Advances in Social Sciences Research Journal – Vol.6, No.7
Publication Date: July. 25, 2019
DoI:10.14738/assrj.67.6766.
Thuo, C. M., Nkurumwa, A. O., & Ombati, J. M. (2019). Farmers' Perception On Acceptability Of Improved Sugarcane Varieties In Kakamega County. *Advances in Social Sciences Research Journal,* 6*(7)* 223-232.

Farmers' Perception On Acceptability Of Improved Sugarcane Varieties In Kakamega County.

Caroline M. Thuo
Kenya Agricultural & Livestock Research Organization,
Department of Technology Transfer, PO Box 388-00217, Limuru, Kenya

Agnes O. Nkurumwa
Department of Agricultural Education and Extension,
Egerton University, PO Box 536-20115, Egerton, Kenya

Justus M. Ombati
Department of Agricultural Education and Extension,
Egerton University, PO Box 536-20115, Egerton, Kenya

ABSTRACT

Improved sugarcane varieties have been developed and promoted in Kenya, with an aim of enhancing sugarcane productivity. However, their acceptance by farmers is low. This paper examines farmers' perception on these varieties as a basis for explaining their acceptability by farmers and attempts to underpin determinants that inhibit or facilitate their acceptance. This study was conducted using a cross-sectional survey research design. Target population was 137,355 small-scale sugarcane farmers from Kakamega County, from which a sample of 384 farmers was randomly selected. Questionnaires were used to collect data, which was analyzed using descriptive and inferential statistics. The research findings confirmed that majority of farmers produced old commercial sugarcane varieties. Respondent farmers prioritized high tonnage, early maturity, pest resistance, ratoonability, high tillering and disease resistance as the top preferred attributes of sugarcane varieties. Based on the farmers' perception, an association between farmers preferred sugarcane attributes and acceptability of the improved sugarcane varieties was established. Improved sugarcane varieties that portrayed compatible attributes with farmers' preferred traditional varieties were found to be highly acceptable for production by farmers. Compatibility of improved sugarcane technologies with the farmers' perceived needs, preferences and values therefore need to be considered in the development of improved sugarcane technologies to enhance their appropriateness and acceptance by farmers. Findings from this study would avail critical information in sugarcane research and development which may serve as a guide to technology developers to ensure technologies produced meet preferences of the targeted user for enhanced technology acceptance.

Key words: Sugarcane, Attributes, Acceptance, Compatibility, Improved varieties

INTRODUCTION

Sugarcane crop is predominantly grown in the tropical and subtropical regions [9]. It is the world's largest produced crop [10] and is cultivated on about 23.8 million hectares. The large demand for sugar is the primary driver of sugarcane production, which accounts for 80 percent of sugar produced worldwide [18]. It is also used for bio energy [26]. Its' production supports approximately 7.5 percent of the world rural population [17]. In Kenya, sugarcane production contributes significantly to the Countries economy. It is the main economic activity in Western, Nyanza parts of Rift Valley and the Coastal region [4]. Approximately 300,000 farmers are

involved in its production and supply over 92 percent of sugarcane processed by the Kenya sugar mills [16]. Kenya produces approximately 600,000 metric tonnes of sugar annually [4].

Various challenges face the Kenyan sugar industry. Low sugarcane productivity at the farm level is one of the key challenges experienced by the sector. Sugarcane yields have been on the decline in the past decade with average tonnes cane per hectare (tch) dropping from 74 tch in 2004 to 61 tch in 2014 [19]. This is against the expected yields of approximately 100 tch [12]. These low yields have been attributed to the continued widespread production of older, low quality sugar cane varieties for many decades [2]. These varieties are prone to diseases particularly smut and ratoon stunting disease; late maturing taking between 20-24 months to mature; and have low sucrose content. Consequently, the yield decline has resulted to farmers getting low returns from sugarcane production thus unable to sustain their livelihood effectively. In addition, there is insufficient sugar production, which has forced Kenya to import approximately 240,000 metric tonnes of sugar annually to bridge the gap in order to meet domestic consumption of 840,000 metric tonnes [4]. Continued deficit in cane yields is likely to have further negative effect on the operations of sugar mills, and may even lead to closure of a number of them due to insufficiency in supply of the raw material.

One of the key reasons for lower agricultural productivity is lack of usage of yield-enhancing technologies such as improved seed [7]. The Kenyan sugar sector therefore needs to embrace better production technologies, to overcome these challenge of low productivity. Improved sugarcane varieties have been developed and promoted for production by the Sugar Research Institute (SRI) through its variety improvement programme [13]. Sugarcane farmers are expected to produce these varieties because they have superior qualities that would enhance sugarcane productivity [12;5]. The varieties are high yielding both in sucrose and tonnage; early maturing and disease resistant e.g smut. However, their acceptance by farmers is low, accounting for approximately 8 percent of the total distribution of sugarcane varieties under production in Kenya [12]. There was need therefore, to investigate the underlying conditions that hinder acceptance of these improved varieties by farmers in Kenya.

According to Smith and Ulu [21], low acceptance of new technologies has been a great challenge worldwide. Many improved agricultural technologies have been availed to farmers but majority of them have failed to accept them. A report by Conroy and Sutherland [8], indicates that one of the main reasons why resource-poor farmers are slow or unable to take up improved technologies is because of their inappropriateness. Abukhzam and Lee [1], also add that farmers may reject technologies because they are not compatible with their values, beliefs, perceived needs and their past experiences. This creates the concern whether low acceptance of the improved sugarcane varieties in Kenya, is due to their inappropriateness or lack of compatibility with the farmers' needs. Introduction of improved sugarcane varieties, which are meant to enhance sugarcane productivity has not brought much change to their production trend. Majority of farmers have been reluctant to produce improved sugarcane varieties [12].

The objective of this study was therefore to establish farmers' perception on acceptability of improved sugarcane varieties in Kakamega County. It was imperative to understand the perception of farmers towards these varieties, which enabled establishment of determinants that inhibit or facilitate acceptance of these varieties by farmers. Findings from this study would avail critical information in sugarcane research and development which emphasizes on farmers preferred attributes in agricultural technologies. The information may serve as a guide to the technology developers to ensure technologies produced meet preferences of the targeted user for enhanced technology acceptance.

RESEARCH METHODOLOGY AND DATA DESCRIPTION

A cross-sectional survey research design was used. The study was conducted in Kakamega County, Kenya. This County occupies an area of 3,033.8 Km^2 and is located 30 Km North of the equator. The study population comprised of 137,355 small scale sugarcane farmers from three sugar zones of Mumias, West Kenya and Butali in Kakamega County. A sample size of 384 sugarcane farmers was selected using the table for determining sample size from the Research Advisors [23]. Proportional sampling was used to determine the number of farmers to be selected from each sugar zone. Then for each zone, random sampling was done. Questionnaires were used to collect the required information from farmers and were administered orally, as the researcher recorded the responses. Data was analyzed using statistical package for social sciences (SPSS) version 20.0. Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics were used to summarize data generated from the research using percentages and frequencies. Cross tabulations were done to establish the relationship between the variables. For the hypotheses seeking relationships, Spearman rank-order correlation coefficient (r) was calculated to show the strength and direction of the linear relationship between the independent and the dependant variables. Hypothesis testing was done using chi-square at 5% level of significance.

Outlined below are descriptions of terms used in the study.

Acceptance referred to the extent to which sugarcane farmers had engaged in production of improved sugarcane varieties in their farms. It was expressed in terms of size of land under improved sugarcane varieties and number of years a farmer has produced improved sugarcane varieties.

Improved technologies refers to technological advancement that improves, even if veryslightly, whatever process it applies to. For this study, it referred to the improved sugarcane varieties.

Improved sugarcane varieties refers to sugarcane types that have been bredwith superior qualities for increased productivity [14]. In this study, it refers to the sugarcane types developed and released for production by the SRI, since 2002 to 2014 [13]. They include six sugarcane varieties released in 2002 (KEN 82-808, KEN 82-216, KEN 82-219, KEN 83-737, KEN 82- 401, KEN 82-247); four varieties released in 2007 (KEN 82-472, KEN 82-62, D84-84, EAK 73-335); three varieties released in 2011 (KEN 82-601, KEN82-121, KEN82-493 and eight varieties released in 2014 (KEN 98-530, KEN 98-533, KEN 98-551, KEN 00-13, KEN00-3811, KEN00-3548, KEN 98-367 and KEN00-5873).

Old commercial sugarcane varieties. They refer to CO 421, CO 617 and CO 945 sugarcane varieties, which has been under production since 1960, 1969 and 1990 respectively [11]. CO 421 occupy 39 percent of the total area under sugarcane production in Kenya, followed by CO 945 at 23 percent and CO 617 at 17 percent [12]

Small-scale farmers refer to farmers with small parcel of agricultural land. For this study, it referred to sugarcane farmers with less than 10 acres of land.

RESULTS AND DISCUSSIONS

Characteristics of Sugarcane Farmers in Kakamega County

The study findings indicate that Kakamega County consists of 88 percent male and 12 percent female small-scale sugarcane farmers. This observation is likely to be associated with the Luhya community cultural practices, whereby growing of sugarcane is practiced by men. They are the custodians of family properties and key decision-makers on land utilization. Both

young and old farmers produced sugarcane and their ages ranged from 21 to 80 years. Results indicate that, majority of farmers (28 percent), belonged to the age group of 41-50 years, followed by the age group of 51-60 years at 23 percent. The oldest age group was 71-80 years at 17 percent, while the youngest was 21-30 years at 4 percent. Farmers in the age group of 31-40 years were only 13 percent. According to Aldosari et al. [6] age plays an important role in the dissemination, adoption and diffusion of innovations and are believed to be positively correlated with age. Younger farmers are known to be less resistant to change than the old farmers. They accept innovations and new technologies readily and quickly.

The overall literacy rate of these farmers was found to be quite impressive. Results depicts that only 6 percent had not received any formal education, with 40 percent having received primary education; 39 percent had received secondary education while 15 percent had post-secondary. Educated people are expected to have more favorable attitudes towards agricultural skills, knowledge and information as compared to uneducated [6]. The findings further indicate that, 81 percent of these farmers were fully engaged in farming as their main source of income. Only 15 percent had formal employment while 4 percent had businesses. Majority of these farmers were found to be small land holders with 35 percent having 0.1 - 2.0 acres; 25 percent had 2.1- 4.0 acres; 17 percent had 4.1-6.0 acres; 8 percent had 6.1-8.0 acres while 16 percent owned between 8.1 to 10.0 acres. According to Aldosari et al. [6] size of land holding plays an important role in the adoption of modern agricultural practices among the farming community. More land holdings mean more potential to increase productivity and efficiency to adopt modern technologies. Results also show that most of the farmers had produced cane for many years, giving them enough experience in cane production. Findings indicate that 16 percent of farmers had produced cane for 1 to 5 years; 35 percent 6 to 10 years; while 49 percent for over 10 years.

Distribution of sugarcane varieties in Kakamega County

Table (i) shows the distribution of various sugarcane varieties under production, across the three sugarcane growing zones in Kakamega County.

Table (i)
Sugarcane Varieties under Production in Kakamega County

			Sugarcane varieties under production								
			1	2	3	4	5	6	7	8	Total
Sugar cane production zone	Mumias	Count	39	85	2	1	6	34	3	10	180
		% within zone	21.9	47.8	1.1	.6	3.4	19.1	1.7	4.5	100.0
	West Kenya	Count	114	0	0	0	0	8	0	5	127
		% within zone	89.8	.0	.0	.0	.0	6.3	.0	3.9	100.0
	Butali	Count	65	0	0	0	0	10	0	2	77
		% within zone	84.4	.0	.0	.0	.0	13.0	.0	2.6	100.0
Total		Count	218	85	2	1	6	52	3	17	384
		% within zones	57.1	22.3	.5	.3	1.6	13.6	.8	3.9	100.0

Key: 1-CO421; 2-CO945; 3-KEN82-472; 4-N14; 5-EAK73-335; 6-KEN83-737; 7-KEN83-493; 8-D84-84.

The study identified eight different sugarcane varieties under production in Kakamega County. They include CO421, CO945, KEN82-472, N14, EAK73-335, KEN83-737, KEN83-493 and D84-84. Findings indicate that CO421 is the most produced variety with 57 percent of farmers growing it, followed by CO945 at 22 percent. Much of the CO421 is produced in West Kenya followed by Butali. Mumias zone leads in production of CO945. KEN83-737 is the most

produced improved sugarcane variety, being under production by 14 percent of farmers, followed by D84-84 at 4 percent. This confirms the KSB report [12], of the low uptake of the improved sugarcane varieties despite their presence since 2002. Results also shows that other improved sugarcane varieties are in production though in small quantities in Mumias zone unlike in West Kenya and Butali.

Farmers Perception on the Improved Sugarcane Varieties in Kakamega County

Farmers' perception has been used as a basis for explaining acceptability of the improved sugarcane varieties by farmers in Kakamega County. In order to establish the perception of farmers on these varieties, the respondents were requested to identify the attributes of these varieties that would make them accept their production. Table (ii) displays these attributes. According to the respondent high tonnage, early maturity, pest resistance, ratoonability, high tillering and disease resistance were the top most preferred attributes. These attributes are associated with high profitability in sugarcane production. Tena, Mekbib, Shimelis and Mwadzingeni [22] similarly identified high yields, early maturity, pest and disease resistance as the most farmers' preferred traits in sugarcane production in Southern Ethiopia. High tonnage is associated with production of high yields, once cane is weighed at the factory weighbridge. Cane payments are weight based and therefore high tonnage implies high profit to farmers. Early maturity is associated with the number of months a sugarcane variety takes to grow before it is ready for harvesting. Early maturity guarantees quick returns to farmers because of early marketing. The shorter the period, the better. Pest resistance is associated with minimizing cane loss during sugarcane growing period due to chewing by human pests. Hard varieties are not chewable by human pests and therefore a preference to the farmer. Ratoonability demonstrates the ability of a sugarcane variety to sustain many subsequent crops. Varieties that have the potential to sustain production of high yields with many subsequent crops (ratoons) are profitable to the farmers and therefore a farmer's preference. The more the ratoonability, the better.

High sucrose content is one of the key attributes found in the improved sugarcane varieties. Results indicate a discrepancy between the farmers' preferences and this attribute of high sucrose. It is among the least considered attributes by farmers when choosing the variety to grow. KSB [12], identifies that production of high sucrose varieties is a key intervention measure, widely recommended for increasing both sugarcane and sugar production in Kenya.

Table (ii)
Sugarcane Attributes which made Respondents Accept Production of the Sugarcane Varieties in their Farms.

Sugarcane characteristics	Number	Percent (%)
High tonnage	180	47.0
Early maturity	59	15.3
High sucrose	2	.4
Ratoonability	25	6.5
Disease resistance	18	4.6
Pest resistance	29	7.5
High tillering	19	4.9
Less weeding due to canopy formation, therefore easy to maintain	5	1.6
Does not deteriorate with delayed harvesting	11	2.7
High vigor	13	3.5
Does not flowering	10	2.5
Performs well even with little fertilizer	3	1.0
Drought resistant	1	.1
Hardy (Can survive under poor farm conditions)	2	.4
No lodging	2	.7
Seed is easily available	2	.4
Total	384	100.0

However, farmers have not recognized this superior quality. This implies that varieties with this attribute are not given much priority by farmers when choosing varieties to grow.Those that give high yields are preferred for production. According to Wale and Yaleh [25], discrepancy between the farmers' needs and the attributes of technologies generated results to low level of technology acceptance. Conroy and Sutherland [8], indicate that one of the main reasons why farmers are slow or unable to accept improved technologies is because of their inappropriateness. This implies that improved sugarcane varieties that have high sucrose content are either inappropriate or less compatible with the farmers' perceived needs, preferences and values, hence their low acceptance by farmers. The attribute of high sucrose has not triggered much interest towards farmers' acceptance in production of improved sugarcane varieties.

Figure (i) is a comparison between sugarcane varieties under production with farmers' preferred sugarcane varietal attributes.

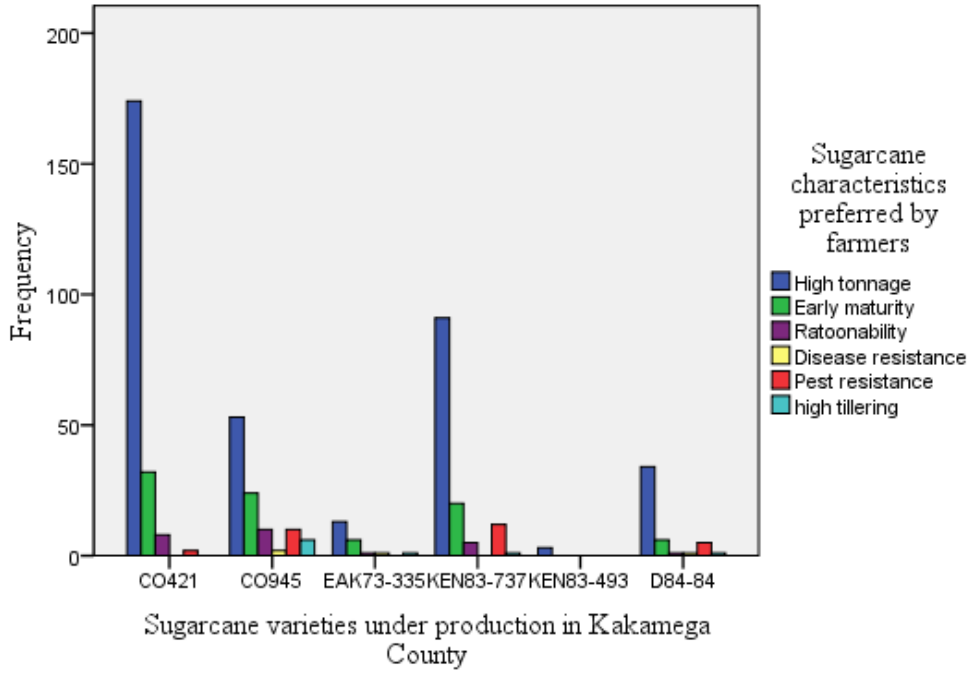

Figure (i). A comparison between key sugarcane attributes preferred by farmers and sugarcane varieties under production in Kakamega County

According to the results, CO421 is the most produced variety, and is associated with production of high tonnage in terms of yields. This is followed by KEN83-737 and CO945 respectively. Other key attributes associated with these varieties are early maturity, pest resistance and high ratoonability. High tillering is also noted in CO945. As results indicate production of high yields is likely to have made these varieties preferred by farmers for production. According to Kshirsagar, Pandey and Bellon [15], farmers will always rely mainly on traditional varieties, which seem to have desirable attributes that are lacking in the improved varieties. This implies that farmers mainly rely on CO421 and CO945 due to their desirable attributes lacking in the improved varieties. KEN 83-737, which is one of the improved varieties has some attributes compatible with farmers' preferences. This has made it acceptable for production by a significant number of farmers, in relation to other improved varieties. Abukhzam and Lee [1] identifies that compatibility of a technology with farmers' values, beliefs, perceived needs and their past experiences enhances technology acceptance.

Figure (ii) identifies various attributes farmers do not like about sugarcane varieties.

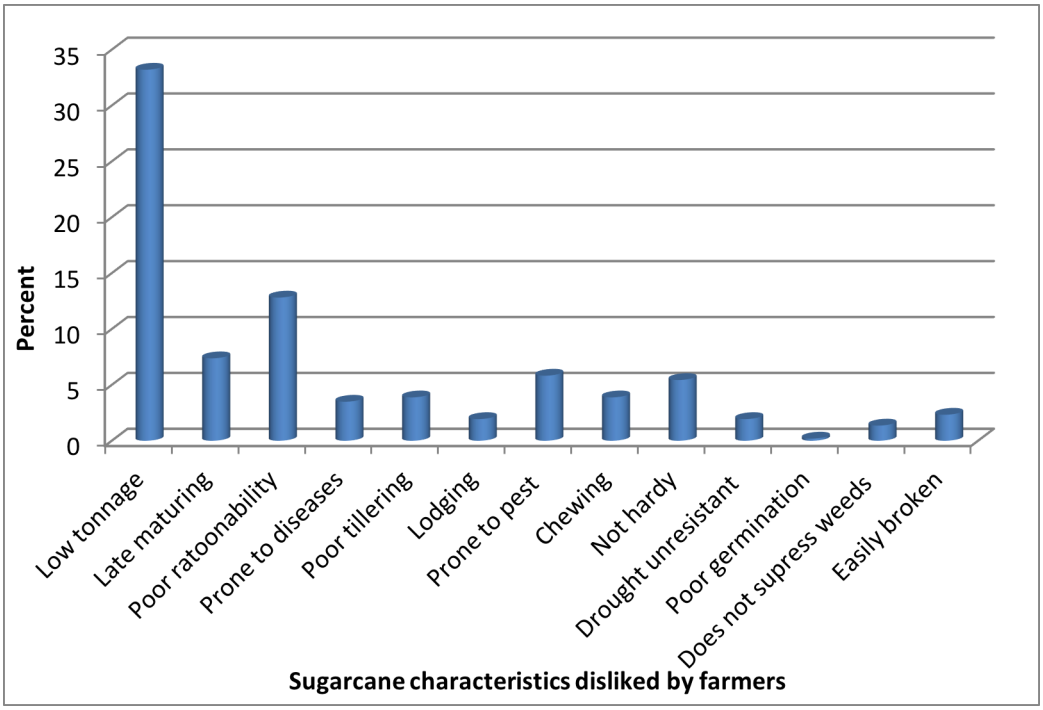

Figure (ii). Attributes farmers do not like about the variety under their production.

Results have shown that low tonnage, poor ratoonability, late maturity and susceptibility to pests were the leading attributes farmers do not like in a sugarcane variety. Farmers are hesitant to produce a variety that portrays them and are associated with loss in cane production. The poor attributes have made some varieties not appealing to farmers for production.

According to Sa'ari, Jabar, Tahir & Mahpoth [20], consumers have subjective preferences for product attributes. It has been established that consumer demand for products is significantly affected by their perceptions of the product's attributes. If the technologies attributes suit the specific circumstances of the farmers, they quickly accept them [24]. Literature by Adesina & Baidu-Forson [3] has also identified that farmers' perceptions of technology characteristics significantly affect their adoption decisions. This implies that demand of the improved sugarcane varieties by farmers for production is likely to be affected by their perception on the attributes associated with these varieties. This calls for farmers and sugarcane breeders to work together to enhance development of sugarcane varieties that meet farmers' needs and interests. According to Tena et.al [22] such partnership is of paramount importance and emphasized that farmer participation in breeding of crop varieties for low-resource farmers is important for variety adoption

CONCLUSION

The study identified different sugarcane varieties under production in Kakamega County, which include CO421, CO945, KEN82-472, N14, EAK73-335, KEN83-737, KEN83-493 and D84-84. CO421 was the most produced variety with 57 percent of farmers growing it, followed by CO945 at 22 percent. KEN83-737 was the most produced improved sugarcane variety, being under production by 14 percent of farmers. Various sugarcane varietal attributes were identified which make farmers accept production of sugarcane varieties in their farm. High tonnage (47%), early maturity (15%) and pest resistance (8%) were the top most ranked preferred attributes. The study established that sugarcane varieties that were compatible with the farmers preferences were the most produced. Farmers' perceived needs, preferences and values therefore need to be considered in the development of improved sugarcane

technologies to enhance their compatibility, appropriateness and acceptance by farmers. Discrepancy between the farmers' needs and the attributes of technologies generated results to low level of technology acceptance.

ACKNOWLEDGMENTS

The authors are grateful to National Commission for Science, Technology and Innovation (NACOSTI) for granting permission to undertake this research study. Our gratitude is extended to Kenya Agricultural and Livestock Research Organisation (KALRO) and Egerton University for their support. Special thanks go to all who assisted during data collection and the respondents who gave valuable data without which the study would not have happened.

References

Abukhzam, M., & Lee, A. (2010). Workforce attitude on technology adoption and diffusion. The Built & Human Environment Review. abukhzam@pgr.salford.ac.uk and a.lee@salford.ac.uk

Abura, G.O., Gikunda, R.M., & Nato, N.G. (2013). Technical knowledge and information gaps among smallholder farmers in the production of sugarcane in Kakamega County, Kenya. IJASRT in EESs, 3(4), 199-207.

Adesina A.A & Baidu-Forson J. (1995). Farmers' perceptions and adoption of new agricultural technology: Evidence from analysis in Burkina Faso and Guinea, West Africa. Agricultural Economics 13, 1-9. SSDI 0169-5150(95)01142

Agriculture, Fisheries and Food Authority (AFFA, 2016). Sugar Directorate.

Agrocharts, (2014). Kenya sugar annual. www.agrochart.com

Aldosari F., Kassem H.S., Khodran H., Al-Zahrani, Al-Zaidi A., Baig M.B., (2017). Factors

Influencing Attitudes of Female Students towards Farming: A Case Study. Agriculture and Forestry Journal: 1 pp. 68-72. DOI: 10.5281/zenodo.1133250

Barua, P. (2016). Factors Affecting Technology Adoption among Smallholder Maize Farmers in Tanzania. Research Gate. Sustainable International Development. https://www.researchgate.net

Conroy, C., & Sutherland A. (2014). Participatory technology development with resource poor farmers: Maximising impact through the use of recommendations domains. Agricultural Research & Extension Network. Network paper No.133. UK

Food and Agriculture Organization (2019). FAO Land & Water. Sugarcane www.fao.org/Land&water/sugarcane.html.

Food and Agriculture Organization, (2010). Crop production. methodology for PLEC-Tanzania. PLEC Tanzania Progress Reports.

Kenya Agricultural and Livestock Research Organization, (2019). Kenya Agricultural and Livestock Research Organization. Sugar Research Institute. E-Repository. www.kalro.org/sugar

Kenya Sugar Board. (2014). Cane Census 2013/14- 14/15 Report.

Kenya Sugar Research Foundation, (2014, June). Newly released varieties, KESREF digest 7 (4).

Kenya Sugar Research Foundation. (2012). Kenya Sugar Research Foundation. A framework for the production, certification and distribution of seed cane in the Kenya sugar industry. Kisumu, Kenya.

Kshirsagar K.G., Pandey S., and Bellon M.R., (2002). Farmer Perceptions, Varietal Characteristics and Technology Adoption: A Rainfed Rice Village in Orissa. Economic and Political Weekly, 37(13), pp. 1239-1246. http://www.jstor.org/stable/4411927

Lihasi, L.K., Onyango C. & Ochola W., (2016). Analysis of Smallholder Sugarcane Farmers' Livelihood Assets in Relation to Food Security in Mumias Sub-County Kenya. Journal of Economics and Sustainable Development.Vol.7, No.20 www.iiste.org

Mnisi, M.S., & Dlamini C. S. (2012). The concept of sustainable sugarcane production: Global, African and South African perceptions. African Journal of Agricultural Research, 7 (31), 4337-4343. http://www.academicjournals.org

Murphy R. (2017). Sugarcane: Production Systems, Uses and Economic Importance. Nova Science Publishers, Inc.

Mwanga D., Ong'ala J., Orwa G.(2017). Modeling Sugarcane Yields in the Kenya Sugar Industry: A SARIMA Model Forecasting Approach. International Journal of Statistics and Applications, 7(6): 280-288. DOI: 10.5923/j.statistics.20170706.02

Sa'ari J.R., Jabar J., Tahir M.H., Mahpoth M.H., (2017).Farmer's acceptance towards sustainable farming technology. Science-Gate International Journal of Advanced and Applied Sciences. 4(12) 2017. Pp: 220-225, Malaysia. http://www.science-gate.com/IJAAS.html

Smith, E. S., & Ulu C., 2012. Technology Adoption with Uncertain Future Costs and Quality. Operation research, 60 (2), 262-274. http://dx.doi.org/10.1287/opre.1110.1035

Tena E., Mekbib F., Shimelis H., & Mwadzingeni L., (2016). Sugarcane production under smallholder farming systems: Farmers preferred traits, constraints and genetic resources. Journal Cogent Food & Agriculture . 2(1) .https://doi.org/10.1080/23311932.2016.1191323

The Research Advisors, (2006). http://research-advisors.com/

Toledano B.I. (2017). Farmers' preferences and the factors affecting their decision to improve maize crops in Mexico. Institutional repository Upcommons. Institute of sustainability. Universitat politècnica de Catalunya. Spain http://upcommons.upc.edu/tesis

Wale E. and Yalew A. (2007). Farmers' Variety Attribute Preferences: Implications for Breeding Priority Setting and Agricultural Extension Policy in Ethiopia. African Development Review Volume19, Issue 2 Pages 379-396 https://doi.org/10.1111/j.1467-8268.2007.00167.x

Zhao, D. & Li Y. (2015). Climate change and sugarcane production: Potential impact and mitigation strategies. International Journal of Agronomy,10. http://dx.doi.org/10.1155/2015/547386