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Full Length Research Paper

Participatory identification and evaluation of sorghum (*Sorghum bicolor* (L.) Moench) landraces from lower eastern Kenya

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ABSTRACT

Eastern Province is a major sorghum growing zone in Kenya. There exist different landraces of sorghum that are not yet known. The landraces continue to be maintained by cultural preferences and traditional practices by the farmers. Germplasm collection was done in the major sorghum growing agro ecological zones in eastern province of Kenya as follows; Mbeere in LM_3, LM_4; Makueni in LM_5, LM_6; Kitui in LM_3, LM_4, LM_5; and Mutomo in LM_4, LM_5. The germplasm was collected separately from 120 randomly sampled farmers. At time of collection information on traits preferred and grain use was recorded for each accession. The seed color/name, sample status, region and agro-ecological zone were used to identify the different landraces. Forty four different accessions were collected from different farmers in the region. Data was analyzed using PROC GLIMMIX model of the Statistical Analysis Systems software (SAS Institute, 2005). Parameters studied were expressed as percentages, Analysis of Variance was performed, and Least Significant Differences used for separation of means at 0.05 level of confidence. Mbeere region had the most landraces available with diverse colorations to Kitui, Mutomo and Makueni. The landraces are unique in their adaptation, food quality, grain yield, quality of harvested products, biotic stress resistance and post-harvest processing.These untapped resources could be useful in crop improvement programmes and in food security. The decline in use of the landraces may erode the genetic base and prevent use of distinctive traits in crop adaptation and improvement.

Keywords: Diversity, grain use, landraces, sorghum, traits

INTRODUCTION

Sorghum (*Sorghum bicolor* (L.) Moench) is one of the most important cereal crops in the semi-arid tropics (SAT) (Rohrbach *et al*., 2002; Meeske *et al*., 1993). The crop was domesticated and diversified in Africa before moving to other parts of the world (Dogget, 1988) and continues to play an important food security role in Africa. Since sorghum originated in Africa, it is uniquely adapted to Africa's climate, being both drought resistant and able to withstand periods of water-logging (Kimber, 2000; Meeske *et al*., 1993). In Kenya, sorghum is an important food crop and dietary staple in the country's arid and semi-arid lands which account for over 80 percent of the total land area (Food and Agriculture Organization, 2008).

The wide distribution of the major cultivated races of the crop in Africa has been reported (DeWet and Harlan, 1971). However, this natural genetic diversity is subjected to a range of threats from natural selection and destruction of habitats and often merely expedient agricultural practices. Landraces of sorghum from the centers of diversity have been rich sources of resistance to new pathogens, insect pests and other stresses such

as high temperature and drought, as well as sources of traits to improve food and fodder quality, animal feed and industrial products (Rosenow and Dalhberg, 2000). A wide diversity of sorghum landraces is cultivated under equally diverse agro-climatic conditions and practices by subsistence farmers in eastern province of Kenya (Mutegi *et al.,* 2010; Jaetzold *et al.,* 2006). The sorghum landraces continue to be maintained by cultural preferences and traditional practices by the farmers.

Sorghum is important for its diverse germplasm (Menz *et al.,* 2004), adaptation to drought (Doggett, 1988) and its various grain use in households (Swigonova *et al.,* 2004; Kellogg, 2001). However, the crop has been neglected due to the perception as food for the poor (Engle and Altoveros, 2000). These species of crops seemingly regarded to be of lower potential are actually an untapped natural resource that when properly harnessed can result in a decreased rate of degradation of environment. They may lead to sustainable production systems, provide diversity in diet and supply deficient micronutrients, provide extra income for farmers, and prevent the loss of genetic diversity (Javier and Foreward, 1993).

Sorghum is one of the crop species that could play an important role in the food security, income generation and food culture of the rural poor in Kenya (Engle and Altoveros, 2000). There is less attention paid to sorghum production especially the popular landraces grown by farmers. Their potential value is under-estimated and under-exploited. It also places them in danger of continued genetic erosion and disappearance. The decline of use of these landraces may erode the genetic base and prevent the use of distinctive useful traits in crop adaptation and improvement. Plant genetic resources play an important role in generating new crop varieties with the high yield potential and resistance to biotic and abiotic stresses (Sajid *et al.,* 2008). The germplasm of most crops collected from the local sources provides greater genetic variability and can furnish useful traits to broaden the genetic base of the under-utilized crop species. Food and Agriculture Organization (1996) recognises the need to conserve indigenous species of different crops. Most indigenous food crops are threatened by rapid adoption of highly improved crop varieties many of which are introduced and poorly adapted. Together with genetic resources, indigenous knowledge associated with the cultivation, utilisation and conservation of indigenous crops is also endangered. Unless something is done to conserve and re-popularise their use, this natural resource may be lost forever. Genetic erosion occurs mainly through cross pollination of plants from same variety, different varieties and wild relatives (Johnson *et al.,* 2004; Hall *et al.,* 2000). The purpose of this work was to identify different sorghum landraces still kept by farmers in different agro ecological zones in Kitui, Mbeere, Makueni and Mutomo districts of eastern Kenya; establish the variability based on grain color, traits preferred and the grain use for each landrace.

METHODOLOGY

Collection of landraces was done in 2010-2011in the major sorghum growing agro ecological zones in eastern province of Kenya as follows; Mbeere in LM_3, LM_4; Makueni in LM_5, LM_6; Kitui in LM_3, LM_4, LM_5; and Mutomo in LM_4, LM_5 (Jaetzold *et al.,* 2006). Eastern Province extend between 38° 15' E and 39° 30'E as well as 1° N and 3° S. The regions range from Zone IV (Semi Humid to Semi Arid) to Zone V (Semi Arid) (Jaetzold and Schmidt, 1983). The Mbeere and Kitui sites are classified as Lower Midland (LM) with some regions in transitional zone towards Upper Midland (UM). Makueni and Mutomo sites are classified as Lower Midland (LM) (Jaetzold *et al.,* 2006).

Mbeere region where landraces were collected receives an annual rainfall ranging from 800-1000mm and an altitude of 840-1189 meters above the sea level (Jaetzold *et al.,* 2006). Makueni region receives an annual rainfall ranging from 600-800mm and an altitude of 914-1600 meters above the sea level. Kitui receives an annual rainfall ranging from 600-1181mm and an altitude of 1036-1115 meters above the sea level while Mutomo receives 500-700mm annual rainfall and an altitude of 914 meters above the sea level (Jaetzold *et al.,* 2006).

The collection was done from farmers based on information gathered in an earlier baseline survey. Landraces were collected separately from 120 randomly sampled farmers. Passport data, grain utilization and traits preferred by farmers were recorded for each accession. Also, the color of the seeds was recorded using Munsel color chart for plant tissues (Anonymous, 1972). The germplasm was reserved for use in morphological and molecular characterization to enable elaborate evaluation of diversity for documentation and crop improvement program.

Data was analyzed using PROC GLIMMIX model of the Statistical Analysis Systems software (SAS Institute, 2005). Parameters studied were expressed as percentages, Analysis of Variance was performed, and Least Significant Differences used for separation of means at 0.05 level of confidence.

RESULTS

The color of the landraces varied considerably between and within the germplasm (Table 1). The landraces which were white in color occurred in the four districts while dirty white (5RP 8/2) occurred only in Kitui and Makueni. Brown and brown white types were available in Kitui, Mutomo and Makueni while dark brown and brown red

Table 1. Frequency occurrence based on color of landraces collected from Kitui, Mutomo, Makueni and Mbeere districts in eastern Kenya

Landrace	Seed color code	Kitui	Mutomo	Makueni	Mbeere	Total
White	-	2	1	1	1	**5**
Dirty white	5RP 8/2	1	0	1	0	**2**
Brown white	2.5 YR 7/4	0	1	0	0	**5**
	10 R 7/4	1	0	0	0	
	7.5 YR 7/4	0	0	1	0	
	2.5 Y 8/4	0	0	1	0	
	5 YR 6/6	1	0	0	0	
Brown	2.5 YR 7/6	0	1	1	0	**7**
	5 YR 7/4	2	0	1	0	
	5 YR 6/6	1	0	0	0	
	7.5 YR 8/4	0	0	1	0	
Dark brown	5 YR 5/6	1	0	0	0	**1**
Brown red	5 R 6/8;7/4	1	0	0	0	**1**
Red	5 R 7/8	3	0	2	0	**8**
	2.5 YR 7/8	0	0	1	0	
	5 R 4/6	0	0	0	1	
	5 R 5/6	0	0	0	1	
Black red	10 R 3/4	0	1	0	0	**1**
Purple	5 RP 5/2	0	0	0	1	**4**
	5 RP 6/2	0	0	0	3	
Purple pink	5 RP 5/2	0	0	0	1	**4**
	5 RP 6/2	0	0	0	1	
	5 R 6/4	0	0	0	1	
	5 RP 7/2	0	0	0	1	
Cream pink	5 RP 8/2	0	0	0	1	**1**
Pink brown	10 R 6/4	0	0	0	1	**2**
	2.5 YR 6/4	0	0	0	1	
Mixture of purple, pink,white	5 R 6/2	0	0	0	1	**2**
	5 RP 7/2	0	0	0	1	
Mixture of purple, pink, white, brown	5 R 6/2;7/2	0	0	0	1	**1**
TOTAL		**12**	**4**	**11**	**17**	**44**

types occurred in Kitui only. However, the brown germplasm had four different types based on the color while brown white had five different types (Table 1). Brown red found at Kitui occurred as a mixer of two color codes (5R 6/8 and 7/4) (Table 1). The red type was present in all districts except Mutomo which had a unique black red type. The red germplasm had four different color codes. Purple, purple pink, cream pink, pink brown, mixture of purple, pink, white, and mixture of purple, pink, white, brown occurred only in Mbeere. The purple germplasm had two different color codes while purple pink germplasm had four different codes. Pink brown germplasm had two codes while the mixed germplasm with purple, pink and white had two different codes (Table 1).

Mbeere region had the highest percentage number of landraces with 38.6%, followed by Kitui with 27.3%, Makueni with 25% while Mutomo had the lowest percentage of 9.1% (Table 2). The results showed that landraces with brown color schemes were more with 18.2%, followed by white color schemes with 13.6%, brown white and red color schemes with 11.4%. Purple and purple pink had a percentage of 9.1% respectively, followed by pink brown and mixture of purple, pink, white with 4.5% and finally dirty white, dark brown, brown red, black red, cream pink and mixture of purple, pink, white, brown with 2.3% (Table 2).

Percentage of farmers preferring drought resistance in sorghum planted was only reported in Mbeere with 30% (Table 3). Farmers preferring resistance to other pests were only in Mbeere with 30% while none were reported in the other three regions. Kitui had the highest percentage of farmers preferring resistance to birds with 27% followed by Mbeere with 3%. Percentage of farmers

Table 2. Percentage landraces collected from Kitui, Mutomo, Makueni and Mbeere districts in eastern Kenya

Landraces	Kitui	Mutomo	Makueni	Mbeere	Total	LSD (*P*=0.05)
White	6.8a	2.3b	2.3b	2.3b	13.6	**4.0**
Dirty white	0.0a	0.0a	2.3b	0.0a	2.3	**1.5**
Brown white	4.5a	2.3b	4.5a	0.0c	11.4	**2.0**
Brown	6.8a	2.3b	9.1a	0.0b	18.2	**3.6**
Dark brown	2.3a	0.0b	0.0b	0.0b	2.3	**2.0**
Brown red	2.3a	0.0b	0.0b	0.0b	2.3	**1.7**
Red	4.5a	0.0b	6.8b	4.5a	11.4	**2.1**
Black red	0.0a	2.3a	0.0a	0.0a	2.3	**1.7**
Purple	0.0a	0.0a	0.0a	9.1b	9.1	**1.0**
Purple pink	0.0a	0.0a	0.0a	9.1b	9.1	**2.8**
Cream pink	0.0a	0.0a	0.0a	2.3b	2.3	**1.5**
Pink brown	0.0a	0.0a	0.0a	4.5b	4.5	**3.9**
Mixture of purple, pink, white	0.0a	0.0a	0.0a	4.5b	4.5	**2.3**
Mixture of purple, pink, white, brown	0.0a	0.0a	0.0a	2.3b	2.3	**1.1**
TOTAL	**27.3**	**9.1**	**25**	**38.6**	**100%**	

*Any two means having a common letter within a row are not significantly different at 5% level of significance according to the LSD test

Table 3. Percentage means of preferred traits in sorghum landraces grown by farmers in four districts of eastern Kenya

Percentage of farmers									
	Drought Resistance	Pest Resistance	Bird Resistance	Early Maturity	Good Taste	High Yield	Plant Vigor	Ease of Cleaning	All Traits
Kitui	0a	0a	27a	33a	10a	20a	0a	7a	20a
Mbeere	30b	3b	3b	30a	40b	20a	0a	0b	7b
Makueni	0a	0a	0b	0b	0c	63b	20b	0b	0b
Mutomo	0a	0a	0b	0b	7a	73b	0a	0b	20a
LSD (*P*=0.05)	**19**	**1**	**11**	**7**	**15**	**24**	**3**	**2**	**5**

*Any two means having a common letter within a column are not significantly different at 5% level of significance according to the LSD test

preferring early maturing sorghum varieties was highest in Kitui (33%). Most varieties take two to four months to maturity with only a few taking six to twelve months. Landraces with good taste were more preferred in Mbeere with 40%. High yielding varieties were preferred in the four regions with Mutomo having the highest percentage (73%). Varieties high in vigour were only preferred in Makueni with 20% while those known to be easy in cleaning were preferred only in Kitui with 7% (Table 3).

White germplasm was dominant in all agro ecological zones while brown white and red occurred in zones $LM_{3, 4, 5}$ (Table 4). Brown occurred in $LM_{4, 5, 6}$; red brown and black red occurred in LM_3 and LM_4 respectively. Cream pink, purple, purple pink, maroon and pink brown dominated LM_3 and LM_4. Traits preferred by farmers in landraces grown were high yields, high vigor, good taste, ease in cleaning, resistance to drought, early maturing, resistance to pests and diseases as shown in Table 4. Farmers prefer landraces that are white and brown white for porridge, *ugali* (thick porridge), *pilau*, *muthura* (mixture of sorghum and legume grains) and for baking (Table 4). Cream pink is mainly used for porridge, *ugali, pilau*, baking and in fermentation of traditional porridge and brews while red and red brown are preferred for making porridge, *muthura* and for fermentation of traditional porridge and brews. Black red, purple, pink brown, maroon and pink brown are used in preparation of *muthura* and in brews.

DISCUSSION

Mbeere district had the most landraces compared to the three districts. Landraces that were purple, purple pink, cream pink, pink brown, mixture of purple, pink, white and mixture of purple, pink, white and brown dominated Mbeere and were not found in the other regions.

Table 4. Preferred traits and grain use of landraces grown by farmers in different agro-ecological zones in four districts of eastern Kenya

					Traits preferred by farmers								Grain use					
No.	Color/name	Source	AEZ	Status	DR	PR	BR	EM	GT	HY	Vig	EC	Fer	Por	Ug	Pil	Mu	Bak
1	White mweruba 1	kw	LM_4	LR	-	-	-	+	+	-	-	-	-	+	+	+	+	+
2	White	kw	LM_5	LR	-	-	-	+	+	-	+	+	-	+	+	+	+	+
3	Whitebrown	kw	LM_4	LR	+	+	-	+	+	+	+	+	-	+	-	-	+	+
4	Brown 1	kw	LM_4	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	+
5	Brown 2	kw	LM_5	LR	+	+	+	+	-	+	+	+	-	+	+	-	+	+
6	Brown 3	kw	LM_5	LR	+	+	+	+	-	+	+	+	-	+	+	-	+	+
7	Brown	kc	LM_3	LR	+	+	+	+	-	+	+	+	-	+	+	-	+	+
8	Red 1	kc	LM_3	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
9	White	kc	LM_3	LR	+	-	-	+	+	+	+	+	-	+	+	+	+	+
10	Brownwhite 1	kc	LM_3	LR	+	+	-	+	+	+	+	+	+	+	+	+	+	+
11	Brownwhite 2	kc	LM_3	LR	+	+	-	+	+	+	+	+	+	+	+	+	+	+
12	Red 2	kc	LM_3	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
13	Brownred	kc	LM_3	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
14	Blackred	mu	LM_4	LR	+	+	+	+	-	+	+	+	+	-	-	-	+	-
15	Brownwhite	mu	LM_4	LR	+	+	-	+	+	+	+	+	+	+	+	+	+	+
16	Brown	mu	LM_5	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	+
17	White	mu	LM_5	LR	+	-	-	+	+	-	+	+	-	+	+	+	+	+
18	Creampink gatengu	mb k	LM_4	LR	+	+	-	+	+	+	+	+	+	+	+	+	-	+
19	Purple	mb k	LM_4	LR	+	+	+	+	-	+	-	+	-	-	-	-	+	-
20	Pinkbrown mwitia	mb k	LM_4	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	-
21	maroon ciakiondo	mb k	LM_4	LR	+	+	+	-	-	+	-	+	+	-	-	-	+	-
22	Purple karuge 1	mb k	LM_4	LR	+	+	+	-	-	+	-	+	+	-	-	-	+	-
23	Purple karuge 2	mb k	LM_4	LR	+	+	+	-	-	+	-	+	+	-	-	-	+	-
24	Purplepink local B	mb k	LM_4	LR	+	+	+	+	-	+	+	+	+	-	-	-	+	-
25	Purplepink local A	mb k	LM_4	LR	+	+	+	+	-	+	+	+	+	-	-	-	+	-
26	Purple thiriku	mb k	LM_4	LR	+	+	+	+	-	+	-	+	+	-	-	-	+	-
27	Purple mubaku	mb k	LM_4	LR	+	+	+	-	-	+	-	+	+	-	-	-	+	-
28	Purple thiriku 2	mb k	LM_4	LR	+	+	+	+	-	+	-	+	+	-	-	-	+	-
29	Pink brown muthiriku	mb k	LM_4	LR	+	+	+	+	-	+	+	+	+	-	-	-	+	-
30	White	mb s	LM_3	LR	-	-	-	+	+	+	+	+	-	+	+	+	-	+
31	Pinkpurple thiriku	mb s	LM_3	LR	+	+	+	+	-	+	+	+	+	-	-	-	+	-
32	Purple	mb s	LM_3	LR	+	+	+	+	-	+	-	+	-	-	-	-	+	-

Table 4 continue

33	Redbrown	mb s	LM_3	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
34	Red	mb i	LM_4	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
35	White	mb i	LM_4	LR	-	-	-	+	+	+	+	+	-	+	+	+	-	+
36	White	m ma	LM_5	LR	-	-	-	+	+	-	+	+	-	+	+	+	-	+
37	Red	m ma	LM_5	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
38	Brown	m ma	LM_5	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	+
39	Brown	m kz	LM_5	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	+
40	Red	m kz	LM_5	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
41	Brownwhite	m kz	LM_5	LR	+	+	-	+	+	+	+	+	+	+	+	+	+	+
42	White	m kib	LM_6	LR	-	-	-	+	+	-	+	+	-	+	+	+	-	+
43	Red	m kib	LM_5	LR	+	+	+	+	-	+	+	+	+	+	-	-	+	-
44	Brown	m kib	LM_6	LR	+	+	+	+	-	+	+	+	-	+	-	-	+	+

DR= drought resistance PR= pest resistance BR= bird resistance EM= early maturity GT= good taste HY= high yield Vig= vigour EC= ease of cleaning LR= landrace + = preferred- = not preferred kw= kitui west kc= kitui central mu= mutomo mb k= mbeere kiritiri mb s= mbeere siakago mb i= mbeere ishiara m ma= makueni makindu m kz= makueni kibwezi m kib= makueni kiboko Fer= fermentation Por= porridge Ug= ugali Pil= pilau Mu= muthura (traditional dish) Bak= baking

Landraces with brown color schemes were the majority though not found in mbeere followed with those with white color scheme which occurred in all the districts. The fact that Mbeere district had the most landraces available with diverse colorations is a clear indication of a possibility of early existence of crop–wild–weed complex of sorghum in this particular region compared to Kitui, Mutomo and Makueni. In earlier studies, sorghums with diverse morpho-types have been reported in many of the sorghum growing regions of Africa, often as indistinct races of *S. bicolor* that form a crop–wild–weed complex (Ejeta and Grenier, 2005; de Wet, 1978). Other studies indicate that morphological diversity of sorghum in areas of origin occur (Clayton and Renvoize, 1982).

In this study, clusters of mixed landraces appeared to occur in different eco- zones while others were well spread across the region. Similar findings were reported in Zambia and Tanzania which was attributed to close distances between regions and farmers selection for specific uses (Tulole *et al.,* 2009). Agro ecological zone LM_3 and LM_4 had all landraces except black red and brown; and red brown respectively. LM_5 was dominated with white, brown white, red and brown. White and brown occurred in zone LM_6. A wide range of sorghum landraces are cultivated under diverse agro climatic conditions in Africa (Mutegi *et al.,* 2010). A continuum of wild-weedy-domesticate complex has been reported to occur in many sorghum growing parts of Africa (Mutegi *et al.,* 2010; Tesso *et al.,* 2008; Dogget, 1988; Dogget and Majisu, 1968). Moreover, cultivated and wild sorghum occupy diverse ecological landscapes and have over the years been subjected to diverse biotic and abiotic selection pressures across their geographic range. Wide spread of variation across the different climatic zones is therefore expected in the landraces of cultivated sorghum in Africa (Mutegi *et al.,* 2010).

The color of the grain varied considerably

within the sorghum landraces obtained. The variation within an accession indicated mixtures of materials planted by the farmers. An earlier study conducted by Kenya Food Security Steering Group (2008) showed that, only 10% of farmers use certified seed for other crops while 90% relied on locally selected seeds. A study conducted by Muui *et al* (2013), indicated that farmers obtain planting seed either from a previous harvest, borrow from neighbors or buy from the market; do not separate seed crop from the grain crop and harvest the crop together resulting to mixed crop stands. Seed exchange among farmers could be a contributing factor to high variation among sorghum landraces (Tulole *et al,* 2009). A study conducted by Nathaniels and Mwijage (2000) revealed sorghum seed exchange among farmers in southern Tanzania as one of the sources of planting seeds. In Zambia, Gwanama and Nichterlein (1995) found the existence of seed exchange among farmers was about 40 %.

Traits preferred by the farmers in landraces grown were high yields, high vigor, good taste, ease in cleaning, resistance to drought, early maturing, resistance to birds and other pests. Landraces with high yields were preferred by farmers in the four districts while those resistant to drought and pests were only preferred in Mbeere. Those preferred for bird resistance and early maturity were most preferred in Kitui and Mbeere while good taste was preferred in all districts except Makueni. The quality of a variety to be used as food largely determines its acceptability by the farmers while adaptation to biotic stresses determines the survival in the field and in storage (Sthapit *et al.,* 1999; Baidu-Forson, 1997). In India, farmers plant sorghum varieties that are high yielding, good in quality of both grain and fodder, and resistance to biotic and abiotic stresses (Rana *et al*, 2000). In Mali, general interest of farmers is in variety adaptation to general environmental conditions, eating quality, yield and resistance to different biotic stresses. In Tanzania, landraces are unique preferred by farmers due to resistance to both biotic and abiotic stresses, good in storage, processing and nutrition qualities (Medraoui *et al*., 2007; Mgonja *et al*., 2005; Kenga *et al*., 2004; Beta and Corke, 2001). Also, landraces perform well under sub-optimal conditions as they are well adapted to local stresses and possesses farmers' preferable traits (Bantilan *et al*., 2004; Setimela *et al*., 2004).

Most families in eastern part of Kenya grow sorghum landraces which are used for making fermented and un-fermented porridge, ugali (thick porridge) and other traditional dishes (Ministry of Agriculture, 2010). The color of the grain of landraces in this study was related to a particular grain use. White and brown white are used in preparation of porridge, *ugali, pilau, muthura* (mixture of sorghum and legume grains) and baking. Red and red brown are preferred for making porridge, *muthura* and for traditional fermentation. Black red, purple, pink brown, maroon and pink brown are used in preparation of *muthura* and in fermentation.

Specific sorghum uses impose a positive selection pressure towards a certain trait by farmers (Manzell *et al*., 2007; Tusekwa *et al.,* 2000). Grain color is recognized as an important consideration in cultivar selection with a greater preference for tan in Ethiopia and white in Mozambique, Zambia, and Zimbabwe as well as parts of Tanzania (Wortmann *et al.,* 2006). Red and brown grain types are preferred in Kenya, Rwanda, Uganda and Western Tanzania. Red and brown grain types are associated with higher tannin content thus preferred less by birds, and are less affected by mold (Wortmann *et al.,* 2006).

CONCLUSION

From this study, it's clear that farmers in eastern region of Kenya maintain a diversity of sorghum landraces by cultural preferences and traditional practices. Farmers maintain landraces that are unique in their adaptation, food quality, grain yield, quality of harvested products, biotic stress resistance and in post-harvest processing. The rich germplasm could be exploited for use in crop improvement programs. And since the region has a high agricultural potential, productivity for better food security could be improved by use of locally available germplasm adapted to this particular environment.

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