finance), focussing on export/cross-border trade in cassava products. Secondary data on cassava marketing surveys were collected from prior cassava projects reports^{18, 19}

4.3. Findings

The main source of cassava products sold on local and export markets are farmer groups and SME (small and medium-sized enterprises) cassava factories selling as wholesalers and retailers, mostly on periodic/weekly markets in rural communities. Based on responses by 105 farmers previously interviewed to assess farmer profiles of cassava farmers in Bo, Moyamba and Tonkolili districts, cassava is produced mainly for sale and not for home consumption. The majority of the farmers (87%) consume up to 10% of cassava roots harvested and sell the rest of the harvest. They indicated their main market outlets were periodic/weekly markets (45% of responses) and daily market (26% responses) followed by minor sites of inter town roadsides, street markets and odd location in town at 18%, 8% and 3% respectively.

Where a buyer has built a strong business relationship with a particular supplier, both parties later go into contractual business and specify quantity and frequency of supply, product and packaging specifications. Defaults in delivery is usually due to the fact that the suppliers are not sole cassava business men/women. They are also engaged in other income generating activities e.g., bike riding, production of other crops, teaching etc. The main constraints encountered by the traders are the high transportation cost, frequent price

¹⁷ Gboku, M.L.S; Davowa, S.K; Gassama, A., 2017: Thematic report on agriculture: Sierra Leone 2015 Population and Housing Census. Statistics Sierra Leone (SSL), October 201

¹⁸ James B. D, Bramel, I., Witte, E. Asiedu, R., Watson, D, and Okechukwu, R. 2011. Expanding the application of cassava value chain technologies through UPoCA project; African Journal of Root and Tuber Crops Vol. 9 No. 1: 38-49

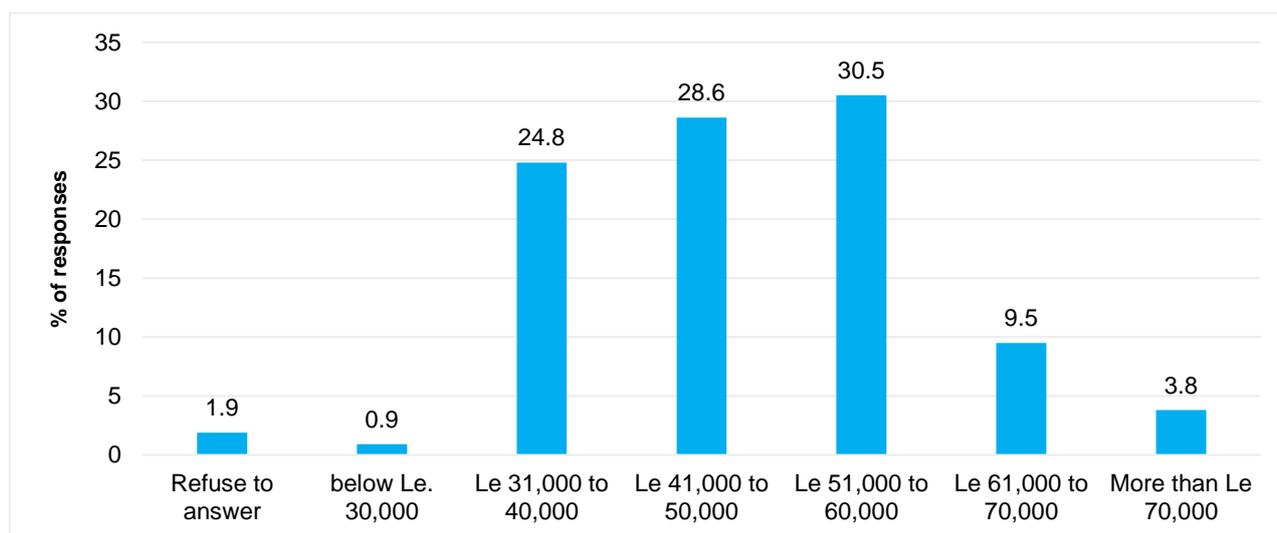
¹⁹ Coulibaly, O, Arinloye A.D., Faye M D and T. Abdoulaye (2014). Regional Cassava Value Chains Analysis in West Africa: Case study of Sierra-Leone. Working Paper. September 2014. West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Dakar, Senegal

fluctuations by suppliers, lack of convenient storage facilities for fresh products, and poor quality of the products.

4.3.1. Sale of fresh cassava roots and leaves

Farmers sell freshly harvested cassava roots and cassava leaves (used as a leafy vegetable). Figure 14 shows the spread of farm-level price for a 75kg bag of fresh cassava roots. The most frequent prices per bag were Le 31,000 to 40,000 (24.8% responses), Le. 41,000 to 50,000 (28.6% responses) and Le. 51,000 to 60,000 (for 30.5% of the responses).

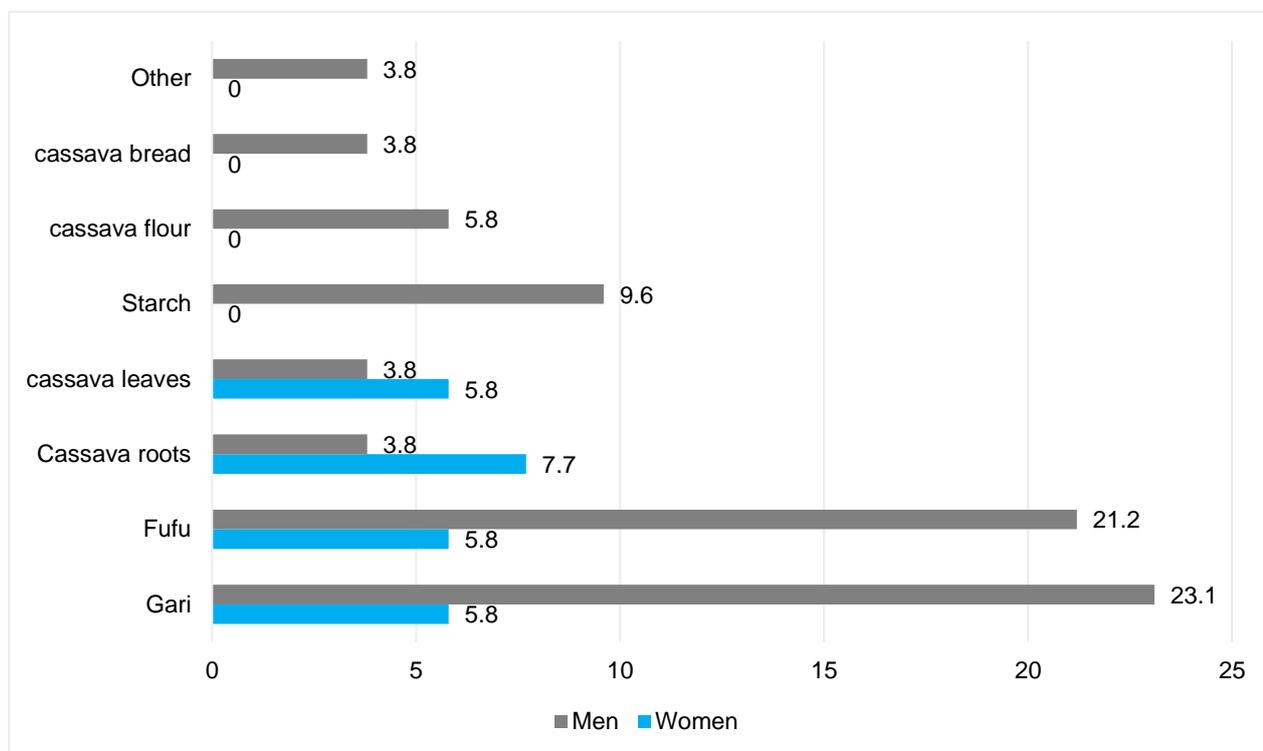
Figure 14: Percentage response on cost of 75Kg bag of cassava root sold by farmers



Traders interviewed in Bo, Moyamba and Tonkolili districts indicated the relative importance of fresh and processed products by frequency of sale (Figure 15). Women dominated in the sale of cassava roots and cassava leaves whilst men dominated in the sale of processed products. The common sources of the products are contact farmers (42.5%) followed by own farms (35%) and open weekly markets (20%). Four traders responded to question on loans and they all take cash loans from financial institutions for the trade. The traders (87.5% responses) have a big say in setting the price for the products; they lack own stores (82.6% of the responses). The business costs are mostly on transport of the products (48.9% responses) followed by market dues to City Council and loan of tables (27.7%) and storage costs (21.3%).

The common market destination of the fresh cassava roots and leaves was Freetown. In Freetown, market women buy the roots at Le 100,000 per 75kg bag of a red-skinned root (proven to be mealy/boil and eat variety) and Le 80,000 for white skin varieties, which according to the market traders are not very mealy. By retailing the roots in piles of approximately 5kg for Le 10,000 and 3kg for Le 5,000, market traders gain at least 50% profit (after payment of market dues) per bag of any of the cassava varieties they buy from wholesalers. The wholesale price of fresh cassava leaves in Freetown was Le 100,000 a 58kg bag. Market traders retail cassava leaves in 1.2kg bundles at Le 5,000 per bundle, gaining 140% gross profit on the product. At Dove Court market, for example, there are at least 30 traders dealing in the raw cassava products. Collectively, they sell an estimated 168MT of fresh cassava root and 87MT leaves per month.

Figure 15: Percentage relative importance of sale of cassava products



4.3.2. Processed cassava products

Gari and fufu (a fermented wet paste of the roots) were reported as the main processed cassava products sold, followed by native starch (Figure 15). Cassava root buyers were mainly market women and cassava processors. The products are transported by traders from rural markets and factory sites into local retail markets and to sub-regional regional markets. A growing number of cassava value chain projects²⁰ have stimulated the emergence of cassava processing into gari, leading to a growing number of smallholder cassava processing factories and farm gate processing units engaged in gari production. A number of national and international organizations have recorded frequent cross border trade in gari to neighbouring countries, namely:

- The National Revenue Authority (NRA) records indicate that:
 - In February 2020, 100kg of gari was shipped to Australia by a single dealer at CIF value of Le. 354,998.52
 - In May 2020, 300,000 kg gari was shipped to Senegal by a single dealer at CIF value of Le 600 million (ca, \$60,000)
- The Sierra Leone Produce Monitoring Board (PMB) has a list of key gari exporters who have used the services of the Board in exporting gari to the UK and USA (Table 3). Traders did not usually enter into formal contracts with their suppliers. The majority (98%) had verbal agreements with suppliers. Most farmers were entirely free to sell their products to traders of their choice. 65% of traders expressed interest in having written agreements with suppliers to secure access to cassava and cassava products

²⁰ Notably USAID/IITA cassava projects; WB Rural and Private Sector Development project; CFC cassava projects; AfDB cassava projects

but 33% did not think that written agreements were necessary. Major problems were lack of quality products in volumes required, untimely delivery of the produces and the need to aggregate the products from different sources

- World Food Programme (WFP) 2010 report²¹ estimated cross border trade in gari to Guinea as 300MT to 400MT per week through Barmoi market (Kambia District) and 60MT per week to Liberia through Bo-Waterside.
- IGC report in 2016²² indicated Sierra Leone is a major exporter of gari to Guinea and Liberia in terms of volume and frequency of trade; and that more than half (51%) of the cross-border gari traders were women who exported through formal crossing but trade through informal crossing points exists.
- A cassava value chain study in 2012²³ focusing on cross border trade in gari, estimated approximately USD 2 million gari supply to neighbouring Guinea and Liberia.
- A 2014 national cassava value chain analysis report²⁴ indicated that Sierra Leone's gari export to Guinea exceeds 1,500 MT per month.
- Earlier in 2020, a gari exporter²⁵ estimated an emerging diaspora export market opportunity for white gari as USD 0.5 million.

Table 3: Gari exporters listed by Sierra Leone Poduce Monitoring Board

Exporter	Location	Category and volume of export
CAC holdings	4A Lightfoot Boston st	Company Exported 600 gari to Yeoma Foods, London,UK
Betty Jalloh	62B Bass Str Brookfields, Freetown	Individual: Exported 60 bags Sakisatu Food, 274 Backing RD EB, 8hr Plaistow National, London
Alicious Gbonie Musa Enterprise	55 Freetown road Lumley, Freetown	Company: Exported 200 bags gari to Toronto Canada
Haja Maseray	14 Lightfoot Boston street Freetown	Individual: Exported 200 bags gari to Swedco Enterprise, Flat 3 House, 165 City Rd., London EC1V 1NR, UK
Amlx Enterprise	13 Jalloh St Freetown	Exported 5 bags gari to Peckham Park Road London.
M.S.K International	31 Jones street, Freetown	Company: Exported 100 bags gari to Mariatu Kamara 911 Regency Rd, Woobridge VA 22191
Zackie & Andrea International Trading	Freetown	Company: Exported 50 bags gari to M & J International 1400 Sharon Green Driv, Columbus Ohio Zip code 43229, USA
Jaffer Foreign Exchange Bureau Ltd	11 Dundas Street Freetown	Company: Exported 100 bags gari to Airport Cargo Cars, 49 Peacock Ave, Feltham TW 14 8E;
Salone International Market	Freetown	Company: Exported 100 bags gari to Salone International Market 8813 Annapolis Road Lanham Mary Land 20706, U.S.A
Sahs Enterprise	37 Pademba Road, Freetown	Company: Exported 10 bags gari to HawaTamba-Lebbie 100 Mordaunt road Harlesden, London NW108NX.

²¹ Jean-Martin Bauer, Laouali Ibrahim, Salif Sow, Amadou Moctor Konaté. 2010. Cross border trade and food security. Liberia, Sierra Leone. WFP report

²²Abou Bakarr Kamara, 2016. Cross border trading: Sierra Leone and her borders. International Growth Centre Report

²³James, B. D and Bah, Sidi 2012: Cross border trade and trade routes for gari in Sierra Leone. USAID project UPoCA technical report

²⁴ Coulibaly, O, Arinloye A.D., Faye M D and T. Abdoulaye (2014). Regional Cassava Value Chains Analysis in West Africa: Case study of Sierra-Leone. Working Paper. September 2014. West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Dakar, Senegal

²⁵Personal communications with Mrs Constance Williams, CEO, CAC Holdings, Freetown, Sierra Leone

Alice Carew Company	Freetown	Company: Exported 50 bags gari to Alice Carew Catering Service LLC 3403 Serene Court, Laurel MD 2074 USA.
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4.4. Conclusion and recommendations

Production of cassava and processing it into gari and fufu appeared to be a profitable business for farmers, traders and processors. Gari is the dominant processed cassava product traded by Sierra Leone and has high potential to meet urban demand in Sierra Leone and the neighbouring countries. Fufu is yet to enter international markets. The product has a strong odour that is offensive to most people. An odourless fufu powder is produced by a few cassava factories but the product is yet to be publicized as an ideal alternative to the wet fufu paste. Similarly, High Quality Cassava Flour is yet to become a favoured choice as an alternative to imported wheat flour. There is no purpose built cassava starch factory in Sierra Leone.

A number of actions can be promoted to increase trade in cassava and its products, including:

- **Improving product supply:**
 - Improve on-farm productivity through increased and timely farmer access to high yielding varieties backed by training in improved cassava production techniques.
 - Develop proper storage facilities for fresh cassava roots and leaves
 - Introduce small-scale, efficient cassava processing technologies backed by training to produce quality gari and other marketable products
 - Promote access to and use of appropriate packaging especially for wholesale trade in cassava products.
- **Ensuring information sharing:**
 - Provide cassava market information to traders and their supply sources
 - Provide product quality information to help make increase the products chances to access market
 - Enhance collaboration between Ministries to ensure a single national source for cassava market data
 - Train value chain actors on business records to provide clear picture of business operations and a basis for credit worthiness.

Re-activate cassava innovation platforms and establish new ones to link value chain actors into vibrant district level groups to test, validate and increase members access to new technologies; explore new ways of extending credit and facilitate easy access to transport facilities.

ANNEXES

Annex 1: Information on farmers and traders interviewed

As part of this study, 105 farmers and 23 traders were interviewed in the districts of Bo, Moyamba and Tonkolili. Additionally 29 other traders were contacted in Bo gari parks but refused to be recorded and only provided general information.

The questionnaire allowed to identify farmers by geographic locations, i.e. region, district, chiefdom, section, village/town and GPS coordinates of the respondent. Rural farmers often did not dispose of email addresses. Mobile phones were not in high use among local farmers: phone coverage was scarce in several localities and the few farmers that dispose of a phone, used to keep it shut most of the time (using them only to communicate through rings).

District	Chiefdom	N. of farmers
Bo	Bongor	2
	Jiama	8
	Kakua	20
Moyamba	Fakunya	30
	Kowa	30
Tonkolili	Mayeppo	15
Total		105

District	Chiefdom	N. of traders
Bo	Jaiama	1
	Kakua	4
Moyamba	Fakunya	4
	Kowa	9
Tonkolili	Kolifa rowala	3
	Mayeppoh	2
Total		23

Annex 2: Farmer survey questionnaire

1. Date:

2. Geographic location

No.	Parameter	Data/response
1	Region	
2	District	
3	Chieftdom	
4	Section	
5	Village/town	
6	GPS Coordinates	

3. Individual respondent profile

No.	Parameter	Response: Tick option
1	Name:	
2	Gender	
	a) Male	
	b) Female	
3	Age	
	a) Youth/young adult	
	b) Middle age	
	c) Aged	
4	Education:	
	a) Illiterate	
	b) Primary school	
	c) Secondary	
	d) Higher education	
5	Main cassava activity	
	a) Cassava production	
	b) Cassava protection	
	c) Cassava marketing	
6	Linkage to cassava factory/processor	
	a) Yes	
	b) No	
7	Linked cassava factory	
	a) Name:	
	b) Location:	
	c) Distance to the factory (miles/km):	

4. Institutional setting (facilities at disposal within the village/locality)

No	Parameter	Response: Tick option
1	Membership of association	
	a) FBO	
	b) CBO	
	c) Village Savings group	
	d) Religious group	
	e) Other (indicate name)	
	f) None	
2	Why did you join the group ^{26,27}	
	a) Easy access to credit	
	b) Easy access to good cassava varieties	
	c) Easy access to cassava stems for planting	
	d) Easy access to other inputs	
	e) Easy transportation of harvest	
	f) Group selling of produce	
	g) Group selling of processed cassava	
	h) Access to group labour	
	i) Access to group market outlets	
3	Which organizations serve you frequently	
	a) Ministry of Agriculture and Forestry	
	b) Research Institute (SLARI, Njala University)	
	c) NGO ²⁸	
	d) Suppliers of stem planting materials/improved varieties	
	e) Fertilizer dealers/sellers	
4	Prior cassava training: Yes or No	
	a) Cassava production	
	b) Cassava processing	
	c) Cassava marketing	
5	Number of cassava production training attended	
	a) Once	
	b) Twice	
	c) More than twice	
6	Number of cassava production field days/demonstrations attended	
	a) None	
	b) Once	
	c) Twice	
	d) More than twice	
7	State your expectations/motivations from training and field days	
	a) Improve on cassava planting techniques	
	b) Improve on cassava farm weeding	
	c) Improve cassava pest control	
	d) Increase cassava farm size	
	e) Increase cassava yields	
	f) Serve as input seller for cassava stems	

²⁶ rank the reasons from the most important to the least

²⁷ If no membership, state reasons

²⁸ Name the NGO

	g) Serve as trainer to other farmers	
8	Have your expectations been met:	
	a) Improve on cassava planting techniques	
	b) Improve on cassava farm weeding	
	c) Improve cassava pest control	
	d) Increase cassava farm size	
	e) Increase cassava yields	
	f) Serve as input seller for cassava stems	
	g) Serve as trainer to other farmers	
9	How often do agricultural extension workers visit you?	
	a) Never	
	b) Not often	
	c) Very Often	
10	Your reliable sources of extension messages on cassava	
	a) Agric extension staff	
	b) Media (Radio/TV/ Newspapers)	
	c) Other farmers	
	d) Cassava buyers/market	
11	Have you ever received credit for cassava production?	
	a) No	
	b) Once	
	c) Twice	
	d) More than twice	
12	If never received credit for cassava production, explain why	
	a) Did not look need credit	
	b) Did not look for credit	
	c) No source of credit in vicinity	
	d) No collateral to guarantee credit	
	e) High interest rate	
	f) Other reason(specify	
13	Did you receive in-kind input for cassava production?	
	a) No	
	b) Yes ²⁹	

²⁹ Indicate in-kind input have you recieved for cassava production

14. Farm information (the farm should have cassava as the main crop; if not move to another farm)

a) Farm No	b) Farm size ³⁰	c) Cropping system ³¹	d) Land suitability ³²	e) Land acquisition ³³	f) If rented, cost of rent for the farm size	g) Distance from the village(km or miles)	h) Distance from village to nearest market (km or miles)
1							
2							
3							
4							
5							

i) Varieties planted ³⁴ ; Indicate local or improved; state name if known or don't know	j) Is the variety planted each year (Yes or No)	k) Are the cuttings easily available (Yes or No)	l) Problems observed with this variety (indicate)	m) Have you ever replaced this variety? Yes or No ³⁵ ; give reasons)

³⁰ Indicate in hectare of or acre and source e.g., research, extension, NGO, friends, FBO etc.

³¹ Indicate it as monocrop or intercrop or mix crop or rotational crop

³² Indicate as suitable or not suitable

³³ Indicate as inherited, bought, rented donated, loaned

³⁴ Indicate local or improved (indicate name if known) or don't know; note farmer why planted this variety e.g. only variety available; resistant to pests/diseases; provided by others, high yield; good post harvest storage; good for raw produce market good for processing

³⁵ Give reasons

5. Cassava production

No	Parameter (Give reasons for each preference)	Tick 1 or more options
1	What are the general cassava production problems in your village?	
	a) Land availability	
	b) poor soils	
	c) Labour scarcity	
	d) Cost of labour	
	e) Lack of improved varieties	
	f) Lack of fertilizer	
	g) Weeds	
	h) Insect pests	
	i) Rodent/wild animals	
	j) Diseases of leaves	
	k) Diseases of stems	
	l) Post harvest problems of the roots/root rots	
	m) Transportation: From farm to markets	
2	What are the five major cassava production problems you face?	
	a) Land availability	
	b) poor soils	
	c) Labour scarcity	
	d) Cost of labour	
	e) Lack of improved varieties	
	f) Lack of fertilizer	
	g) Weeds	
	h) Insect pests	
	i) Rodent/wild animals	
	j) Diseases of leaves	
	k) Diseases of stems	
	l) Post harvest problems of the roots/root rots	
	m) Transportation: From farm to markets	
3	What are the common sources of cassava stems in your village	
	a) From fellow farmers	
	b) Provided by research	
	c) Provided by Ministry of Agriculture and Forestry/Extension	
	d) Provided by NGO projects	
	e) Saved from previous harvest	
	f) Other (specify	
4	What are the frequent sources of cassava stems for you?	
	a) From fellow farmers	
	b) Provided by research	
	c) Provided by Ministry of Agriculture and Forestry/Extension	
	d) Provided by NGO projects	
	e) Saved from previous harvest	
	f) Other (specify	

No	Parameter (Give reasons for each preference)	Tick 1 or more options
5	What are the common land clearing methods for cassava in your village?	
	a) Manual land clearing	
	b) Use of tractors	
	c) Fire to burn the vegetation	
	d) Use of herbicides	
6	Which land clearing method do you use frequently?	
	a) Manual land clearing	
	b) Use of tractors	
	c) Fire to burn the vegetation	
	d) Use of herbicides	
7	What are common labour sources for land clearing for cassava in the village?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
8	Which labour source for land clearing do you use frequently?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
9	What is the common date of planting for cassava in the village?	
	a) Early (at start of rains; first season crop)	
	b) Late (when rain settles); first season crop	
	c) At tail end of rains (Sept/Oct), second season crop	
10	Which planting date do you practice frequently?	
	a) Early (at start of rains; first season crop)	
	b) Late (when rain settles); first season crop	
	c) At tail end of rains (Sept/Oct), second season crop	
11	What are the common cassava planting modes in your village?	
	a) Planting on the flat	
	b) Planting on ridges	
	c) Planting on mounds	
12	Which planting mode do you use frequently?	
	a) Planting on the flat	
	b) Planting on ridges	
	c) Planting on mounds	

No	Parameter (Give reasons for each preference)	Tick 1 or more options
13	Which labour source for digging/flat, ridging, mounds do you use frequently?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
14	What are the common methods to prepare cassava stem cuttings in your village	
	a) No particular method	
	b) Cut with rough edges	
	c) Cut with smooth edges	
	d) Cut with about 5 nodes	
	e) Cut mature stems only	
	f) Also use the immature green stems	
15	Which cassava stem cuttings preparation method do you use frequently?	
	a) No particular method	
	b) Cut with rough edges	
	c) Cut with smooth edges	
	d) Cut with about 5 nodes	
	e) Cut mature stems only	
	f) Also use the immature green stems	
16	What are the common sources of labour for cassava planting in your village?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
17	Which labour source do you use frequently to plant cassava?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
18	What are the common fertilizers used for cassava production in your village?	
	a) None	
	b) Inorganic fertilisers (name it and indicate source)	
	c) Farm manure	
	d) Other (specify)	
19	Which types of fertilizers do you use frequently in yor cassava farm	
	a) None	
	b) Inorganic fertilisers (name it and indicate source)	
	c) Farm manure	
	d) Other (specify)	

No	Parameter (Give reasons for each preference)	Tick 1 or more options
20	What are the common methods for weeding cassava farms in your village?	
	a) Hand weeding	
	b) Under brushing	
	c) Use of herbicides	
21	Which weeding methods do you use frequently in your cassava farm	
	a) Hand weeding	
	b) Under brushing	
	c) Use of herbicides	
	d) Mechanical hand weeding	
22	How many times do you weed your cassava farm	
	a) Once before harvest	
	b) Twice before harvest	
	c) Thrice before harvest	
	d) More than 3 times before harvest	
23	Weeding timing	
	a) When the farm gets bushy	
	b) First weeding 1MAP	
	c) Second weeding "MAP	
	d) Under brushing after the cassava is tall	
24	Which labour source do you use frequently to weed your cassava farm	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
25	Results from your weeding practices	
	a) Not very successful: The farm gets bushy frequently	
	b) Successful: The farm is never bushy	
26	What are the major pests/diseases in your village	
	a) Grasshopper pest of leaves and stems	
	b) Rodents pest of roots	
	c) Bird pests of the roots	
	d) Diseases of the leaves	
	e) Root rots	
27	What pest/disease control methods are used on cassava in your village	
	a) Rely on nature	
	b) Use resistant varieties provided	
	c) Use of insecticides	
	d) Fence the farms against rodents	
	e) Other (specify)	

No	Parameter (Give reasons for each preference)	Tick 1 or more options
28	Which cassava pest/disease control methods you used frequently?	
	a) Rely on nature	
	b) Use resistant varieties provided	
	c) Use of insecticides	
	d) Fence the farms against rodents	
	e) Other (specify)	
29	What are your main sources of labour for pest/disease control?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Extension agents	
	f) Other (specify)	
30	Results of cassava pest/disease control practices on your farm	
	a) Not very effective: The farm gets heavily infested frequently	
	b) Partially effective: The pest are abundant in the dry season	
	c) Effective: The farm is never heavily infested	
31	At what crop age do you start harvesting the cassava roots	
	a) 6 months after planting (MAP)	
	b) (MAP	
	c) 12 MAP	
	d) 14 MAP	
	e) Other (specify)	
32	What are your main sources of labour for cassava harvesting?	
	a) Family	
	b) Hired	
	c) Communal	
	d) FBO/group membership	
	e) Other (specify)	
33	How many times did you harvest your cassava for sale during the last Season?	
	a) Less than 5 times	
	b) Upto 10 times	
	c) Upto 20 times	
	d) More than 20 times	
34	How many shake-hand bags cassava roots did you harvest last year	
35	How many shake-hand bags cassava roots do you expect to harvest this year	

No	Parameter (Give reasons for each preference)	Tick 1 or more options
36	What proportion of harvest do you consume?	
	a) Less than 5 parts out of 100 parts	
	b) Upto 10 parts out of 100 parts	
	c) Upto 20 parts out of 100 parts	
	d) More than 20 parts out of 100 parts	
37	How much do you sell a shake-hand bag of freshly harvested cassava	Price=
38	How much do other farmers sell a shake-hand bag of harvested cassava	Price=
39	Who are your customers	
	a) Market traders	
	b) Cassava processors	
	c) Passersby/travellers	
	d) Other (specify	
40	Effect of fertilizer use on the harvest	
	a) The farm gets too bushy with increased weed growth	
	b) No major increased harvest	
	c) Major increase in harvest	
	d) Buyers/consumers don't prefer the roots	
	e) Buyers/consumers don't prefer the roots	
41	List constraints associated with access to land to grow cassava in your village	
42	List constraints associated with labour availability in your village	
43	List constraints associated with use of improved varieties in the village	
44	List constraints associated with use of cassava planting methods in your village	
45	List constraints associated with the use of pesticides in your village	
46	List constraints associated with the use of fertilizers in your village	
47	List constraints associated with selling fresh cassava roots in your village	

6. Post harvest storage

No	Parameter (Give reasons for each preference)	Tick 1 or more options
1	Do you store cassava roots after harvest?	
	a) No, sell same day of harvest	
	b) Yes	
2	What storage methods do you or others use to store the roots in the village?	
	a) Harvesting the roots within the root stock intact	
	b) leaving the roots unharvested in the ground until they are needed	
	c) Re-buying the roots in trenches covered with plant material and soil	
	d) Piling the roots in heaps and keeping them moist by watering them daily	
	e) Applying a thick coating of soft clay or mud	
	f) Keeping small quantities of cassava in water	
	g) Other (specify)	
	h) Other (specify)	
	i) Other (specify)	
3	Source of information of fresh root storage method/techniques	
	a) research/extension	
	b) Fellow farmers/friends	
	c) parents/traditional knowledge systems	
	d) Social media	
	e) Other (specify)	
	f) Other (specify)	
	g) Other (specify)	
4	Effectiveness of the root storage method/technique: Indicate not effective or effective or very effective	
	a) Harvesting the roots within the root stock intact	
	b) leaving the roots unharvested in the ground until they are needed	
	c) Re-buying the roots in trenches covered with plant material and soil	
	d) Piling the roots in heaps and keeping them moist by watering them daily	
	e) Applying a thick coating of soft clay or mud	
	f) Keeping small quantities of cassava in water	
	g) Other (specify)	
	h) Other (specify)	
	i) Other (specify)	
5	List constraints associated with any storage root technique you have practiced; indicate how long (days or weeks the roots stay fresh under the technique)	

Annex 3: Marketing survey questionnaire

Objective: To collect information on cassava commercialization

1. Date:

2. Geographic location

No.	Parameter	Data/response
1	Region	
2	District	
3	Chiefdom	
4	Section	
5	Village/town	
6	GPS Coordinates	

3. Individual respondent profile

No.	Parameter	Response: Tick option
1	Name:	
2	Gender	
	a) Male	
	b) Female	
3	Age	
	a) Youth/young adult	
	b) Middle age	
	c) Aged	
4	Education:	
	a) Illiterate	
	b) Primary school	
	c) Secondary	
	d) Higher education	
5	Main Activity	
	a) Cassava production	
	b) Cassava protection	
	c) Cassava marketing	
6	Linkage to cassava producer	
	a) Yes	
	b) No	
7	Linked cassava producer	
	a) Name:	
	b) Location:	
	c) Distance to the cassava farm (miles/km):	

4. Cassava commercialization

No	Parameter	Response: Tick option
1	Membership of association	
	a) FBO	
	b) CBO	
	c) ABD	
	d) Trader	
	e) FFS	
	f) Other (indicate name)	
	g) None	
2	Why did you join the group	
	a) Easy access to credit	
	b) Easy transportation of harvest	
	c) Group selling of produce	
	d) Group selling of processed cassava	
	e) Access to group market outlets	
3	What specific trading operation do you do	
	a) Wholesaling	
	b) Retailing	
	c) Exporting	
	d) Business agent/middle men	
	e) Other	
4	What type of cassava/cassava products are you trading in	
	a) Raw cassava root	
	b) Cassava leaves	
	c) Cassava flour	
	d) Fufu	
	e) Starch	
	f) Cassava bread	
	g) Gari	
	h) Others	
5	What kind of market do you sell your cassava/cassava products?	
	a) Daily market	
	b) Periodic market	
	c) Road side market	
	d) Street side market	
	e) Others	
	f) None	
6	How often do you come to this market	
	a) Daily	
	b) Weekly	
	c) Monthly	
	d) Others	
7	What is/are the sources of the cassava / cassava products that you sell?	
	a) Own farm	
	b) Contact cassava farmers	

	c) Retaillers/ open market	
	d) Wholesalers	
	e) Others	
8	How often do you buy cassava /cassava product from your source?	
	a) Daily	
	b) Weekly	
	c) Monthly	
9	Do you have any agreement with your suppliers?	
	a) Yes	
	b) No	
10	By what means do you usually transport the cassava/cassava products from your suppliers to your store/shop?	
	a) Supply delivery	
	b) Walk	
	c) Public transport	
	d) Private transport	
	e) Others	
11	How far is your shop /store from the supplier?	
	a) Nearest	
	b) Fartherst	
12	Are there motorable roads that links you to the suppliers	
	a) Yes	
	b) No	
13	What costs do you incur in trading cassava/cassava products?	
	a) Transport fare	
	b) Storage	
	c) Market due	
	d) Others	
14	Do you have any storage facility?	
	a) Yes	
	b) No	
	How long do you store the cassava and cassava product before selling?	
	a) Days	
15	b) Weeks	
	c) Months	
16	Do you package the cassava/ cassava product before selling?	
	a) Yes	
	b) No	
17	Have you receive any training for your cassava/ Cassava products?	
	a) Packaging	
	b) Storage and conservation	
	c) Norms and standards	
	d) Marketing	
	e) Others	
18	Do you get loan for your cassava/cassava product business?	
	a) Yes	
	b) No	

19	What type of loan do you normally receive?	
	a) Money	
	b) Equipment	
	c) Other credits	
20	From what source do you normally get these loans?	
	a) Financial institution	
	b) Money lenders	
	c) Neighbour	
	d) Relatives	
	e) NGO	
	f) Government	
21	Who decides the price of the cassava/ cassava products that you sell?	
	a) Trader	
	b) Customer	
	c) Producer	
	d) Suppliers	

22. How much do you pay for your cassava/ cassava products? Indicate price per quantity eg amount per Kg

Product	Normal price (Le/kg)	Lowest price(Le/kg)	Highest price (Le /kg)
Raw cassava			
Cassava leaves			
Gari			
Fufu			
Cassava flour			
starch			

23. What are the main constraints you face in selling your cassava / cassava products?

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24. What should be done to overcome these constraints?

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