

Full Length Research Paper

A study of farmers' awareness of sweet sorghum (*Sorghum bicolor* [L] Moench) and possibility of its use in Kenya

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Studies on farmer's perception of technologies constitute a useful link between both descriptive and prospective research lines. They generate information about the farmer and their socio-economic conditions that influence technology adoption. The area of study was Western and Coastal regions of Kenya. A multistage random sampling technique was used to select the farmers who were organized into groups. Descriptive and inferential statistical tests were used to analyze the data. It was observed that 72.9% of the respondents were male, 95.7% married and 46% had formal education. Most of the farmers (78.0%) cultivated below 2 acres of farmland. About 40% of the respondents were aware of existence of sweet sorghum varieties while 50% of them were aware of sweet sorghum processing technologies. Farmer's inability to have contact with extension agents affected their perception and awareness of the technologies. Farmers appreciate the potential of sweet sorghum and existence of capacity for its exploitation.

Key words: Farmers, perception, potential, sweet sorghum.

INTRODUCTION

Farmers' subjective assessments of agricultural technologies influence adoption behavior (Nowak, 1992). Understanding the farmers is an initial step towards the search for an effective and sustainable way to make agricultural research more relevant to them (Kudadjie et al., 2004). Many researchers have reported on the negative consequences of not including farmers in setting up research and policy agenda (Derera et al., 2006). Variables which affect farmers' access to information, and hence their perception formation (e.g. extension,

education, media exposure, etc.), are typically used in economic models of the determinants of adoption decisions (Feder et al., 1985; Shakya and Flinn, 1985; Kebede et al., 1990; Poison and Spencer, 1991; Strauss et al., 1991). Situational studies are very important in generating information about the farmer and their socio-economic conditions that influence on cultivar adoption. This information can be gathered using participatory research techniques used to gather information prior to, during and after technology deployment (Matata et al., 2001). The situational studies can also help to explain the anticipated adoption pattern, which aid future breeding projects for the farmers. Stakeholders views in Zimbabwe and South Africa on development of sorghum for bio-energy

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has been reported (Makanda, 2009).

Sweet sorghum has wider adaptability and offers comparable grain yields Reddy et al. (2008). Sweet sorghum is best suited for ethanol production because of its higher fermentable sugar content in the stalk compared to sugarcane by Reddy et al. (2008). Other utilization can include processing it into syrup, grains for human consumption, stillage fibre and animal feed.

National and international research centers have reported significant yield increases in many crops. However, farmers remain unaware and have low perception of the skills to take full advantage of these technologies (Ekpere, 1995). An ineffective extension service has been partly blamed for this deficiency as well as lack of support services among other factors that make it unprofitable for farmers to accept and implement new technologies (International Institute of Tropical Agriculture 1993, unpublished). No matter how well new technologies work on research stations, if farmers do not have access to them, their development would have been in vain (Bremer et al 1989). It is acknowledged that some feedback on farmer reaction to a new technology is desirable in order to refine that technology.

Research concerning the production of biofuels has focused on the technical and economic feasibility, as well as the potential supply of alternative sources of biofuel feedstocks (De la Torre et al., 2007; Graham et al., 2007; Perlack et al., 2004; Nelson et al., 2010). A significant short-coming of many of these studies is that while they provide a useful frame of reference, they do not examine the necessary economic and institutional conditions under which such a large-scale undertaking would be plausible (Rajagopal et al., 2007). That is, how likely it is that farmers are willing to adopt biofuel crops with underdeveloped or nonexistent markets. Rajagopal and Zilberman (2007) indicated that there still exists a need to understand the factors that lead to the adoption of biofuel technologies by farmers.

The agricultural research system must therefore conceptualize an effective mechanism and capacity to measure the farmers' perception of new technologies.

Studies on farmer's perception of technologies constitute a useful link between both descriptive and prospective research lines.

The overall objective of the study was to analyze the perception of farmers on the potential of sweet sorghum and feasibility of its utilization. In order to meet this objective, the following specific objectives were formulated:

- To identify the demographic characteristics of the farmers
- To determine the level of perception of farmers on sweet sorghum and feasibility of its utilization
- To ascertain the level of awareness on existing infrastructure and their exploitation in sweet sorghum processing.

MATERIALS AND METHODS

A survey was conducted in Homabay, Ndhiwa, and South Nyanza Sugar zone, Kakamega, Mumias, Busia, Nyando and Kwale from October to November, 2012. A multistage random sampling technique was used to select farmers for study who were organized into groups. Both structured questionnaires and interview schedule were used to obtain data from the sampled farmers. Data was collected on sorghum production, cultivars grown, the preferred cultivar traits, farmers' awareness and perceptions on use of sweet sorghum as a bio-energy crop, and farmers' preparedness to grow sweet sorghum cultivars, potential of sweet sorghum for sugar and allied products and challenges and opportunities for bio-ethanol production in Kenya.

The data collected were analyzed using both the descriptive and inferential statistical tools such as frequency counts and percentages to indicate the proportion of responses to certain variables. Chi-Square tests and Pearson Product Moment Correlation were used to test for significant relationship between awareness and perception of farmers on utilization of sweet sorghum at 0.05 level of significance.

RESULTS AND DISCUSSION

During the survey of the farmers' perception on sweet sorghum and feasibility of its utilization in Kenya, a total of 70 farmers were interviewed. Data was collected on the farmers' socio-economic status, awareness, perceptions on use and potential of sweet sorghum for sugar and its allied products and preparedness to grow sweet sorghum. The analysis of the data was based on two categories viz; descriptive analysis and inferential analysis.

Socio economic characteristics of the farmers

Socio-economic characteristics of farmers are important factor in determining the perception and awareness of some farming practices and adoption of the farming technology. Table 1 shows the proportion of factor levels of some of the socio-economic characteristics of the farmers. It can be pointed out from the results that males (72.9%) were more prominent in farming activities than females. The high percentage of male farmers may be due to their access to farmland and their position as head of family. These results agree with the work of Oguntola (1998) who concluded that farming is a male-dominated profession. The lower proportion of female farmers could be due to previous land ownership system which discriminated against women. The high percentage (95.7%) of the farmers that were married may be as a result of the belief of the local people that married people

Table 1. Socio-economic characteristics of the farmers to establish their perception and potential of sweet sorghum in Kenya.

Variable	Factor	Counts (%)
Gender	Male	51 (72.9)
	Female	19 (27.1)
Marital status	Married	67 (95.7)
	Single	3 (4.3)
Education level	None	3 (6.7)
	Primary	28 (40.0)
	Secondary	32 (45.7)
	Tertiary	1 (1.4)
	Missing	6 (8.6)
Occupation	Farming	56 (80.0)
	other occupation	14 (20.0)
Age	up to 35	12 (17.2)
	35 to 50	34 (48.6)
	over 50	21 (30.2)

Table 2. Land ownership of sorghum farmers.

		Land Ownership			
		Own	Leased	Communal	Total
<i>Land sizes in acre</i>	0 to 2	32 (78.0%)	7 (100.0%)	10 (54.6%)	49 (73.5%)
	2 to 5	4 (9.8%)	0 (0.0%)	4 (21.1%)	8 (11.8%)
	5 to 10	3 (7.3%)	0 (0.0%)	3 (15.8%)	6 (8.8%)
	10 & above	2 (4.9%)	0 (0.0%)	2 (10.5%)	4 (5.9%)
	Total	41 (61.5%)	7 (10.3%)	19 (27.9%)	67 (100.0%)

are more responsible. In addition, most people probably married in order to raise large families that would supply labour on the farm. The distribution of age (Table 1) revealed that only 30.2% of the farmers were aged between 35 to 50 years. Approximately 46% of the farmers had secondary education. This reflects fairly high levels of literacy of people in the area. These gives a strong combination characteristics that when fully utilized, there would be a high awareness and perception and hence high adoption and productivity of technologies (Strauss et al., 1991)

Farmers' land ownership

The cross tabulation in Table 2 shows the acreage of land farmers have and their ownership. It is pointed out that 78.0% of the farmers have only up to 2 acres of land.

The land tenure system, fragmentation of farmland and human activities such as the building of roads and industries may force people to have small farm size. Very few farmers have 10 and above acres (4.9%). 61.4% of the farmers that were interviewed own parcels of land.

These may be farmers that had access to farmland because they were indigenous to the area or they were leaders of families. 10.3 % of the farmers lease land for their farming activities. Some farmers (27.9%) use their communal land although majority of them (54.6%) had less than 2 acres.

Preferred common sorghum varieties currently grown by the farmers.

There are a number of sorghum varieties that are currently grown by farmers. Some of the varieties are

Table 3. Common sorghum variety preference by farmers.

	Whether the farmer like the current variety				Total		
	Yes	No	Yes	No			
Sorghum variety grown	Seredo	12	80%	3	20%	15	21%
	Ochuti	6	100%	0	0%	6	9%
	Brown	3	100%	0	0%	3	4%
	Hybrid	2	100%	0	0%	2	3%
	Jowi Jamwomo	2	100%	0	0%	2	3%
	Andiwo	1	100%	0	0%	1	1%
	Japidi	0	0%	1	100%	1	1%
	Gadam	0	0%	1	100%	1	1%
	Obama	1	100%	0	0%	1	1%
	Local	27	71%	11	29%	38	54%

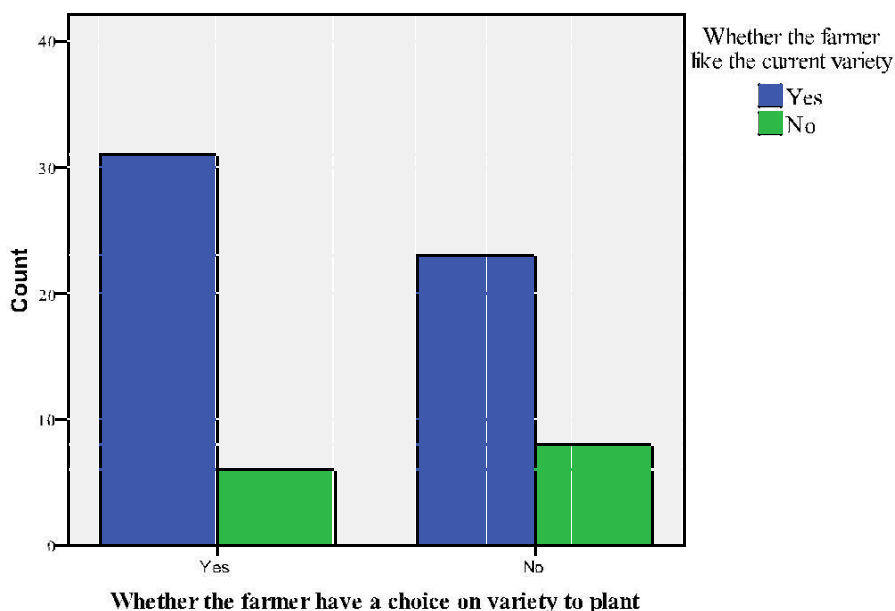


Figure 1. Association of having a choice on variety and preference of the variety.

known to the farmers as listed in Table 3 while majority of the farmers (54%) are not aware of the variety they are growing. Amongst the varieties that are known to the farmers, Seredo is the most common (21% of the farmers are growing it). Majority (77%) of the farmers who were interviewed liked the varieties that they are currently growing.

Effect of famers having a choice on variety on the preference of the variety

A Chi-Square analysis was used to determine if having a choice on variety of sorghum will have an association

with the preference of the variety the farmer grows. The Chi square test resulted to a test statistics of 0.949 and a P-value of 0.333. Using the assumed null hypothesis of no association, there is no significant evidence of association between having a choice on variety and preference of the grown (Figure 1 and Table 4).

Reasons for common sorghum varieties preference

Some of the reasons for sorghum variety preferences are shown in Table 5. Higher percentage of farmers prefers the varieties that they are currently growing because of their palatability. The percentages are computed based

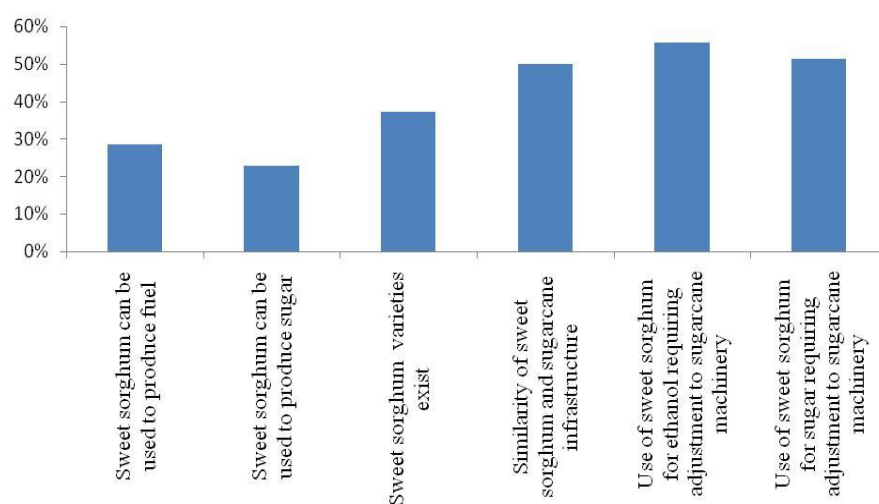
Table 4. Effect of farmers having a choice on variety on the preference of the variety.

Chi-square tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.949 ^a	1	0.330		
Continuity Correction ^b	0.453	1	0.501		
Likelihood Ratio	0.946	1	0.331		
Fisher's Exact Test				0.378	0.250
N of Valid Cases	68				

^a0 cells (.0%) have expected count less than 5. The minimum expected count is 6.38. ^bComputed only for a 2x2 table.

Table 5. Reasons for common sorghum variety preferences.

Variety	High Yield		Early maturity		High bird tolerance		High Drought tolerance		Palatable		Total no. of farmers
Seredo	7	(47%)	6	(40%)	7	(47%)	2	(13%)	13	(87%)	15
Ochuti	2	(33%)	0	(0%)	3	(50%)	0	(0%)	5	(83%)	6
Brown	0	(0%)	1	(33%)	1	(33%)	0	(0%)	1	(33%)	3
Hybrid	2	(100%)	1	(50%)	0	(0%)	0	(0%)	2	(100%)	2
Jowi Jamwomo	1	(50%)	0	(0%)	0	(0%)	0	(0%)	2	(100%)	2
Andiwo	0	(0%)	0	(0%)	0	(0%)	0	(0%)	1	(100%)	1
Japidi	0	(0%)	0	(0%)	1	(100%)	0	(0%)	1	(100%)	1
Gadam	0	(0%)	0	(0%)	0	(0%)	0	(0%)	0	(0%)	1
Obamo	1	(100%)	1	(100%)	0	(0%)	1	(100%)	1	(100%)	1
Local	9	(39%)	7	(30%)	5	(22%)	7	(30%)	17	(74%)	23

**Figure 2.** Farmers' awareness of the potentials of sweet sorghum.

on the number of farmer's responses per variety.

Farmers' awareness of the sweet sorghum production potentials

The farmers' awareness on the potentials of sweet

sorghum was measured in different aspects as shown in Figure 2. Amongst the aspects measured, approximately 40% of the farmers are aware that sweet sorghum varieties exist while 50% of the farmers acknowledge that there is need for the adjustment of the sugarcane machinery to be used in producing fuel and sugar from

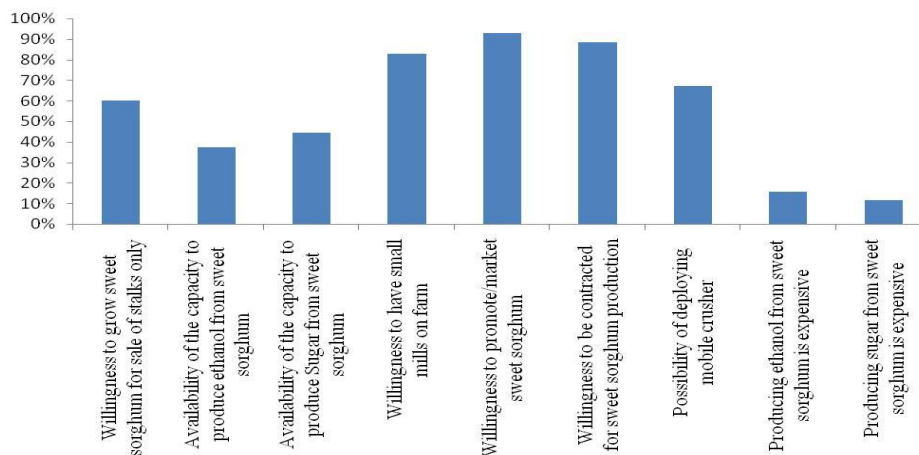


Figure 3. Farmers' perception on sweet sorghum production and related technologies.

sweet sorghum.

There was some evidence of significant association between level of education and the awareness that the farmers had about the similarity of sweet sorghum and sugarcane infrastructure (Chi-square statistics=31.313, PV=0.012) and between level of education and the awareness that the use of sweet sorghum for ethanol requires adjustment to sugarcane machinery (Chi-square statistics=52.359, PV=0.000). However infrastructural challenges were identified as potential limitations to exploitation of sweet sorghum for bio-ethanol production.

Farmers' perception on sweet sorghum production

Sweet sorghum being a new technology in the sugar industry, majority of farmers (60%) as shown in Figure 3, is willing to venture in the farming of sweet sorghum with the aim of selling the stalks only. They are also willing to take part in the development of the sweet sorghum and its products by allowing small mills in their farms (80%), promoting and marketing sweet sorghum (90%) and willing to be contracted for sweet sorghum production (85%). These results are consistent as shown in Figure 3. Further analysis on the farmers' awareness and perception on sorghum production was done using Chi-square test. The results show that there is a strong association between the farmer's willingness to promote/market sweet sorghum and their awareness on sorghum varieties they plant (Chi-square statistic = 26.564 and P-Value=0.001). Also a significant association was realized between the willingness to promote/market sweet sorghum and awareness that there is similarity of sweet sorghum and sugarcane infrastructure. (Chi-square statistic = 23.331 and P-Value=0.003).

These results are in line with the impact of acquiring knowledge by farmers. Amongst the respondents that

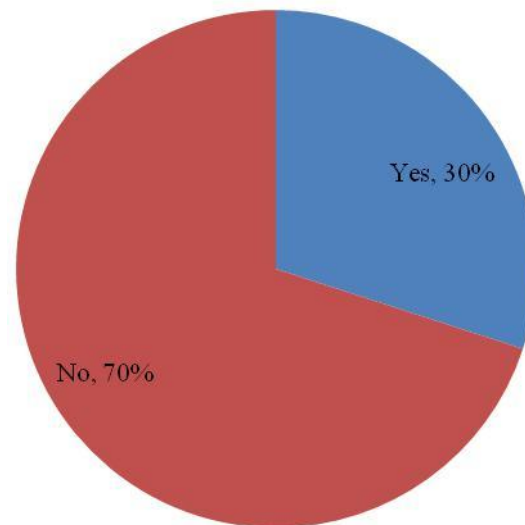


Figure 4. Whether farmer receive advice on sorghum farming.

were interviewed, only 30% of them had received some training on sorghum farming. Though there was no significant association between farmers awareness on sweet sorghum production technologies and whether they received training or not (Figure 4).

CONCLUSION AND RECOMMENDATIONS

It was observed that the perception of farmers on sweet sorghum technologies was affected by the basic characteristics of the farmers and the source of awareness. The study has revealed that farmers were aware of sweet sorghum and accompanying technologies however their perception was constrained by some socio-

cultural factors. In order to alleviate these constraints the following recommendations should be considered.

Research institutes and extension agents should embark on enlightenment campaign on the importance of sweet sorghum as a multipurpose crop suitable for food, feed, fiber and fuel.

Level of education and the awareness that the farmers had about the similarity of sweet sorghum and sugarcane infrastructure are strongly associated and therefore sweet sorghum farming will thrive amongst educated farming community.

It has been observed that 78.0% of the farmers have only up to 2 acres of land. The small land holding units are not feasible for economic purposes and farmers should be encouraged to consolidate their lands to maximize on the economies of scale.

From the analysis there is no significant evidence of association between having a choice on variety and preference of the variety. This means the variety respondents grow are mainly farmer retained seeds which do not have special attributes to enhance their preference. A well coordinated sweet sorghum seed supply system should therefore be promoted.

Preliminary evaluation on sweet sorghum genotypes should be carried out in the areas where they are to be introduced. This will assist in relating the relevance of this technology to the target area.

Farmers appreciate the potential of sweet sorghum and existence of capacity for its exploitation and are likely to adopt sweet sorghum even with underdeveloped or nonexistent markets.

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APPENDIX

Questionnaire on farmers’ perceptions on sweet sorghum and potential of its utilization in Kenya

Section 1: Demographic characteristics

- 1.1 Zone.....
- 1.2 Farmer’s Name.....
- 1.3 Sector/Area Zone.....
- Sub-Location.....
- 1.4 Country.....
- 1.5 Gender: Male Female
- 1.6AgeoftheFarmer
- 1.7 Marital status
 Married Single Other (specify).....
- Level of Education (No. yrs spend)..... Primary..... Secondary.....
- 1.8 None.....
- 1.9 Occupation.....
- Head of household Male Female
- 1.10
- 1.11 Land size in acres.....
- 1.12 Nature of land holding

OWN LEASED COMMUNAL

Section 2: General views

- 2.1 For how long have you grown sorghum?
- 2.2 Which sorghum variety are you growing?
- 2.3 What benefit do you get from sorghum? Subsistence Cash crop Both
- 2.4 Do you have a choice on the variety to plant?
 Yes No
- 2.5 Do you like the sorghum variety you have been growing?
 Yes No
- 2.6 If **Yes** to 2.5 above, which specific characteristics do you **like** about the variety you have been growing?

1. Yield

HIGH	MEDIUM	LOW	NOT SURE
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2. Maturity

SHORT	MEDIUM	LONG	NOT SURE
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3. Bird tolerance

HIGH	MEDIUM	LOW	NOT SURE
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4. Drought tolerance

HIGH	MEDIUM	LOW	NOT SURE
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5. Taste

NOT PALATABLE	PALATABLE	NOT SURE
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6. Color

RED	WHITE	KHAKI	NOT SURE
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2.7 If **No** to 2.5 above, which characteristics don't you **like** about the variety you have been growing?

- 1 Low Yield
- 2 Late maturity
- 3 Susceptible to drought

4 Preferred by birds

5 Others specify.....

2.8 Awareness on the use of sweet sorghum to produce fuel

YES	NO	MAYBE	NOT SURE
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2.9 Awareness on the use of sweet sorghum to produce sugar

YES	NO	MAYBE	NOT SURE
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View on farmer willingness to grow sweet sorghum for sale of stalks

2.10 only

YES	NO	MAYBE	NOT SURE
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2.11 View on farmers' awareness on the existence of such varieties

YES	NO	MAYBE	NOT SURE
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2.12 Availability of the capacity to produce ethanol from sweet sorghum

YES	NO	MAYBE	NOT SURE
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2.13 Availability of the capacity to produce sugar from sweet sorghum

YES	NO	MAYBE	NOT SURE
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2.14 Willingness to have small mill on farm (farmer stakeholders)

YES	NO	MAYBE	NOT SURE
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2.15 Willingness to promote/market sweet sorghum

YES	NO	MAYBE	NOT SURE
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2.16 Willingness to be contracted for sweet sorghum production

YES	NO	MAYBE	NOT SURE
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Section 3. Challenges on the use of sweet sorghum

3.1 Similarity of infrastructure for sweet sorghum as for sugarcane

YES	NO	MAYBE	NOT SURE
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Use of sweet sorghum for ethanol requiring adjustment to sugarcane
3.2 machinery

YES	NO	MAYBE	NOT SURE
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3.3 Use of sweet sorghum for sugar requiring adjustment to sugarcane machinery

YES	NO	MAYBE	NOT SURE
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3.4 Possibility of deploying mobile crusher's on-farm

YES	NO	MAYBE	NOT SURE
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3.5 View on whether producing ethanol from sweet sorghum is more expensive than using sugarcane

YES	NO	MAYBE	NOT SURE
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3.6 Which factors/constraints do you think would hinders you from adopting the improved Sweet Sorghum Varieties?

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.....
.....

Section 4: Dissemination pathways

4.1 Do you receive advice on sorghum farming?

Yes No

4.2 If No, what is the source of your advice?

4.3 Which of the following extension function have you ever attended? Please tick from the list provided.

Extension pathways

Tick appropriately

- Field visits
- Seminars/ workshops
- Field days/ Open days
- Farmers barazas/ meetings
- Farmer Research Groups
- On farm demonstrations
- Any other (specify

4.4 To you which is the most effective and comprehensive extension method for your zone?

.....

4.5 Interviewers' comments.....

Signature: