Cassava farming transforming livelihoods among smallholder farmers in Mutomo a semi-arid district in Kenya

C. M. Githunguri[1]; E.G. Lung'ahi[2], J. Kabugu[3] and R.Musili[2]

[1]Kenya Agricultural Research Institute Katumani Research Centre, P.O Box 340-90100; Machakos, Kenya, Email :cyrusgithunguri@yahoo.com
[2]Arid Lands Information Network (ALIN), AAYMCA Building, State House Crescent, Off State House Avenue; P O Box 10098 00100, Nairobi, Kenya, Email: getrudelu24@gmail.com
[2]Arid Lands Information Network (ALIN); Mutomo Maarifa centre, Mutomo, Kitui, Kenya Email mutomomaarifa@alin.net
[3]http://joansdiary101.blogspot.com/joankabugu@gmail.com

Abstract

Purpose - To assess the impact the introduction of elite cassava had on the livelihoods of participating farmers in Mutomo using photography and focused group discussions. Design/methodology/approach - Included literature review, interviews, photography, physical observations, and focussed group discussions. Findings - The study established that climate change is real and has negatively affected smallholder farmer families in Mutomo and as such it was prudent to introduce drought tolerant crops like cassava in order to improve food security as a climate change adaptation technology. It was evident the elite cassava varieties from KARI were supplying the much needed carbohydrates in an affordable form. The assessment also established water scarcity is a major development-limiting factor in Mutomo that needed urgent attention. The Mutomo community had shed "Mwolyo" the hand-out mentality through adoption of appropriate technologies for this place like growing, processing, marketing, and consumption of cassava. Cassava roots were mainly marketed as fresh roots for chewing and boiling. Cassava cuttings and cakes on sale in the Mutomo market suggested that demand for cassava was rising and only need upscaling. Being dominated by agro-pastoralists, it was obvious that cassava and other crops that take more than four months before being harvested do not fit well into the system and this is an area that has to be addressed to pre-empt potential conflicts. Originality/value -This is the first case study based article that focuses on the potential of using cassava as a drought mitigating crop in Mutomo a semi-arid area in Kenya

Key words: Cassava, climate change, adaptation, semi-arid areas.

Introduction

Cassava (Manihot esculenta Crantz) produces about 10 times more carbohydrates than most cereals per unit area, and are ideal for production in marginal and drought prone areas, which comprise over 80% of Kenya's land mass (Githunguri *et al.,* 1998; Githunguri, 2002; Nweke *et al.,* 2002). A cassava plant possesses several growth parameters and physiological processes which can be used to measure its ability to produce adequate yield under various abiotic and biotic stresses (Ekanayake *et al.,* 1997a; Ekanayake *et al.,* 1997b; Ekanayake, 1998; IITA, 1982, 1990a; Osiru *et al.,* 1995). According to these authors, some of these parameters include long fibrous roots, shedding of leaves, leaf area index, leaf water potential, moderate stomatal conductance, transpiration rate, water use efficiency, crop growth rate and dry matter accumulation in the tuberous roots. Cassava can reach its production potential only where the attributes of the environment best match the crop requirements. Breeding and selection of varieties according to prevailing environmental characteristics can ensure optimal performance (IITA, 1990b).

The cassava commodity system has four main components: production, processing, marketing and consumption. Linking them is the key to successful cassava products development. Strong ties with both public and private institutions engaged in research, extension and social development are essential in the accomplishment of this linkage. The exact character of these linkages will vary according to the

stage of the project in technology generation and transfer (Githunguri *et al.,* 2006). Plant breeders can contribute to better productivity and quality, agronomists to improvements in cultural practices and cropping systems, and agro-ecologists to the proper analysis of resource management issues. In order to enhance the commercial achievement of Economic Recovery Strategy (ERS) goals, the Government of Kenya in collaboration with development partners has established the Kenya Agricultural Productivity Project (KAPP) (Ministry of Agriculture (MoA), 2005). The KAPP uses thematic concepts with demonstrative multi-sectoral approach to address agricultural challenges. In this regard, the cassava value chain project was funded by KAPP to enhance cassava production, processing and marketing in Kenya and beyond our borders, especially the Common Market for Eastern and Southern Africa (COMESA) region and Europe (Kadere, 2002; Mbwika, 2002). In Eastern Kenya cassava is eaten either raw or boiled (Githunguri, 1995). Despite its great potential as a food security and income-generating crop among rural poor in marginal lands, its utilization remains low. The potential to increase its utilization is enormous with increased recipe range (Githunguri, 1995) and provision of adequate clean planting material. One of the major constraints to cassava production in the arid and semi-arid areas includes lack of adequate disease and pest free planting materials (Obukosia *et al.,* 1993) exacerbated by the slow multiplication rates of 1:10. KARI-Katumani has bred cultivars tolerant to cassava mosaic disease and acceptable to end-users (Githunguri *et al*, 2003) whose multiplication and distribution is being attained through irrigation. Other constraints to cassava production in Kenya including semiarid eastern include lack of adequate disease and pest free planting materials, poor cultural practices, lack of appropriate storage and processing technologies, poor market infrastructure (Githunguri and Migwa, 2003; Lusweti *et al.,* 1997). KARI-Katumani has developed cassava varieties that are widely adapted to diverse agro-ecological zones, high yielding, early bulking, drought resistant/tolerant, resistant to major biotic and abiotic stresses and have good root quality (Githunguri *et al.,* 2003; Githunguri, 2004). KARI-Katumani has recognized the importance of involving farmers in their selection and breeding research programmes as suggested by Bellon (2001) and Fliert and Braun (1999). One of the objectives of this project was to establish demonstration plots and select entrepreneurial farmers for commercial cassava planting material multiplication and distribution to farmers in semi-arid Eastern Kenya in a bid to improve food security as a climate change adaptation technology. Mutomo district situated in Kitui County in semi-arid Eastern Kenya was one of the areas that were selected for the establishment of a cassava seed system.

Materials and methods

Cassava agronomic demonstrations, seed multiplication and distribution programmes were established in order to assure processors of a steady supply of tuberous roots. To ensure sustainable supply of planting materials, farmers who were willing to grow cassava on at least a quarter of an acre of their farm were selected to participate in planting materials multiplication and distribution in the selected project sites, Kibwezi (Kwa-Kyai), Mukuyuni, Mutituni, Matiliku, and Mutomo. Elite cassava cultivars grown under sprinkler irrigation at KARI Masongaleni and Kiboko Sub-Centers situated in Kibwezi and Makindu districts were harvested and distributed to several farmers who had shown interest in growing cassava in the project sites. In 2009, Revitalization of Indigenous Initiatives for Community Development (RINCOD), a local non-governmental organization carried out needs assessments in Mutomo. During these assessments, community groups agreed to start the Mutomo Cassava Production and Processing Association (MUKAPA). The project involved more than 100 households and over time, it has established high-yielding, disease and drought-resistant cassava varieties developed by the Kenya Agricultural Research Institute (KARI). During project initiation, the community selected three farms for cassava propagation and planted 10,000 cuttings on each with support from RINCOD and KARI. From these three farms, all the 100 members were then supplied with cuttings. During the last quarter of year 2012 and 1st quarter of 2013, A team of journalists, extension and research officers went out on a fact finding tour to assess the impact the introduction of elite cassava had on the livelihoods of participating farmers in Mutomo using photography and focussed group discussions.

Results and Discussions

The use of the elite cassava varieties has had several benefits among the Mutomo community. Figure 1 shows the Mutomo Meteorological Officer collecting dairy weather data. According to the officer, they are mainly concerned with temperature, armyworm, and rainfall data. Rainfall in Mutomo is scarce and erratic, while temperatures are generally high and the area prone to armyworm infestations especially during good seasons and that is why it is crucial to monitor these parameters.

Figure 1: Mutomo Meteorological Officer collecting (i) Max. Temperature, (ii) Armyworm, and (iii) rainfall data

A team of journalists, extension and research officers visited a typical Mutomo farmer's homestead to get a first-hand experience of what he/she goes through in a normal day (Figure 2). This farmer like most others has been growing maize and beans religiously season after season despite frequent crop failures. Changing the farmer's attitude towards the growing of these crops is a major challenge in tackling food insecurity in this area. Like the pictures depict, poverty levels and food insecurity are very high. The empty granary is a constant and stark reminder of the frequent crop failures that have occurred in that area since year 2003. The owner of this homestead works as a night guard in Mutomo town and as such he had been able to install a small solar panel that is able to light four bulbs and run a small radio. Learnt climate change is real and has negatively affected Mutunga's family. It was sad to see the farmer's abandoned empty granary due to climate change since year 2003. The team realized how lucky the farmers in high potential areas are and the urgency there is in creating awareness among them about the utter need for them to preserve, conserve and improve their environment jealously. There is real need to introduce drought tolerant crops like cassava in this area if food insecurity is going to be addressed.

Figure 2: Mutunga's homestead (i and ii) and a (iii and iv) granary which has been empty for several failed seasons since year 2003– this is typical of a smallholder farmer in Mutomo who has been growing maize and beans

Figure 4 shows the beginning of a typical day of a smallholder farmer in Mutomo. The farmer and his family which included the family cat were enjoying boiled cassava for breakfast. Due to the high poverty levels in the area the most of the farmers cannot afford to buy bread for breakfast. The family heartily shared the little cassava- breakfast which was really moving. The pictures suggest cassava is

important in supplying the much needed carbohydrates in an affordable form. However, since this is a predominantly "boil and eat" society, it is important to introduce only low cyanogenic cassava cultivars. In addition, it is crucial to train cassava consumers on how to detoxify cassava through appropriate processing.

Figure 4: Mutunga enjoying cassava breakfast together with his grandchildren, son and family cat enjoying

After the farmer had taken cassava breakfast with his family the team walked to his main farm which was about 20 minutes away. During the walk the team of officers was able to observe other resident farmers going to fetch water in a common well situated near the farmer's main farm (Figure 5). Looking at the heavy traffic consisting of both livestock and human beings going to collect water at the same well, it was realized that water scarcity is a major development-limiting factor in this area that needs urgent attention. Figure 5 shows Mutunga's daughter in-law and other neighbours fetching water from a dry riverbed well situated 3 km away from their homestead. In this area the donkey is the preferred mode of transporting water from the communal wells. It was heartrending to watch a whole population including men, women, and children, and their livestock going for water in just one watering place where there was not enough of it. However, it was encouraging to realize that the community here was doing all it can to make ends meet and that they had shed "Mwolyo" the handout mentality through adoption of appropriate technologies for this place like growing, processing, marketing, and consumption of cassava.

Figure 5: Smallholder farmers fetching water in a communal well situated in a dry riverbed over 3 km away from most homesteads

Water scarcity in Kanzilu is a major challenge as is clearly evident from the pictures in Figure 6. Children and women scoop water from a typical shallow well in Kanzilu location in Mutomo for domestic use and for their donkeys, cows and goats. As is also evident getting clean water is also a major challenge. There is need to introduce project s that supply adequate clean water in this area alongside those addressing food insecurity. Transporting water and watering livestock in Kanzilu is a major occupation mainly conducted by women and children.

Figure 6: Children and women scoop water from a typical shallow well in Kanzilu location in Mutomo for domestic use and for their donkeys and other livestock

Water scarcity in Kanzilu, a village in Mutomo, is a major challenge in the lives of residents and has to be addressed through diverse approaches. According to Figure 7, cassava is a mitigating technology. The farmer's cassava farm had been maliciously grazed by goats which unless addressed is a major potential area for conflict between farmers and agro-pastoralists. It was difficult to understand why anybody in their right frame of mind would want to deliberately graze his goats on the farmer's farm. However, on the flipside this demonstrates the importance and resilience of cassava as a drought mitigating technology in Mutomo. The farming system in Mutomo is dominated by agro-pastoralists and it is apparent that cassava and other crops that take more than four months before being harvested do not fit into the system as farmers release their livestock to graze communally after maize has been harvested. This is an area that has to be addressed if cassava farming is going to be adopted. However, the farmers understand this and they fence the parts of their farms that have crops that take longer than four months to mature.

Figure 7: Watering cassava in Mutunga's farm in Kanzilu village in Mutomo which had been grazed and defoliated by goats maliciously belonging to agro-pastoralists

According to Figure 8, cassava was mainly marketed as fresh roots for chewing by men to improve their virility. Cassava cuttings were also on sale in the Mutomo market suggesting demand for cassava was rising. Cassava cakes were also on display in the market. The photographs suggest that cassava products were popular in Mutomo and that is why they were on sale. Cassava roots, cuttings, and cakes were on sale in the open-air market.

Figure 8: A typical day in Mutomo Market: (i) a vendor selling cassava & assorted fruits; (ii) cassava roots for chewing on sale; (iii) cassava stakes on sale; and (iv) cassava-based baked products on sale

At the Mutomo Bakery, cassava was being chipped, dried in a solar drier, milled and bread baked using the same flour mixed with wheat flour in various ratios. A loaf of cassava bread was retailing at K. Shs 42. Figure 9 shows a demonstration on how to make a cassava-based cake which has a ready market in Mutomo.

Figure 9: (i) Cassava cake ingredients; (ii) cassava cake dough being spread in the pot ready for baking; (iii) and (iv) cassava cake is finally ready for serving; and (v) Mutheu can hardly wait to taste the cassava cake

Conclusions and Recommendations

Climate change is real and has negatively affected smallholder farmer families in Mutomo. There is urgent need to introduce drought tolerant crops like cassava in Mutomo in order to address food insecurity. It was evident the elite cassava varieties from KARI have brought several benefits among the Mutomo community. Due to the high poverty levels in the area the most of the farmers cannot afford to buy bread for breakfast and as such cassava is important in supplying the much needed carbohydrates in an affordable form. Water scarcity is a major development-limiting factor in Mutomo that needs urgent attention. As such there is need to introduce projects that supply adequate clean water in this area alongside those addressing food insecurity. The Mutomo community was doing all it can to make ends meet and that they had shed "Mwolyo" the handout mentality through adoption of appropriate technologies for this place like growing, processing, marketing, and consumption of cassava. Cassava roots were mainly marketed as fresh roots for chewing by men to improve their virility. Cassava cuttings were also on sale in the Mutomo market suggesting demand for cassava was rising. Cassava cakes were also on display in the market suggesting that cassava products were popular in Mutomo and only need upscaling. The farming system in Mutomo is dominated by agro-pastoralists and it is apparent that cassava and other crops that take more than four months before being harvested do not fit well into the system as farmers release their livestock to graze communally after maize has been harvested. This is an area that has to be addressed to pre-empt potential conflicts. However, the farmers understand this and they fence the parts of their farms that have crops that take longer than four months to mature.

Acknowledgement

The authors would like to acknowledge the Director KARI; the Director Arid lands Information Network, and the USAID Programme for providing funds, support and other facilities in making this work a success. The Director KARI is further thanked for granting permission to publish this work. We also thank Dr. A. M. Mailu and Ms. Jayne Gathii of USAID for many valuable discussions and suggestions. Finally but not last, we thank most sincerely the various collaborative partners (Ministry of Agriculture among others) for their invaluable technical contributions.

References

Bellon, M. R. (2001), "Participatory Research Methods for Technology Evaluation. A Manual for working with Farmers". Mexico, D.F.: CIMMYT, 93p.

Ekanayake, I. J., Osiru, D. S. O. and Porto, M. C. M. (1997a), "Morphology of cassava". IITA Research Guide 61: 1 - 30.

Ekanayake, I. J., Osiru, D. S. O. and Porto, M. C. M. (1997b), "Agronomy of cassava". IITA Research

Guide 60: 1 - 30.

Ekanayake, I. J. (1998), "Screening for abiotic stress resistance in root and tuber crops". IITA Research Guide 68: 46pp.

Fliert, E. van de and Braun, A. R. (1999), "Farmer Field School for Integrated Crop Management of Sweet potato. Field Guides and Technical Manual". Andi Offset, Yogyakarta, Indonesia: CIP,III-101p.

Githunguri, C. M. and Migwa, Y. N. (2003), "Sweetpotato Feathery Mottle Virus Resistance and Yield Characteristics of Different Sweetpotato Cultivars in Machakos and Makueni Districts of Kenya". In: Githunguri C. M., Kwena, K., Kavoi, J., Okwach, E. W., Gatheru, M. and Abok, J. O. (eds.). Kenya Agricultural Research Institute, KARI Katumani Research Centre annual report 2002. Pp. 91 - 95.

Githunguri, C. M. (1995), "Cassava food processing and utilization in Kenya". In: Cassava food processing". T. A. Egbe, A. Brauman, D. Griffon and S. Treche (Eds.) CTA, ORSTOM, pp119-132.

Githunguri, C. M., Ekanayake, I. J., Chweya, J. A., Dixon, A. G. O. and Imungi, J. K. (1998), "The effect of different agroecological zones and plant age on the cyanogenic potential of six selected cassava clones". In: (R. S. B. Ferris ed.) Post harvest technology and commodity marketing. Proceedings of a postharvest conference held on 2 November – 1 December 1995, Accra, Ghana. IITA, Ibadan, Nigeria, 71 - 76pp.

Githunguri, C. M. (2002), "The influence of agro-ecological zones on growth, yield and accumulation of cyanogenic compounds in cassava". A thesis submitted in full fulfilment for the requirements for the degree of Doctor of Philosophy in Crop Physiology, Faculty of Agriculture, University of Nairobi, 195pp.

Githunguri, C. M., Migwa, Y. N., Ragwa, S. M. and Karoki, M. M. (2003). "Cassava and sweetpotato agronomy, physiology, breeding, plant protection and product development. Root and Tuber Crops Programme in KARI-Katumani". Paper presented at the Joint Planning meeting organized under the Eastern Province Horticulture and Traditional Food Crops Project, held at Machakos, Kenya on 5th 7th March 2003, 5p.

Githunguri, C. M. (2004), "Farmers' Participatory Perspectives on Sweetpotato Cultivars in Kathiani Division of Machakos District, Kenya". In: Book of Abstracts of the 9th Triennial Symposium of the International Society for Tropical Root Crops- Africa Branch (ISTRC-AB), Mombasa, Kenya, 31st October – 5th November 2004. 84pp.

Githunguri, C. M, Karuri, E. G., Kinama, J. M., Omolo, O. S., Mburu, J. N., Ngunjiri, P. W., Ragwa, S. M., Kimani, S. K. and Mkabili, D. M. (2006), "Sustainable Productivity of the Cassava Value Chain: An Emphasis on Challenges and Opportunities in Processing and Marketing Cassava in Kenya and Beyond". KAPP Competitive Agricultural Research Grant Fund, pp. 106

IITA. (1982), "Management practices for production of cassava planting materials". IITA tuber and Root crops production Manual series, 244pp.

IITA. (1990a), "Cassava in Tropical Africa". Reference Manual IITA, 176pp.

IITA. (1990b), "Targeting cassava Breeding and Selection". In: Proceedings of the fourth West and Central Africa Root Crops workshop, held in Lome, Togo, 12-16 December 1988. IITA Meeting Reports Series 1988/6, pp. 27-30.

Kadere, T. T. (2002), "Marketing opportunities and quality requirements for cassava starch in Kenya". In Proceedings of regional Workshop on improving the cassava sub-sector, held in Nairobi, Kenya, April 2002, 8-18, pp. 81 - 86.

Lusweti, C. M., Kiiya, W., Kute, C., Laboso, A., Nkonge, C., Wanjekeche, E., Lobeta, T., Laya, S., Kakuko, A., and Chelang, E. (1997), "The farming systems of Sebit: In: Summary from PRA activities". Pp. 54 - 67.

Ministry of Agriculture (MoA). 2005, "Strategy for Revitalizing Agriculture 2004 – 2014". Ministry of Agriculture, 23pp.

Mbwika, J. M. (2002), "Cassava sub-sector analysis in the Eastern and Central African region". In Proceedings of regional Workshop on improving the cassava sub-sector, held in Nairobi, Kenya, April 2002, 8-18, pp. 8-18.

Nweke, F. I., Spencer, D. S. C. and Lynam, J. K. (2002), "Cassava transformation. International Institute of Tropical Agriculture". 273p.

Obukosia, S. D., Muriithi, A and Musangi, R. S. (1993), "Biotechnological approach to the improvement of root, tuber and horticultural crops in Kenya. Production constraints and potential solutions". Proceedings of the national agricultural biotechnology workshop, Nairobi, PP. 92-106.

Osiru, D. S. O., Porto, M. C. M., and Ekanayake, I. J. (1995), "Physiology of cassava". IITA, Research Guide 55: 3 - 19.