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Adoption of Cassava Production Technology in the Central Rift Valley Province Kenya

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Abstract : ***Cassava (Manihot esculenta) is the third largest source of carbohydrates for human consumption and is ranked third among the root crops in Kenya. In the tropical countries it is ranked third in the value of production after sugarcane and rice. Cassava has a carbohydrate content which is about 40% higher than that of rice and 25% more than that of maize. It is an important crop in Arid and Semi-Arid lands (ASAL) of Kenya due to its ability to adapt well to soils with low contents of nutrient and areas with poor rainfall (< 700 mm per annum). Farming of cassava in Kenya has been practiced for many years without it being viewed as an important crop for food security due to the introduction of exotic crops in the farming system. In order to address these shortcomings, a participatory research approach method that would enable the farmers to share, enhance, and analyze their knowledge on cassava together with the scientists was adopted in this research exercise. Farmers in the four districts of the province have not as yet found an alternative crop that can tolerate drought. Baseline data on cassava was initiated by scientists and stakeholders during the centre research advisory committee (CRAC) meeting with farmers in Central Rift Valley province of Kenya in 2004, with the additional aims of identifying constraints and assessing farmers' perception to cassava farming for food security. In this research, a questionnaire was administered to one hundred and seventeen (117) farmers in the four districts of the Central Rift Valley Province namely, Nakuru, Kericho, Bureti and Bomet. The study showed that 21.07% of the cassava farmers in the province were from Nakuru, 22.22% from Kericho, 45.02% from Bureti and 11.69% from Bomet. The study further revealed that there were more men (59.06%) respondents involved in cassava farming than women (40.93%). Evidence of diffusion of cassava production was apparent from the higher numbers of farmers participating in the cultivation of cassava the project. Demonstrations were carried out in all the four districts, from selection of the appropriate cassava planting to the final utilization of its products. Lessons learned by the farmers included cooking (19.7%), correct planting method (42.7%) and value addition (26.5%). Seventeen percent (17.1%) of the farmers involved in this exercise were first time participants. A notable improvement was recorded in Kericho district where 38.89% of the participants were women compared to 0% when the project started four years earlier. In addition the farmers were also exposed to different methods of management of cassava farming, including production and multiplication of suitable clean planting materials.***

Keywords: Participatory research; adoption; cassava technology

1. Introduction

Globally, cassava ((*Manihot esculenta* Crantz)) is the 3rd largest source of carbohydrates for human consumption after rice and maize. It is also the most important food crop on the African continent (Sanchez, 1999; Fauquet and Fargette, 1990). According to United Nations Food and Agriculture Organization (FAO), cassava ranks fourth of food crops in the developing countries after rice, maize and wheat. The leaves are relatively rich in protein and can be consumed just like any other green vegetables at household level. Cassava is used as a reserve food when the main food crop like cereals fails due to drought conditions (FAO 2000). It is among the traditional crops, which were introduced in Kenya between the 16th and 19th century by the European explorers. It was introduced along with other crops such as beans, maize and sweet potatoes. Cassava adapted well to the environment and by the start of 20th century it was widely grown in the country (Suttie, 1970). Among the starchy staples Cassava gives a carbohydrate production which is about 40% higher than rice and 25% more than maize. It is also a cheap source of calorie for both human nutrition and animal feed making cassava an important crop in Arid and Semi-Arid Lands (ASAL) of Kenya. Its ability to adapt well to soils with low nutrient in areas with low rainfall is an added advantage. The crop has the ability to produce substantial yields with minimum inputs under poor soil fertility and low moisture regime where most other crops especially cereals fail. Cassava has a comparatively high biological efficiency of food – energy production because of rapid and prolonged crop growth. It produces 2.2 times more calories per hectare than maize (FAO, 1986), with a lower resource cost (Hahn *et al*., 1979).

Breeders spent the greater part of their time developing new technologies with no intention of involving the end user. The farmer is normally involved during the final stages after varietals release through demonstration and field days. It is then expected that the farmer will final adopt the technology. Knowledge about innovation is crucial to the potential adopter in his/her adoption decision making process. Generally, farmers are averse to changes especially new seed or new planting material. They prefer to hold-on and plant what they know and have assurance. The fear of food insecurity due to failure of new planting material, increased cost of management and many other associated problems are all eminent. Other envisaged problems that come with new technology would also include unknown diseases, change in taste and nutritional content of new variety

The general objective of this study was to provide farmers and scientists an opportunity to work together in selecting the most suitable variety for each region through participatory research approach (PRA). The study was also able to identify constraints and opportunities for scale-out cassava production.

2. Research Methodology

The study started by identification of CBOs and self help groups in the four districts of Nakuru, Kericho, Buret and Bomet by use of identification matrix..

The stakeholders were selected according to their involvement in agricultural activities. Purposive sampling procedure was used to arrive at the required number of fifty (50) CBOs with one hundred and seventeen (117) farmers. A Reconnaissance survey was then carried out and information gathered from farmers who were members of the CBOs. A questionnaire was administered to the members of the communities at their home with the head of the family being the respondent.

The sampled farmers were of small-scale type of farming ranging from 2-5 hectares of land. The study examined the effects of independent variables, which included farmer's personal characteristics on dependent variables and cultivation of cassava. A sociological survey was used to collect data using a standard questionnaire. A questionnaire was administered to one hundred and seventeen (117) selected farmers. The independent variables included farm size, land ownership, education levels, age and gender. Data obtained was subjected to both descriptive and inferential statistics to achieve study objectives. The Scientific Package for Social Sciences (SPSS) was used to analyse data

3. Results and Discussion

3.1 Stakeholder identification matrix

Identification matrix in the initial stages of the study was used to bring stakeholders together which included Extension staff, farmers, CBOs and NGOs

During the reconnaissance survey, it was clear that cassava exist in the region for different reasons and in different forms. Farmers did not want to destroy the crop neither did they want to cultivate seriously.

Cassava production is not a major enterprise due to the emerging exotic crops in the farming system. The study also established that the area under cassava cultivation has been increasing steadily, while production and yields have been erratic which is due to many factors like lack of knowledge of varieties, pests and diseases. Proper information was needed and availability of clean planting materials. Production in Kenya is mainly by small-scale farmers growing less than one acre which are found either as mono-crop, inter-crop with other crops like maize, beans, bananas, Napier grass and even sugarcane. In all areas surveyed, most respondents reported growing cassava under mixed cropping system. Only 7% of the household grew more cassava in the cropping system, while 62.8% as mixed cropping and 30.2% had none on their farms planted.

The study also established that cassava was grown under small-scale system with (97.7%) of the farmers on less than 0.5acres with 2.3% on 2 acres of mixed cropping. None of the farmer's surveyed planted cassava on pure stand and the most common cassava variety grown was of traditional cultivar (72.1%) while (16.3%) did not know the variety grown in their farms. Data collection was done with collaboration with farmers

3.2 Farmers' Participation in Cassava Utilization

Most agricultural innovations originate from research stations and manifest themselves in material form, for example new chemicals, fertilizer application rates, or new high yielding varieties. However, the reverse is also possible in the case of Macadamia nut, which originated from a farmer in Kenya and was only later promoted by extension agents (Adams, 1984). The decision to make full use of an idea, practice or technology as the best course of action available is adoption (Vago, 1990). Adoption, therefore, is the responsibility of the farmer who is the end user (De Vries and Toenniessen; 2001). This was demonstrated by the second phase of the project when the number of farmers increased with time giving participatory research higher chances of influencing adoption. According to Muthamia *et al*. (1996), participatory research has proved more effective in technology adoption than the top-down approach. However, cassava faces several constraints which affect its cultivation and utilization. There are few on-farm demonstrations and ownership of developed technology is not visible. It had also been associated with death in human and livestock due to cyanide levels found in some of the varieties. Formative evaluation carried out during the sixteen months period of the project cycle to assess farmer's perception.

In Kericho, Bureti and Bomet district cassava use is not known except for boiling aspect with 48.8% utilizing cassava as food once in a day while 37.9% rarely consume cassava and 16.3 % do not touch the product at all. Farmers preferred a local cultivar known in different names grown by 72.1% because of taste. The study established that taste was a major factor in selection of variety (53.5%) and the least of all was texture (2.3%). Most farmers (79.1%) acquired planting material from fellow farmers which is a common phenomenon in African traditional farming which also extends across districts and borders among the neighbouring communities. Respondents also indicated deficiencies of planting materials among farmers which could possibly be due to a combination of other factors such as extended dry seasons before the next planting season.

During the demonstration on various ways of utilizing cassava, farmers were able to learn a number of lessons (see Table 1) which included correct planting method (42.7%), cooking (19.7%), value addition (26.5%) and (17.1%) had no opinion due to lack of participation.

Table 1: Lessons in Cassava Utilizing Cassava

Lessons	Number	Percentage%
Planting methods	50	42.7
Value addition	24	20.5
Cooking methods	23	19.7
N/A	20	17.1
Total	**117**	**100**

Cultivar MM4884, Micericeri, Miygera and MM4466 had the highest number of tubers and most preferred by farmers

due to cooking period and taste. The demonstration included using cassava leaves as vegetables providing women with a new alternative in dry spells.

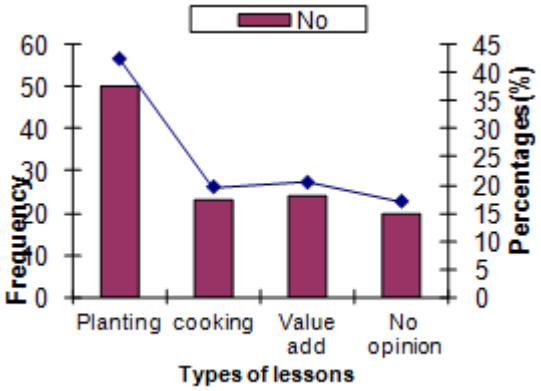

Figure 1: Lessons learned by farmers

3.3 Age of the Farmer and Gender

Studies relating to farmer's age to his/her adoption behaviour showed that 57.3% were males with 42.7% females showing no statistical significant difference at α=0.05. Other studies on gender reveal conflicting results with some showing positive relationships while others reflect strong negative relationship. Amudavi, (1993) found no relationship between age and technology up-take. Rogers, Adoption may vary as a function of stage in life cycle of a farmer and his family. The World Bank (1993) reported that there was no significant difference between the male-headed households and female-headed household in adoption. Oywaya (1995) in a study in Machakos district Kenya found significant gender difference in adoption rates. This was attributed to the fact that women were more committed to farm work than their male counter parts and hence could easily put into practice what they learned from the extension officers. Women are more available for farm work than the men who are involved in off-farm employment making women better adopters of innovations than men. This was shown clearly during the demonstration period.

Table 2: Gender participation of farmers by districts in 2004

District	Males	Females	Total
Nakuru	14 (87.5%)	2 (12.5%)	16
Kericho	8 (100%)	0 (0%)	8
Bureti	15 (75.0%)	5 (25.0%)	20
Bomet	3 (18.8%)	13 (81.2%)	16
Total	40	20	60

Table 2 below shows the attendance in Kericho, in terms of gender during the initial stakeholder meetings with scientists was very poor with only males (100%) but the situation changed during the second phase of the exercise and it was encouraging to see the gender representation of (52.77%) males and (47.36%) females in the second activity.

Table 3: Gender participatory of the farmers by district in 2007

District	Males	Females	Total
Nakuru	20 (51.28%)	18 (47.36%)	38
Kericho	19 (52.77%)	17 (47.2%)	36
Bureti	49 (63.6%)	28 (36.36%)	77
Bomet	13 (65%)	7 (35%)	20
Total farmers reached	**101**	**70**	**117**

3.4 Processing

At household level cassava is consumed raw, boiled or roasted. However certain varieties have to undergo processing before consumption. Most farmers are not aware of cyanide effects found in cassava which has caused death in some families. The study therefore allowed the scientists to select materials that have less cyanide for different districts.

The market for cassava is young and potential large scale processing companies have come up to encourage farmers to cultivate the crop. They include processing plant like (Tapioca Limited) with an installed capacity of 30 tons and (Suneco fuels Pvt. Ltd) with a capacity of 40tons /day of dried cassava. Some of the cassava products that farmers were able to learn include;cassava flour, Cassava Soya bread, Cassava cookies, Cassava doughnuts, Cassava chapattis, Cassava-bread sticks, Cassava scones, Cassava fritters, Cassava strips, Cassava cake, Cassava mandazi, Cassava biscuits, Cassava chips, Cassava banana mash, Cassava buns, Cassava samosa, Cassava finger millet ugali, Cassava finger millet porridge, Cassava leaves

4. Conclusion

Cassava is increasingly becoming an important food crop and future income generating cash crop. Therefore, there is great potential to increase cassava production in the region. This can be achieved through increase in acreage as well as increase in yield. Identification of farmers to multiply clean planting materials and distribute has been put in place. This will be by building on the existing achievements so far. All the teachings were bound in a booklet for use by farmers. It is also possible to introduce and promote cassava/finger millet composite for different important dishes in the region.

References

[1] Amudavi, M.D (1993). *Influence of socio-economic factors on adoption of maize Related technology. The case of small holder farmers in Hamisi division.* (Unpublished M.Sc. Thesis), Melbourne, Australia, University of Melbourne.

[2] Bock K. R. (1994). Control of Africa cassavamosaic germinivirus by using virus free planting material. Tropical Science 34,102-109

[3] De Vries and Toenniessen (2001). Securing and Harvesting . Biotechnology, breeding and seed systems for African crops. The Rockefeller Foundation. CABI Publishing

[4] FAO, (2000). The global cassava development strategy and implementation plan. Volume 1. CIAT, CIRAD IITA, NRI, IFAD, FAO, Rome Italy

[5] FAO/UNDP Cassava Project (1994). Breeding cassava for multiple pest resistance in Africa African Crop Science Journal. 2 (4). 539-552

[6] Fauquet, C. and Fargette, D. (1990). African cassava mosaic virus: Etiology, epidemiology and control. Plant Diseases 74, 404-411

[7] Hahn S. K., Terry E. R., Leuschner, K., Okari C.and Lal R. (1979) Cassava improvement in Africa. Field crop research, 2,193-226

[8] Hahn S. K. (1984) Tropical root crops: their improvement and Utilization IITA 2,28
[9] Muthamia J.G.N, J. W. Irungu, A. Sutherland, J.O. Ouma and Muchemi. (1996) Participatory evaluation of sorghum varieties in Eastern Kenya: Focus on Agriculture Research for sustainable Development in a changing Economic Environment. Proceeding of the 5th KARI scientific conference.14th to 16th October, 1996 Nairobi Kenya.
[10] Oywaya, M. A. (1995). *Socio-economic factors influencing innovation and the*
[11] *Participation of Women in agricultural extension programmes in Malala divisionof Makueni district Kenya* Unpublished MSc. Thesis, Njoro, Egerton University
[12] Rogers, E. M.,(1995). *Diffusion of innovation*. 4th Ed. New York, The Free Press
[13] Sanchez, G., Restrepo, S., Duque, M-C., Fregene, M., Bornierbale, M. and Vardier, V. 1999. AFLP assessment of genetic variability in cassava accession (*Manihot esculenta*) resistant and susceptible to the cassava bacterial blight CBB. Genome 42, 163-172
[14] Suttie, J.M. (1970). A review of crop introduction in Kenya and a checklist of crops. E, Afric. Agric. & Forestry Journ. 35, 3720-377.
[15] Swanton, M. M. and Harrison, D. B. (1994). Properties, relationships and distribution of cassava mosaic Gemini viruses. Tropical Science 34, 15-25
[16] Theodore M. M. and Balezi N (2001). Diagnostic survey of cassava mosaic virus spread in Congo Democratic Republic. Africa Crop Science proceedings Vol. 5 pp 445-448
[17] Thesh, J.M., Otim Nape G.W., Taukappan, M. and Muniyappa, V. (1998). The mosaic diseases of cassava in Africa and Indian caused by whitefly-borne geminiviruses. Reviews of Plant Pathology 77, 823-833.
[18] Thesh, J.M., Otim Nape, G.W., Legg, J.P., and Fargette, D. (1994). Effects of African cassava mosaic geminivirus disease on yield of cassava: Tropical Science 34, 26-42
[19] Vago, S. (1990). *Social change.* St. Lois University, New Jersey, Prentice Hall, Englewood Cliffs,
[20] World Bank (1993). *Evaluation of the performance of "T and V" system of extension in Kenya*; Technical Paper, No. 208, Africa Technical Department series Washington D.C. U