



## **Utilization and Processing of Sorghum by Small Holder Farmers in Drought Prone Agro-Ecological Zones of Kenya**

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### **ABSTRACT**

**Sorghum is an under-utilized crop and one of the most important cereal crops in semi-arid tropics. In Kenya, sorghum is grown in the often drought prone marginal agricultural areas of Eastern, Nyanza and Coast regions where there are many biotic and abiotic constraints that reduce its productivity. The aim of the present study was to assess the current utilization and processing practices by small holder farmers. Makueni County, a representative of drought prone areas situated in agro-ecological zone was selected since sorghum is a widely cultivated crop and the region has organized formally registered farmer groups. Key informant interviews (20), household survey questionnaires (300) and focus group discussions (12) with the farmers were conducted to gather data on sorghum production, challenges in production consumption and utilization, processing technology and market access. Key informant interviews (20), household survey questionnaires (300) and focus group discussions (12) with the farmers were conducted to gather data on sorghum production, challenges in production consumption and utilization, processing technology and market access. The main uses of sorghum include: Stiff porridge (ugali) (37.6%), thin porridge (uji) (35.2%), fried dough (mandazi) (3.1%), flat bread (chapatti) (2.6%), githeri (sorghum mixed with legumes) (8.0%), sorghum cake (1.2%), beverage (sorghum tea) (0.8%) and animal feed (8.5%). The greatest challenges that hinders utilization and limits processing of sorghum and value addition were lack of markets (12.3%), low volumes of production due to low productivity (3.5%), lack of capital (4.6%), pest and diseases (38.2%), lack of farm equipment (24.6%) and lack of processing knowledge (16.8%). This work recommended that more farmers training on sorghum value addition be conducted to create awareness on sorghum products utilization and to link the products to the markets.**

**Keywords:** Farmer Groups, Processing, Small holder Farmers, Sorghum products, Utilization.

## INTRODUCTION

Sorghum is an under-utilized crop and one of the most important cereal crops in semi-arid tropics (Muui et al., 2013; Jacob et al., 2013). In Kenya, sorghum is grown in the often drought prone marginal agricultural areas of Eastern, Nyanza and Coast regions (Muui et al., 2013). Within these growing areas, people associate sorghum as a poor man's crop and some still prefer to grow maize even in areas where it does not do well. As a result, there is increasing food insecurity (Dicko et al., 2006; Orr et al., 2016).

Despite the growing population in Kenya which mainly depend on cereal grains as their main diet, the sorghum sub-sector's economic contribution at the micro and macro level is well below its potential. The reasons for the low performance include: low processing capacity, lack of ready market, low processing efficiency levels, and the crop being labour intensive (Mwadalu and Mwangi 2013)

Sorghum production has widely been promoted among smallholder farmers because of its ability to thrive well in arid and semi-arid regions and the low input requirements compared with most staple cereals like maize. These initiatives have great potential for growth and expansion of the crop and are expected to impact the livelihoods of many farmers through food security and income generation.(Chepngatich 2014).

The main challenge is however, that sorghum has not been developed into products for major urban areas, and thus lacks markets. The crop remains mostly a crop of small cultivators and is consumed locally where it was grown with low levels of technology adoption. A consumption restraint has been the lack of commercially available foods such as flours, breads, cereals and other products for those who are not farmers and who cannot devote time to making flour from sorghum grain (Omoró 2013).

In Eastern Kenya, most farmers plant sorghum for their own consumption alongside other crops such as cowpea, pigeon pea, green grams, maize. Grain sorghum is food for millions of people living in the arid and semi-arid tropics. In Kenya various communities have diversified the use of sorghum ranging from ugali, porridge, Githeri (sorghum mixed with legumes), chapatti, doughnuts, sorghum Pilau, Mandazi and even as a beverage (Oyier et al., 2016, Okuthe et al., 2013).

The major household level uses of sorghum are to make porridge and ugali, while other uses such as making of cake, chapatti, chicken feed and alcohol are minimal. There is therefore, need to have value addition activities and training to promote and diversify the household level use of sorghum products for food and for marketing (Maragu et al., 2014)

## MATERIALS AND METHODS

### Population size sampled

The interviewed population comprised of sorghum growing households and targeted the farmers who had grown sorghum for at least last three previous cropping seasons.

Purposive sampling technique was used to identify farmers growing sorghum and could provide relevant information about the research topic. A sample size of 300 farmers was selected based on the availability of study participants and funds.

### Farmer Interviews

Key informant interviews were conducted with 20 people comprising of government extension officers, farmers' group leaders, grain millers and sorghum farmers who have been active in the sorghum sub-sector. These individuals were selected with the help of the district extension officers and on the basis that they interacted with the farmers frequently. The interviews of the key informants were conducted individually, to avoid influences from other informants. Eight Focus Group Discussions (EFGD) were also conducted mainly with the farmer groups and some of the farmers selected by the group leaders on the basis of their experience in sorghum farming.

The focus group discussion membership constituted of 11 to 15 participants with attempts to balance gender of group members and Swahili language was the main language of communication since most of the farmers could not understand English. Where necessary, the questions were interpreted with the help of local field assistants for better understanding. 300 individual farmers were randomly selected for the household surveys targeting the farmers who had grown sorghum in at least the last three cropping seasons. A previously pretested semi-structured questionnaire was used as a guide to gather the information.

### Statistical analysis

The data collected were subjected to Analysis of Variance (ANOVA) using SPSS version 2.0 for Windows and effects declared significant at 5% level. Least Significance Difference was used to separate means.

## RESULTS

The main buyers (46.5%) of sorghum were found to be the local buyers. Other notable buyers included brokers (middle men) (23.8%), wholesalers (14.5%) and retailers (15.2%) as shown in Figure 1.

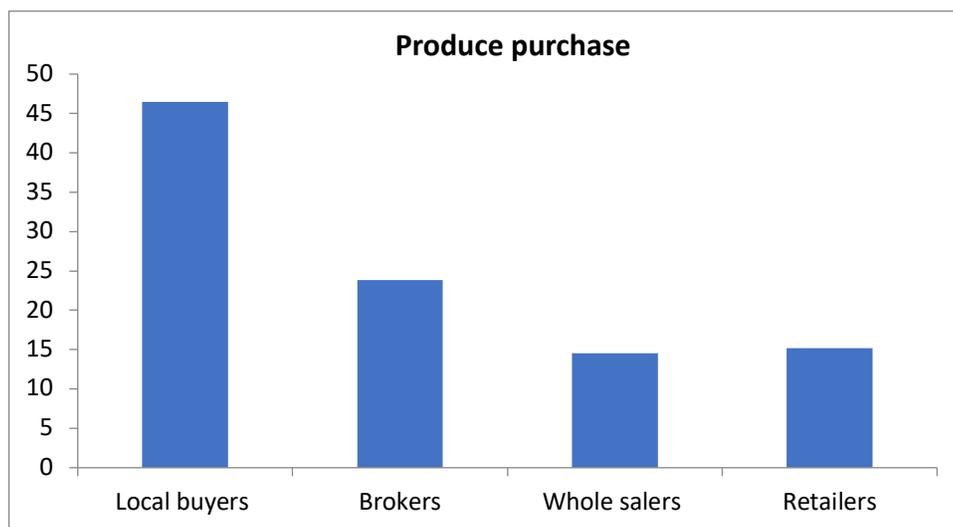


Figure 1 Purchase of sorghum by different buyers.

It was observed that a great proportion of the farmers (42.6%) used sorghum to prepare uji (thin porridge), 35.2% used to prepared ugali (stiff porridge) from sorghum while 11.5% prepared Githeri from sorghum (sorghum mixed with legumes). Other food products made included mandazi (fried dough) (3.1%), chapatti (flat bread) (2.6%), tea or beverage (1.2%), and other uses (3.8%) such as preparation of sorghum cake

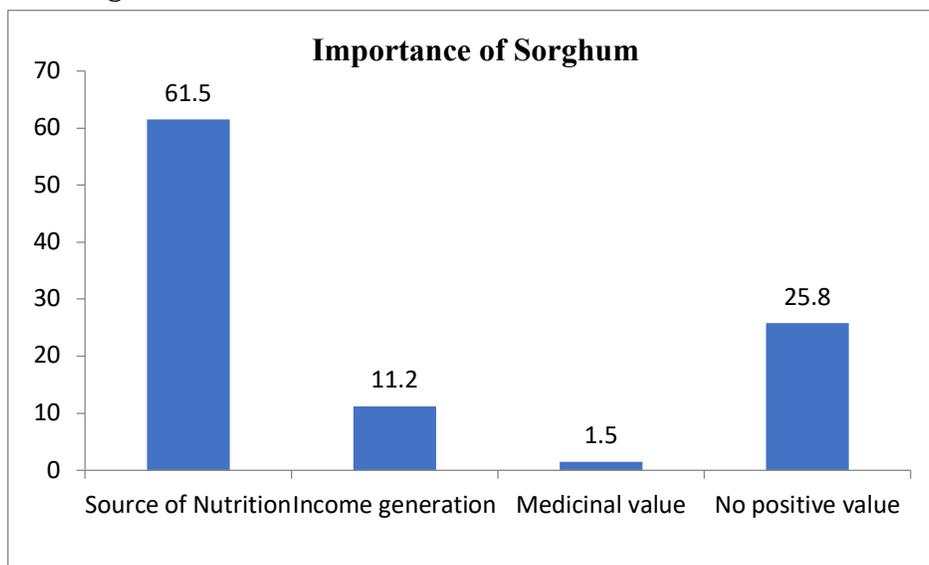
Majority of the farmers (81.4%) indicated that they consume the products made from sorghum with only 18.6% reported that they sold the products. The main buyers of the products made from sorghum were local buyers (89.6%).

About 73.1% of the farmers were aware of the existence of sorghum products in the market. The farmers’ suggestions on how to improve consumption and utilization of sorghum based products are summarised in table 1

**Table 1 Improving utilization and consumption of sorghum products**

Suggested Solutions by farmers	Proportion (%)
Awareness creation in markets	41.5
Adoption of new technology for sorghum products processing	21.1
Improved sorghum varieties	18.9
Creation of new marketing channels	16.7
Proper storage	1.9

Commercially processed sorghum products were viewed as source of food and nutrition by about 61.5% of the farmers whereas 11.2% believed that it is the best way to create income from sorghum farming as shown in figure 2.



**Figure 2 Farmers perceived importance of sorghum**

### DISCUSSION

The study revealed that the main buyers of sorghum are local buyers with other notable buyers being brokers or middle men who collect the produce at the farm gate and paid the farmers immediately and in cash, except in some cases where the farmer knows the broker in person in

which case the broker was given the produce on credit. Farmers also believed that brokers sell sorghum to EABL as well as some local buyers who they said they buy sorghum on behalf of EABL. Similar findings were reported by Marangu and others (2014) who found that farmers sold sorghum grains to key buyers who included brokers or middlemen (67%) consumer of other farmer (16%) rural assembler (13%) urban grain trader (4%). Mwadalu and Mwangi, (2013) also reported that sorghum marketing and trading is low due to poor marketing channels and that only 30% of the domestic production is marketed.

Farmers have diversified the use of sorghum by preparing variety of products such as ugali (stiff porridge), uji (thin porridge), Githeri (sorghum mixed with legumes), mandazi (fried dough), chapatti (flat bread) and tea or beverage. Some farmer groups make sorghum cake and sorghum tea where they sold these products at local markets especially during special occasions and functions. During preparation of chapatti (flat bread), cake and mandazi (fried dough), sorghum flour is mixed with small amount (up to 30%) of wheat flour to help spreading of the dough. Ugali (stiff porridge), githeri (sorghum mixed with legume) and uji (porridge) were used as main dishes which are prepared almost on daily basis while other products like cakes and the beverage were less frequently used and made only during functions and special occasions. Previous study conducted by Marangu and others (2014) found that the most important uses for sorghum flour were for preparation of porridge (uji) (50%) and ugali (stiff porridge) (37%) while other uses included preparation of alcoholic drinks (4%), chapatti (flat bread) (7%), cake (1%) and as animal feed (2%). Similar findings were also reported by Kavoi and others (2013) who found that the main sorghum products made by the farmers were porridge, sorghum cake, 'Musandi' (sorghum mixed with cowpea), sorghum chapatti (flat bread) and sorghum Mandazi (fried dough).

Products made from sorghum are mainly used for home consumption with only few farmers selling their products mainly at functions although some farmers take it to the local markets such as Kathonzi. Visitors who come to the functions also buy some of the processed sorghum products. The products sold include sorghum cake, sorghum tea (beverage), porridge, mandazi (fried dough) and githeri (sorghum mixed with legumes). The findings were in agreements with those of Kagwiria and others (2019) found that some of the reasons that farmers allocated small areas of land to sorghum in Makueni could be the low commercialization of sorghum and the lack of ready and reliable marketing channels that consider value addition. (Mwadalu and Mwangi, 2013) also reported that sorghum trading in Kenya is low with poor marketing channels.

Majority of the farmers were found to be aware of existence of sorghum products in the market. The main products that the farmers were familiar with were sorghum beer and flour. On the other hand, the main solutions to improve sorghum consumption and utilization suggested by the farmers included creation of awareness for sorghum products in the market, adoption of new technology and use of improved sorghum varieties. Previous studies by Mundia and others (2019) found that sorghum is difficult to process into food-quality form. Kagwiria and others (2019) also found that there is need to increase commercialization and mechanization of the sorghum production process and recommended strengthening of farmer groups and increasing their capacity through trainings. Kavoi and others (2014) also reported that adoption of improved technologies and innovations in the Eastern region has been minimal.

The study found that majority of the farmers' considered sorghum valuable in terms of nutrition and income generation. Similar findings were reported by Orr and others (2013) who found that 25% of the respondents used as food security crop while around 11% of them used sorghum as a cash income crop.

### CONCLUSION

The survey reported showed that sorghum utilization is well below its potential owing to the fact that processing and commercialization of sorghum products is minimal. Sorghum is mainly used for home consumption with few farmers selling their produce to local buyers. The main products made from sorghum are Ugali and porridge, but there are other important products made from sorghum including sorghum cake, beverage or tea, mandazi and chapatti. The products are mainly consumed at home.

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