Influence of Information Access on Production and Marketing on Improved Sweetpotato Varieties in Kenya: A Case of Migori County, Kenya

Ojuodhi A. Tabitha [1*] Ndiema C.A [2] Maling'a[J] N [3] Akhwale M.S [1].

[1]*Non RuminantInstitute. Kenya Agricultural and Livestock Research Organization Kakamega,P.O Box 169-50100 Kakamega,Kenya*
[2]*Masinde Muliro University of Science and Technology. P.O.Box 190-50100 Kakamega.*
[3]*Food Crops Research Institute .Kenya Agricultural and Livestock Research Organization, P.O.Box 450-30200, Kitale ,Kenya*
Corresponding Author: Tabitha A. Ojuodhi
Non Ruminant Institute, Kenya Agricultural and Livestock Research Organization
Kakamega, P.O Box 169-50100 Kakamega, Kenya.

ABSTRACT: Sweetpotato (Ipomea batatas)is the seventh most important food crop after wheat, rice, maize, potato, barley and cassava in Sub –Saharan Africa and in Kenya. It is a health and food security crop with a flexible source of income to rural households.. Improved sweetpotato varieties were disseminated by different institutions and organization in Migori County from 2014, but studies reveal that production is still low. Studies have shown that access to information is vital for improving agricultural production especially in rural areas where agriculture is the main source of livelihood.The purpose of this study wasto establish sources of information access on production and marketing pathways of improved sweetpotato varieties in Migori County, Kenya. The research designwas household survey in Migori sub counties, Suna East, Suna West, Kuria West and Kuria East. Random sampling was used to select 143 household and 12 key informants were purposively selected. Semi structured questionnaires and interview schedules were administered as data collection instruments to sampled respondents.Data collected for analysis were both qualitative and quantitative. SPSS version 20 was to generate descriptive and inferential statistics. Logit model was used to establish the relationship between the study variables.The results showed that,the significant levels of adoption and sweetpotato production in relation to farm size ($P \leq 0.02\alpha0.05$). The adoption percentage levels of improved sweetpotato varieties that were grown in the four sub counties, Kenspot 1, 27%, Kabode, 23% and vitaa. 22%.In conclusion access to information was associated with adoption of improved sweetpotato varieties. The study recommends thatstrengtheninglinkages of agricultural Research institutions with Extension agents in dissemination of improved sweetpotato technologies for accessibility to farmers should be enhanced. Dissemination of new released sweetpotato varieties to farmers by establishment of sweetpotato vine nurseries for accessibility is key to adoption.
Key words: Adoption, information access,Improved, sweetpotato.

Date of Submission: 24-10-2019   Date of Acceptance: 09-11-2019

I.   INTRODUCTION

Sweetpotato was introduced from India to East Africa later under British colonial influence by Speke and Grant expedition in the 1860's (Stathers *et a*l., 2013).New Guinea is considered as the most important secondary center of diversity of sweetpotato landraces (Roullier *et al*., 2013).Sweetpotato is ranked as the seventh most important food crop in the world after wheat, rice, maize, potato, barley and cassava (Loebenstein et al., 2003, Ray and Ravi, 2005). Sweetpotato is a food security crop which offers food and income to rural households. It is drought tolerant crop with a wide ecological adaptation and a short maturity period of three to six months (Ndolo *et al*., 2001).

Sweetpotato is rich in carbohydrates offering a source of energy. It is an excellent source of vitamin A, especially the orange fleshed sweetpotato (OFSP) varieties which can be made into several products when value added (Ndolo *et al*., 2001). Sweetpotato roots also have high levels of Vitamins C and E, several B vitamins, Iron, Zinc, Potassium, and fiber (Stathers *et al*., 2018). The fresh roots have several uses, boiling or roasting while the leaves are nutritious and widely eaten as a vegetable and fed to animals (Stathers *et al*., 2018).

Globally, China is the top producer of sweetpotato accounting for 70% andit is also widely cultivated in many developing countries, where it serves as a principal source of food and income in the world's poorest and most nutritionally insecure people (Tavva and Nedunchehiyan, 2012). Other nations, primarily in Asia and Africa are significant producers of sweetpotato. The top sweetpotato producing nations include Nigeria, with a 2013 harvest estimated3.3 % of total world production; Uganda,2.5 % of total world production and Indonesia and Vietnam 1.3 % of world production respectively. United States is the sixth largest sweetpotato producing nation in the world (Tavva and Nedunchehiyan, 2012). In Kenya sweetpotato is ranked third among root and tuber crops after potato and cassava (Sanginga and Mbabu, 2015). According to FAOSTAT (2015), Kenya produces 62,000 tons per annum. Average yield of sweetpotato fresh roots in Kenya is only 7 tonnes per hectare compared to world average of 14.3 tonnes per Hactare by farmers and 30 tons/ha under experimental conditions.In Kenya, Lake Victoria Basin is the main producing sweetpotato growing area accounting for over 75% of the national production (FAOSTAT, 2012).

For improved sweetpotato varieties to be adopted, there has to be strong linkages between agricultural research development partners and key actor's institution in nutrition, health and education is crucial for intended objective to be impacted (FAO, 2012).

Despite the efforts of different organizations to disseminate recently released improved sweetpotato varieties of various attributes (Karanja *et al*., 2015), studies show that there is still low uptake of these technologies by farmers (Gichangi et al., 2013), the reasons for this low adoption is not clearly known, the study therefore sought to explore factors which influence adoption of improved sweetpotato varieties.

The potential of sweetpotato contribution to food security, increased incomes and reduction of nutritional deficit is therefore considerable and is yet to be fully exploited in Kenya (Bovell-Benjamin, 2007). Sweetpotato is an emerging crop of commercial value in Migori County where farmers grow local varieties. Kenya Agricultural and Livestock Research Organization released and recommended new varieties among them white, yellow, and orange-fleshed sweetpotato such as Vitaa, Kabode, kenspot 1, kenspot 2, Kenspot 3, Kenspot 4 and Kenspot 5 (Karanja *et al*., 2015). Sweetpotato is produced as a subsistence crop in most parts of Kenya like, Homa Bay, Migori, Kakamega, Bungoma just to mention a few in counties of former Nyanza and Western Provinces (FAOSTAT, 2014). Regardless of the released sweetpotato varieties, studies show that adoption is still low. The knowledge will go a long way to guide efforts to improve information access and enhance adoption. Opportunity exists in sweetpotato being a crop of income to rural farmers if they grow high yielding improved sweetpotato varieties. New research areas will be identified and reference materials for academia will be availed.

II. MATERIALS AND METHODS

The study was carried out in Migori County which issituated in the South Western part of Kenya. It borders Homa Bay County to the North, Kisii and Narok counties to the East and the Republic of Tanzania to the South, it also borders Lake Victoria to the West. The county is located between latitude 0^0 24, South and 0^0 40 South and Longitude 34' East and 34' 50 East. The county has a population of 917,170 and covers an area of 2,596.5 km^2 and approximately 478km^2 of water surface (Kenya National Bureau of Statistics, 2009. It has an altitude of between 1140 meters above sea level at the shores of Lake Victoria in Nyatike Sub Countyto 4625 meters above sea level in Uriri subcounty. The County has 8 sub counties and 40 wards, the study was conducted in 4 sub counties namely, Suna East, Suna West, Kuria East and Kuria West in (Table 1).

This study investigated sources of information access which influence production and marketing of improved sweetpotato varieties in the selected sub counties of Migori County. The primary data used mainly were interviews from farmers on sweetpotato varieties produced, sources of information on production and marketing. Secondary data was provided by Kenyan ministry of agriculture from the sub counties and through relevant literature. The primary data was collected in May 2017 in the four sub counties where 143 respondents were interviewed by use of structured questionnaires. This study was conducted through a research design of household survey. Purposive sampling procedure was used to obtain study site which was Migori County. Multistage sampling procedure was used to identify four sub counties out of eight sub counties in Migori which were Suna East (n=29), Suna West(n=27), Kuria East(n=24) and Kuria West(n=63) where sweetpotato is grown. Data collected was both quantitative and qualitative. Statistical Package for Social Sciences version 20 was used to generate descriptive and inferential analysis data.Logitmodel regression analysis was used to find out the relationship between variables.

Sources of information access influencing production and marketing of improved sweetpotato adoption of new agricultural technologies can be divided into: farm and farmers' associated attributes and attributes associated with the technology(Adesina *and* Zinnah,1993). Various models are used to analyze the specific factors affecting the adoption of the technologies. Feder *et al*. (1985) showed that many models used in adoption studies fail to meet statistical assumptions necessary to validate the conclusions based on the hypotheses tested and they advocated the use of qualitative response models. The two models of choice in adoption studies are the

Logit and Probit. The probabilities in the two models are bound between 0 and 1.(Amemiya, 1981)reveals that the decision on which model to choose among the two is difficult given that they have statistical similarities. The Logit model is specified as follows (Amemiya 1981):

$$\ln[Pi/(1 - Pi)] = \beta0 + \beta1X1i + \beta2 X2i + \beta3 X1i + \cdots . + \beta kXki + \varepsilon i$$

Where:
$[Pi/(1-Pi)]$ = Odds of the outcome
P = Probability of the outcome
i = I -th observation in the sample
β_0 = Intercept term
$\beta_1, \beta_2, \ldots, \beta_k$ = Coefficients associated with each explanatory variable
$X_1, X_2, \ldots X_k$ = Explanatory variables
The coefficients in the model reflect the effect of individual explanatory variables on its log of odds $\{\ln[P/(1-P)]\}$.

The model was used in analyzing factors affecting access to market information for improved sweetpotato varieties and secondly, when looking at the factors affecting farmer adoption of improved sweetpotato technology. In both instances, the X_{ki} variables covered the farm, farmer and technology attributes. P took a value of 1 with access to information or adoption and 0 if otherwise in both cases.

III. RESULTS AND DISCUSSIONS

Socio-economic characteristics of households in Migori County

Farm household characteristics influence farming decisions and are important in understanding decisions relating to choice and adoption of technology. Table 2, shows the socio-economic characteristics of the households in the sampled areas of Migori County. Gender analysis of household heads show that male 61.5 % and female 38.5%. Education levels of the households were categorized into non-formal 7.0%, primary 59.4%, secondary 14.7% and tertiary14.7%. Education of the households analyzed revealed that majority59.4% were primary level, while others withnon-formal education 7.0%,secondary and tertiary 14.7%. Education influences respondent's attitude and thoughts making them more open, rational and able to analyze the benefits of the new technology. Distribution of farm sizes were as follows, household heads<2, 5.6 %, 2<3, 15.4% and 3>4, 16.8. According to County Integrated Development Plan of Migori County (CIDP ,2010-2017)it was revealedthat, the mean holding size of land in the county for small scale farmers are 3 acres, while for large scale farmers are 7acres. Land under improved sweetpotato varieties, production from the analysis was only 20%, this indicated that the rest of households produced local varieties.

Results from socio-economic characteristics are shown in Table 2

Access to information for improved sweetpotato varieties

Most people in the community (98.6%) had heard about the improved sweetpotato varieties from the study carried out.Farmers who heard about the improved sweetpotato from Kenya Agricultural and Livestock Research Organization, represented 62% source of information which was the largest given that the organization was central in managing the projects that were promoting improved sweetpotato varieties. Friends/relations/neighbour 37 % , Ministry of Agriculture 32 %, Field days 29 % and group training 31 % (Fig 1). Radio was the least source of information on improved sweetpotato varieties,these percentages were still low in information accessed.From other studies carried outit was noted thatfor improved sweetpotato varieties to be adopted well, there has to be strong linkages between agricultural research and development partners and key actor's institution in nutrition, health and education is crucial for intended objective to be impacted(FAO 2012). This is in agreement with the outcome of the results where respondents who were trained on sweetpotato ongood agronomic practices (GAP), value addition and agribusiness had more likelihood of adopting improved sweetpotato varieties than those who did nothave the training. Figure 1 show sources of information accessed by farmers in Migori County.

Profiling adoption of improved sweetpotato varieties

Farmers received information about varieties and their characteristics and associated agronomic practices including pest and disease management. They were given multiple advantages of the improved sweetpotato varieties that attracted them to adopt various varieties. Among them, high yields and presence of vitamin A were high selling points in the promotion of the improved sweetpotato root,early maturity was also an important selling point.

Of the total number of farmers (N=143) who heard about improved sweetpotato varieties 93% of them started producing them. Those who did not produce improved sweetpotato irrespective of the given advantages cited lack of planting materials which in part was attributed to lack of funds to purchase (4.9%) and lack of reliable markets (0.7%) for the produce. The farmers producing improved sweetpotato had a higher preference

for Kenspot 1 (27%), Vitaa (23%) and Kabode (22 %)(Figure.2). In studies carried out by Were et al., (2013) on attributes of sweetpotato studies , showed that preferred sweetpotato varieties attributes are due to taste, high yield and maturity period,followed by disease and pest resistance, availability of planting material and market preference. Sweetpotato varieties with high beta carotene like Vitaa, Kabode and Kemb 10 are preferred by farmers in Eastern, Central and Western Kenya(Kivuva, 2014). Studies done on sweetpotato showed that, varieties with high dry matter content were preferred by smallscale farmers in Sub –Saharan Africa(Kivuva et al.,2014)

Sources of market information across the**sub counties of Migori**

When the farmers were grouped into sub counties, variations in sources for market information became distinct (Figure 3). Kuria West sub County had the largest market share in access to market information. Farmer to farmer 48%, traders 42% and mobile phones 33%. In contrast, Kuria East had minimal use of the various market information sources. Use of radio as a source of market information for improved sweetpotato varieties was minimal across the four sub Counties. The kind of information accessed included demand for the improved sweetpotato varieties, prices and quality characteristics.

Factors influencing the adoption of improved sweetpotato varieties.

A binomial logistic regression was used to determine the factors influencing farmer adoption of improved sweetpotato production. The dependent variable was binary with adoption taking a value of (1) and non-adoption taking the value of (0). Table (1)summarizes the regression results. It follows that farm size under crops, participation in sweetpotato training, access to both production and market information and source of improved sweetpotato information were significant variables in explaining the probability of farmer adoption of improved sweetpotato varieties. These are mainly farm and institutional factors.

The results showed that the total size of land under crops among them maize being the staple food, beans, sorghum it followed that a household was associated with a higher likelihood of producing improved sweetpotato if the farm size was large. Production information access, compares the likelihood of a household with access to credit and that without access, adopting improved sweetpotato production. Households had a higher likelihood of adopting improved sweetpotato varieties if the information was either from KALRO or Ministry of agriculture's extension division as opposed to radios or group trainings. In access to market information for improved sweetpotato varieties, the probability of those households without access to adopt improved sweetpotato technologies were 0.4 times that of those households with access to market information for sweetpotato.

Itwas evident from the results that a larger farm size increased the likelihood of a household adopting improved sweetpotato varieties. Having a larger farm size gave the households a leverage in crop diversity. Those with smaller pieces were limited in the number of crops they could grow. Given that sweetpotato was not ranked the most important among the crop enterprises compared to maize being the most important followed by beans, then sorghum it followed that farmers with smaller land sizes had a lower likelihood of adopting improved sweetpotato varieties. Studies carried out on adoption of Agricultural technologies revealed that, adoption of agricultural technologies by farmers is influenced by a number of factors, which include farm attributes, technology characteristics and institutional factors (Ndiema, 2010).

Farmers who had received training in improved sweetpotato production technologies had a higher likelihood of adopting the improved sweetpotato varieties. Improved sweetpotato varieties were promoted as a rich source of vitamin A precursor in beta carotene, the ingredient for boosting body immunity. The training too included agribusiness with prospects of making money out of improved sweetpotato varieties must have enticed farmers who attended the trainings. All these explain the reason why farmers who had access to information about improved sweetpotato varieties had a higher likelihood of adopting more than those who did not. The source of information was an important aspect to farmers who got their information from either KALRO or MOA.They had a higher likelihood of adoption than those who got information from either radio or other groups/organizations. KALRO and MOA were central in running the programmes that introduced and promoted improved sweetpotato varieties. They thus came with resources like plantingmaterials as a starter seed for production of improved sweetpotato varieties given to farmers,this jumpstarted farmer in the adoption process. Studies carried out have shown that access to information is vital for improving agricultural production, especially in rural areas where agricultural is the main source of livelihood (Oladele, 2006)

IV.   CONCLUSIONS

This study sought to understand the adoption of improved sweetpotato varieties and the role of information access in the whole process in Migori County. Households had a higher likelihood of adopting improved sweetpotato varieties if the information was either from KALRO or Ministry of agriculture's extension division as opposed to radios or group trainings. Access to information was found to be a function of

the gender and age of the farmer, and whether the farmer was engaged in sweetpotato production or not.Information accessed was not sufficient since production improved sweetpotato varieties were only on 20% of cultivated land.

The study recommendsstrengthening linkages of agricultural research institutions with extension agents in dissemination of improved sweetpotato technologies for accessibility to farmers be enhanced.

Dissemination of new released sweetpotato varieties to farmers by establishment of sweetpotato vine nurseries for accessibility

ACKNOWLEDGEMENTS

REFERENCES

[1]. Adesina, A. 14 A., & Zinnah, M. M. (1993). Technology characteristics, farmers' perceptions and adoption decisions: A Tobit model application in Sierra Leone. *Agricultural economics*, *9*(4), 297-311. https://doi.org/10.1016/0169-5150(93)90019-9

[2]. Amemiya, T. 1981. Qualitative Response Models: A Survey Journal of Economic Literature, 19, 483–536.

[3]. Bovell-Benjamin, A. C. 2007. Sweet potato: a review of its past, present, and future role in human nutrition. Advances in food and nutrition research, 52, 1-59. https://doi.org/10.1016/S1043-4526(06)52001-7

[4]. FAOSTAT. 2012. FAO (Food and Agriculture organization of United Nations) Statistics Database. Available onlne: www.faostat.org.

[5]. Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Ec.onomic development and cultural change1993*, *33*(2), 255-298. https://doi.org/10.1086/451461.

[6]. Gichangi, A. W. 2010. Analysis of Structure, conduct and performance of sweetpotato marketing: the case of Nairobi and Kisumu, Kenya Doctoral thesis, Egerton University.

[7]. Karanja, L., Malinga, J., Ndung'u, J., Gichangi, A., Lelgut, D., Kamundia, J., & Gethi, M. 2015. Development and Evaluation of New Sweetpotato Varieties through Farmer Participatory Breeding for High Altitudes in Kenya.*Potato and Sweetpotato in Africa: Transforming the Value Chains for Food and Nutrition Security*, 88-97.

[8]. Kivuva B.M., Musembi J., Githiri M.S., Yencho C.G. and Sibiya J. 2014. Assessment of Production Constraints and Farmers Preferences for sweetpotato Genotypes. *Journal of Plant Breeding and Genetics:* 2: 15-29.

[9]. KNBS (2009). Kenya National Bureau of Statistics. Kenya population and housing census: population by sex and number of households, Volume 1A, 2

[10]. Loebenstein, G., Fuentes, S., Cohen, J., & Salazar, L. F. (2003). Sweet potato. In Virus and virus-like diseases of major crops in developing countries (pp. 223-248). Springer, Dordrecht.

[11]. Ndiema, A. C. 2010. Factors influencing adoption of drought tolerant wheat varieties in the arid and semi-arid lands of Narok and Kajiado Districts-Rift Valley Province of Kenya Doctoral thesis, Egerton University.

[12]. Ndolo, P. J., Mcharo, T., Carey, E. E., Gichuki, S. T., Ndinya, C., and Maling'a, J. 2001. Participatory on-farm selection of sweetpotato varieties in Western Kenya.*African Crop Science journal*, 9(1), 41-48. https://tspace.library.utoronto.ca/html/1807/21850/cs01033.html.

[13]. Oladele, O. I., Akinsorotan, A. O., & Ajadi, A. A. 2010. Knowledge and utilization of job enrichment techniques among agricultural extension managers in Botswana and Nigeria. Journal of International Social Research, 3(12).

[14]. Roullier, C., Kambouo, R., Paofa, J., McKey, D., & Lebot, V. 2013. On the origin of sweetpotato (Ipomea batatas (L.) Lam.) Genetic diversity in New Guinea, a secondary centre of diversity, Heredity, 110 (6), 594-604.doi: 10.1038/hdy.2013.14.

[15]. Sanginga, N., & Mbabu, A. 2015. Root and tuber crops (cassava, yam, potato and sweet potato). In proceedings of an action plan for African Agricultural Transformation Conference, Dakar, Senegal 21-23.

[16]. Stathers, T., Low, J. W., Carey, T., Mwanga, R., Njoku, J., Tumwegamire, S., and Andrade, M. 2013. Helping adults to learn .Origin and importance of sweetpotato. Sweetpotato varietal selection and characteristics everything you ever wanted to know about sweetpotato: Reaching agents of change ToT manual.

[17]. Stathers, T.; Carey, E.E.; Mwanga, R.O.M.; Njoku, J.; Tumwegamire, S.; Malinga, J., Andrade; M.I. 2018. Everything you ever wanted to know about sweetpotato. Topic 3: Sweetpotato varietal selection

and characteristics. Reaching agents of change ToT manual. International Potato Center, Lima, Perú. 107.https://hdl.handle.net/10568/98335.

[18]. Tavva, S., & Nedunchezhiyan, M. 2012. Global status of sweet potato cultivation. Fruit Veg. Cereal Sci. Biotechnol., 6(SI 1), 143-147.
[19]. Were H.K., Omuterema S., Ndolo, P., Imbuga B., Omuse C.N. and Keya N.C.O. 2013. Sweetpotato Production and use in sugarcane growing areas of Western Kenya. *International Journal of Disaster Management and Risk Reduction*: 5(1).
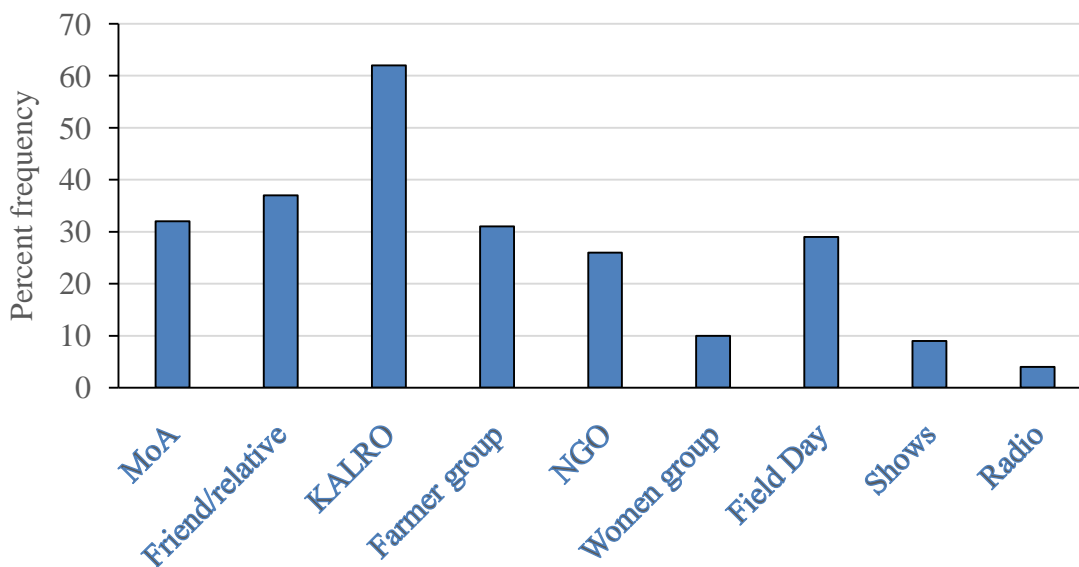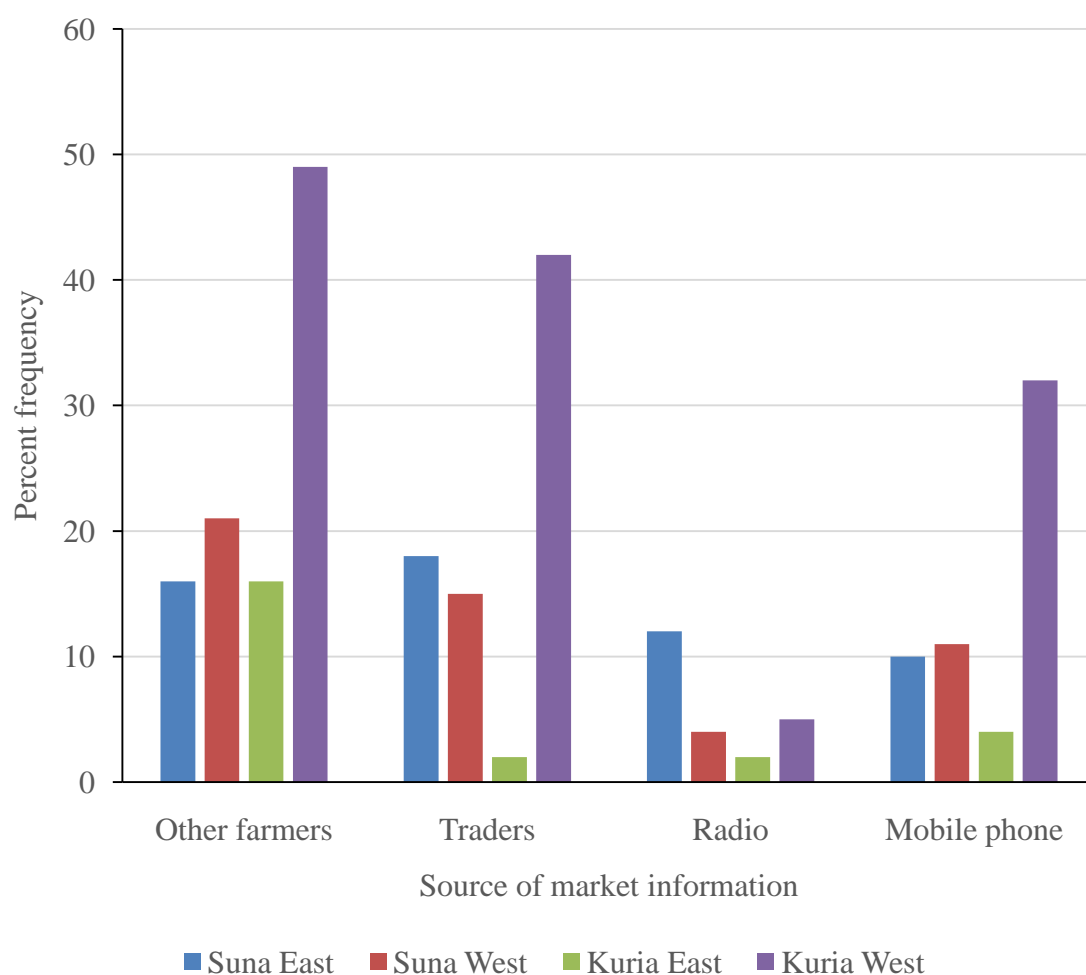

Figure 1*: Sources of information to farmers on production of improved sweetpotato varieties in Migori County, Kenya.*

Source: Researcher, data (2017)
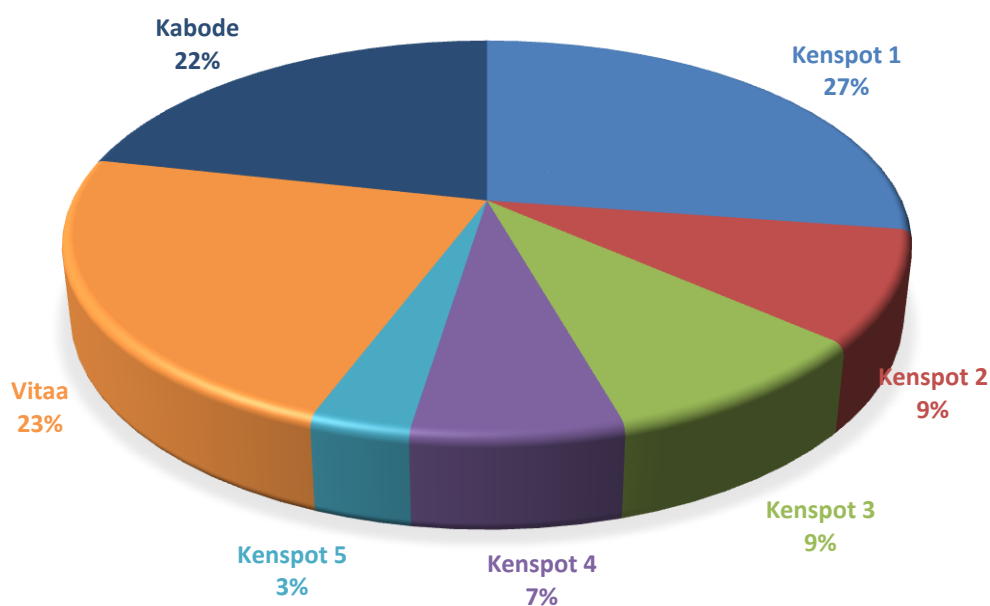
Figure 2*: Farmers' preferred   improved sweetpotato varieties grown in Migori County, Kenya.*
Source: Researcher, data (2017)

Figure 3*: Sources of market information in sub counties of Migori, Kenya.*
Source: Researcher data, (2017)

Table1: *Basic statistics of the focal sub counties of Migori County, Kenya.*

Sub County	Population	Area (Km2)	Density(Km2)	Wards
Sun East	97,121	207.3	468.5	4
Suna West	94,127	282.8	332.8	4
Kuria East	93,229	235	396.8	5
Kuria West	162,857	332.5	489.8	7
Total	447,334	1057.6	1687.8	20

Source: KNBS, Migori, County, Kenya, (2011)

Table 2: *Socioeconomic characteristics involved in sweetpotato production in 4 sub-county of Migori .*

Household Characteristics (sample size 143)	Frequency	%
Gender		
Male	88	61.5
Female	55	38.5
Education level		
No- formal	10	7.0
Primary	85	59.4
Secondary	21	14.7
Tertiary	27	14.7
Farm size		
<2	8	5.6
2>3	22	15.4

3 < 4	24	16.8
Land size under sweetpotato		
<2	123	83.5
2	16	11.5

Source: Researcher   data (2017)

Table 3: *Factors affecting adoption of improved sweetpotato varieties*

Variable	Coefficient	SE	P-value	Ex(β)
Farm size	0.18**	0.08	0.02	1.19
Sweetpotato training (Yes = 1)	1.85**	0.77	0.02	6.34
Production information access (Yes = 1)	2.94**	1.25	0.02	18.98
Source of production information (KALRO=1)	-0.91***	0.34	0.01	0.40
Market information access (Yes=1)	0.91*	0.50	0.07	2.49
Number of observations	143			

Source: Researcher data (2017)