ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 04, pp.48570-48575, April, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

PERFORMANCE EVALUATION AND PALATABILITY TASTE OF CASSAVA VARIETIES IN FEDIS AND BABILE DISTRICTS, EASTERN ETHIOPIA

***[1]Gebisa Benti and [2]Gezu Degefa**

[1]School of Plant Sciences, College of Agriculture and Environmental Sciences, Haramaya University, Ethiopia
[2]Fedis Agricultural Research Center, Oromia Agricultural Research Institute, Ethiopia

ARTICLE INFO

Article History:
Received 11th January, 2017
Received in revised form
16th February, 2017
Accepted 22nd March, 2017
Published online 20th April, 2017

Key words:

Cake,
Cassava,
Injera,
Kello,
Porridge,
Qulle,
Root,
Sorghum.

ABSTRACT

In the eastern part of Ethiopia, land scarcity is one of the most important problems constraining food production. This problem has compelled farmers to practice monocropping and exposed the land to soil erosion and infertility. Therefore, it is important to practice a cropping pattern that enhances food production per unit area and also alleviates the problem of land degradation. Cassava (*Manihot esculenta*) could be a good candidate for this purpose since it is a drought tolerant crop that may produce higher yields per unit area. However, farmers in eastern Harerghe zone have no acquaintance with how cassava is processed into different food items. Therefore, the objectives of study were to evaluate performance of cassava and to determine the mixing ratio of sorghum-cassava flour for suitable food preparation in the study area. The treatments consisted of three cassava varieties (Kello, Qulle and local check). The experiment was laid out in randomized complete block design and replicated three times. Data were analyzed using the Generalized Linear Model of SAS Statistical Software package. Results revealed that there was significant ($P<0.05$) differences among the varieties for root diameter, root yields and number of roots per plant at Fedis and Erer. However, all others parameters did not significantly differ among the varieties. Kello and Qulle had increased root diameters by about 18.3% over the local check at Fedis while the local variety exceeded Kello and Qulle varieties in the number of roots per plant by about 14.1 and 36.7%, respectively. Kello and Qulle variety had superior root yields over the local variety by about 11 and 5 tons, respectively. There was also significant ($P < 0.05$) differences across the two locations for all parameters, except root length. The result showed that Qulle was more attractive in root color and ranked first among the evaluated varieties. Thus, it was found to be the most preferred variety in terms of sensory traits such as taste. Sole cassava flour was more preferred for cake making than the mixing ones for the three varieties. For porridge preparation, the ratio of 25 and 75% of cassava and sorghum flour, respectively, was the most preferred formulation for Qulle and the local variety while 50 and 50% of cassava and sorghum flour ratio was the most preferred formulation by farmers. According to attendants, Injera was not physically attractive when the ratio of cassava flour increased as compared to sorghum flour for the three varieties. Thus, sole sorghum flour was preferred by farmers for Injera making. In conclusion, Kello and Qulle variety performed well at Fedis and similar agro-ecology and they were most preferred by farmers for cake and porridge making.

Copyright©2017, Gebisa Benti and Gezu Degefa. *This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.*

Citation: Gebisa Benti and Gezu Degefa, 2017. "Performance evaluation and palatability taste of cassava varieties in Fedis and babile districts, Eastern Ethiopia", *International Journal of Current Research*, 9, (04), 48570-48575.

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a tropical woody shrub. It is dicotyledonous plant belonging to the botanical family *Euphorbiaceae* (Onwueme and Charles, 1994). It originated in North East Brazil with additional centre of origin in Central America. Though the domestication of cassava started in these districts, today the crop is cultivated all over the tropical world (Elias *et al*., 2001). Of all the tropical root crops, cassava is the most widely distributed and cultivated in different parts of the tropics (Kay, 1987; Onwueme and Sinha, 1991). It is being cultivated as the main source of energy and as the most important staple food crop for over 900 million people of the world (Bainbridge *et al*., 1997; Ngeve, 1999). In sub-Saharan Africa (SSA) cassava is mainly a subsistence crop grown for food by small-scale farmers who sell the surplus. It grows well in poor soils with limited labor requirements. It provides food security during conflicts when the invader cannot easily destroy or remove the crop, since it conveniently grows underground. Cassava is usually intercropped with vegetables, plantation crops (such as coconut, oil palm, and coffee), yam, sweet potato, melon, maize, rice, groundnut, or other legumes.

Corresponding author:* **Gebisa Benti,
School of Plant Sciences, College of Agriculture and Environmental Sciences, Haramaya University, Ethiopia.

The application of fertilizer remains limited among small-scale farmers due to the high cost and lack of availability. Roots can be harvested between 6 months and 3 years after planting. Apart from food, cassava is very versatile and its derivatives and starch are applicable in many types of products such as foods, confectionery, sweeteners, glues, plywood, textiles, paper, biodegradable products, monosodium glutamate, and drugs. It is rich in carbohydrates, calcium, vitamins B and C, and essential minerals. However, nutrient composition differs according to variety and age of the harvested crop, and soil conditions, climate, and other environmental factors during cultivation. Cassava chips and pellets are used in animal feed and alcohol production (IITA, 2009). Although reliable statistical information on the distribution and production of cassava in Ethiopia is lacking, the crop has been cultivated, particularly in the South, South West, and Western parts of Ethiopia since its introduction. Its use as a food security crop in Ethiopia has increased during and after the 1984 famine (Amsalu 2003). Its use as a potential food crop in Ethiopia has been appreciated since 1984 famine (Amsalu, 2006). Despite its importance, cassava production in Ethiopia has different constraints and opportunities. It is mainly cultivated by small resource poor farmers on smallholding plots of land. It is both a food security crop and a source of household income.

In Eastern part of Ethiopia, the land scarcity is the most important problem. This enforced farmers for monocropping and exposed the land to soil erosion and infertility. A better understanding of the importance of cassava crop is needed in order to develop production strategies, which minimize the poverty and can grow where other crops cannot grow. In Eastern part of Ethiopia, Fedis and Babile are one of the lowland woredas where low (500 - 600 mm) and uneven distribution of rainfall is received. Cassava can withstand low rainfall and is important lowland crop. Therefore, it is important to evaluate performance of different varieties to the area to fulfill the gap of food insecurity during the prevalence of drought. It is increasingly becoming a source of industrial raw material for production of starch, ethanol, waxy starch, bio-plastics, glucose, bakery and confectionery products, and glue among others. Fresh cassava roots cannot be stored for long because they rot within 48 hours of harvest. They are bulky with about 70% moisture content (Hahn, 1994). Therefore, cassava must be processed into various forms in order to increase the shelf life of the products, facilitate transportation and marketing, reduce cyanide content and improve palatability.

The nutritional status of cassava can also be improved through fortification with other protein-rich crops. Processing reduces food losses and stabilizes seasonal fluctuations in the supply of the crop. Traditionally, cassava roots are processed by various methods into numerous products and utilized in various ways according to local customs and preferences. Traditional cassava processing methods in use in Africa originated from tropical America, particularly north-eastern Brazil and have been adapted from indigenous techniques for processing yams (Hahn, 1994). The processing methods include peeling, boiling, steaming, slicing, grating, soaking or seeping, fermenting, pounding, roasting, pressing, drying, and milling to fine flour. Thus, the objectives of this study were: 1) to evaluate performance of cassava at low moisture stress area, and 2) to determine the mixing ratio of sorghum-cassava flour for suitable food preparation.

MATERIALS AND METHODS

Description of Experimental Site

The experiment was conducted at two districts (Babile and Fedis) to evaluate performance of cassava for root yield and yield parameters, and food preparation from mixing ratio of sorghum and cassava flour... Babile is located at 34 km from Harar city. Babile research sub site is located latitude of 09^{o} 10' 41.5" north and longitude of 042^{o} 15' 27.3" east, and altitude of 1200 - 1300 meter above sea level, which is lowland area. The second location is at Fedis research sub-site, which is located at the latitude of 9^{o} 07' north and longitude of 42^{o} 04' east, in the middle and lowland areas and at the altitude of 1702 meters above sea level, with a prevalence of lowlands. The area is situated at the distance of about 24 km from Harar town in the southerly direction.

Experimental Design and Treatments

The experiment was conducted with (Qulle, Kello and farmers' variety) cassava varieties. The treatments were arranged in Randomized Complete Block Design (RCBD) in three replications. Cuttings of 30 cm in length of each variety were randomly assigned to the plots and planted at 1m and 1.5m between plants and rows, respectively. Cassava roots uprooted washed, peeled and soaked in water for three days for fermentation and then dried in sunshine and after dried well it was broken to small pieces and milled to a flour. Sorghum was also grind and flour of cassava and sorghum were mixed in different ratio. The treatments for food preparation from sorghum and cassava flour mixing ratio were 0, 25, 50, 75, 100 and 100, 75, 50, 25, 0 cassava and sorghum flour, respectively. The treatment combination were (0, 100%), (25%, 75%), (50%, 50%), (75%, 25%) and (100%, 0) cassava and sorghum flour, respectively. About 50 farmers, 6 experts of food sciences and 4 developmental agents were participated on the sensory evaluation and cassava food preparation. Among the panelists farmers and experts about 25 of them were females farmers. Food preparation was carried out using different ratio of sorghum and cassava flour. Cassava roots uprooted washed, peeled and soaked in water for three days for fermentation and then dried in sunshine and after dried well it was broken to small pieces and milled to flour. Sorghum was also grind and flour of cassava and sorghum were mixed in different ratio.

Planting and Harvesting Procedures

Cuttings of 30 cm in length of each variety were prepared from healthy and young parents and randomly assigned to the plot size of 4.5 x 4m and planted at 1m and 1.5m between plants and rows, respectively. Each plot consisted of about 20 cassava plants. Matured cassava roots were harvested by digging the soil around the roots and uprooted safely. Then after, marketable and unmarketable roots were separated and washed with clean water.

Data Collection

Agronomic and yield data

Plant height (cm) was measured by tape meter from the base of the plant to the shoot tip at root maturity. The average of five plants were taken from each plot to measure plant height.

Normal and marketable roots were counted from each plant per plots. Five plants were taken randomly from each plot. Root length (cm) was measured by using 50 cm ruler from five plants per each plot. Root diameter (cm) was also measured by the use of veneer caliper from five plants per each plot. Average root weight (g) of five plants from each plot were measured using sensitive balance. Normal and uniform roots were measured by digital balance from the central four rows of each plot. collected and analyzed using Generalized Linear Model of SAS Statistical Software package.

Food taste data

Data of food sensory taste were collected by using the check lists and interviews simultaneously during tasting. Physical appearances of prepared food (Injera, Cake and porridge), color preferences data were collected after moved over food prepared and observation using check lists.

Statistical Data Analysis

Data were subjected to analysis of variance using the Generalized Linear Model of SAS Statistical Software package (SAS institute, 2003). Means that differed significantly were separated using the LSD (Least Significant Difference) test at 5% level of significance.

RESULTS AND DISCUSSION

Agronomic and Root Yield

The experiment was conducted to evaluate the performance of two varieties (Qulle and Kello) of cassava with one locally known cassava variety for their root yield and some agronomic traits. The results revealed that there was significant ($P<0.05$) differences among varieties for root yields and root diameter at Fedis. Number of roots per plant had significantly ($P<0.05$) affected by varietal differences at Erer. However, other parameters did no significantly affected due to varietal differences both at Fedis and Erer Valley. Kello and Qulle variety increased root yields over local variety by about 11 and 5 tons at Fedis, respectively. Tesfaye *et al.* (2012) stated root yields of Kello and Qulle were 28.1 and 27.2 tons, respectively, in southern part of Ethiopia. Variety Kello and Qulle advanced about 18.28 and 17.7% root diameters over locally cultivated cassava at Fedis location whereas locally cultivated cassava were increased number of roots per plant by 36.87 and 14.10 % over Qulle and Kello, respectively. This study was in agreement with the findings of Tewodros and Getachew (2013) who stated that root diameter had significantly ($P<0.01$) affected due to varietal differences and environmental interaction.

Table 1. Combined mean squares from analysis of variance for agronomic traits, yield and yield parameters of cassava

Traits	Replication (1)	Variety (2)	Residuals(14)	CV (%)
Plant height (cm)	0.0103	0.2003**	0.0304	7.8
Number of roots/plant	44.4940	34.1040*	8.7550	20.5
Root length (cm)	417.4000	6.2600ns	44.7000	12.8
Root diameter (cm)	24.4223	5.0871**	0.7610	11.3
Mean root weight (kg)/plant	71.9600	4.7070*	1.4160	23.3
Root yield (ton/ha)	7.19E+09	4.71E+08*	1.42E+08	23.3

**= highly significant, *=significant, ns=non-significant, E = power of 0^9 and power of 0^8

Table 2. Mean plant height, roots per plant, root length, root diameter, root weight per plant and root yield, of cassava varieties at Fedis and Erer

	Fedis						Erer					
Variety	Plant height (cm)	Roots/ plant	Root length (cm)	Root diameter (cm)	Root weight/ Plant(kg)	Root yield (tons/ha)	Plant height (cm)	Roots/ plant	Root length (cm)	Root diameter (cm)	Root weight/ Plant(kg)	Root yield (tons/ha)
Qulle	218.60	11.50	47.50	9.40a	7.04	31.28ab	232.00	12.17b	57.46	6.39	2.97	13.21
Kello	215.50	13.30	48.20	9.46a	8.36	37.18a	198.00	16.56ab	58.36	7.56	3.69	16.42
Local	247.80	13.77	46.87	7.73b	5.89	26.19b	238.00	19.28a	55.64	5.67	2.64	11.72
LSD	NS	NS	NS	1.34	NS	8.47	NS	4.840	NS	NS	NS	NS
CV%	6.7	32.1	10.3	6.7	25.8	25.8	8.9	13.3	12.3	13.1	16.5	16.5

Means in the same column sharing the same letter(s) are not significantly different at P =<0.0 5

Table 3. Combined mean root yield and some agronomic performance of cassava over location at Fedis and Erer

Variety	Plant height	Roots/plant	Root length	Root diameter	Root weight/plant	Root yield (kg)/ha
Qulle	2.25ab	11.83b	52.48	7.89a	5.01ab	22.25ab
Kello	2.06b	14.93ab	53.28	8.51a	6.03a	26.80a
Local	2.43a	16.52a	51.25	6.70b	4.27b	18.96b
LSD	0.180	3.263	NS	0.864	1.250	6.803
CV%	7.8	20.5	12.8	11.3	23.3	23.3

Means in the same column sharing the same letter(s) are not significantly different at P =<0.0 5

Table 4. Cassava root color preferences rank by attendants

Variety	Fedis	Babile
Kello	2nd	2nd
Qulle	1st	1st
Local	3rd	3rd

Figure 1. Cassava varieties on field at Fedis (A) and at Erer low rainfall and not productive as that of Fedis (B)

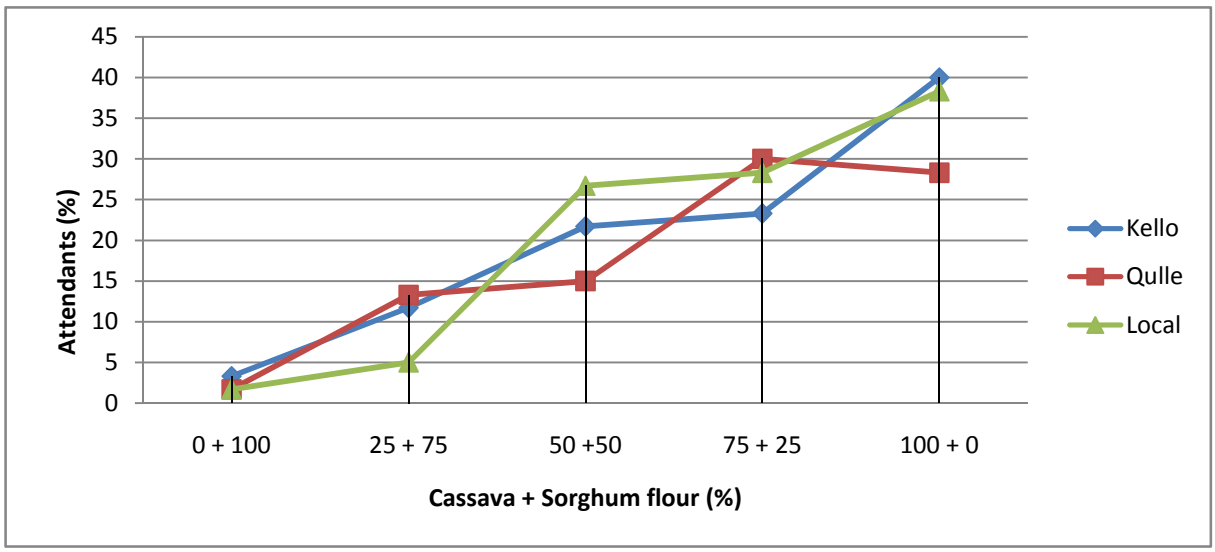

Figure 2. Cake preparation preferences from cassava and sorghum flour by attendants, respectively

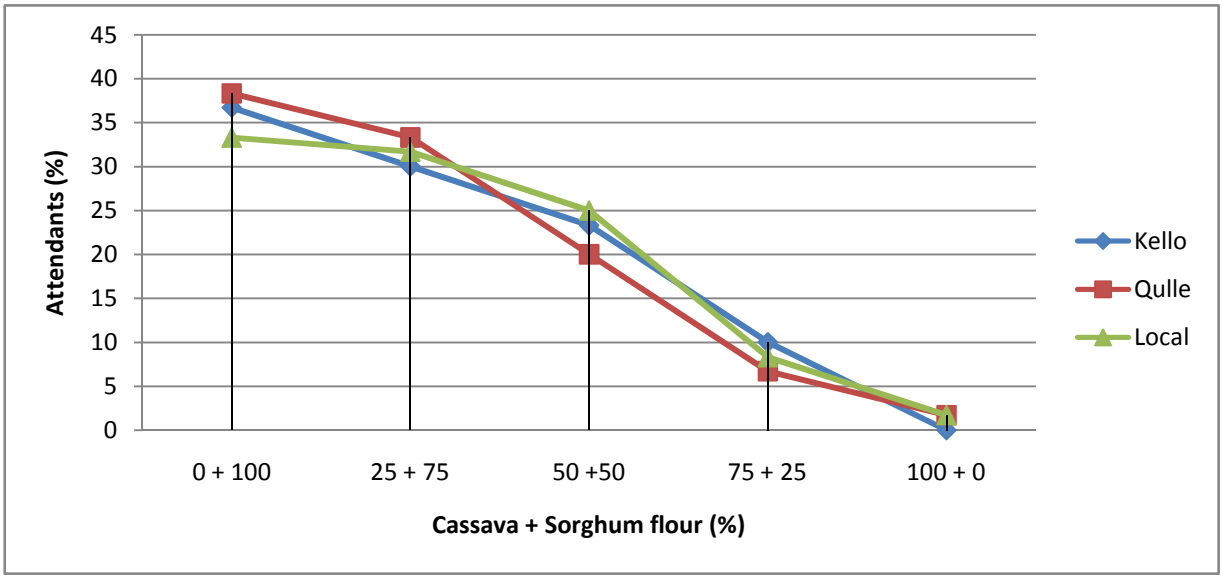

Figure 3. *Injera* preparation preferences from cassava and sorghum flour by attendants, respectively

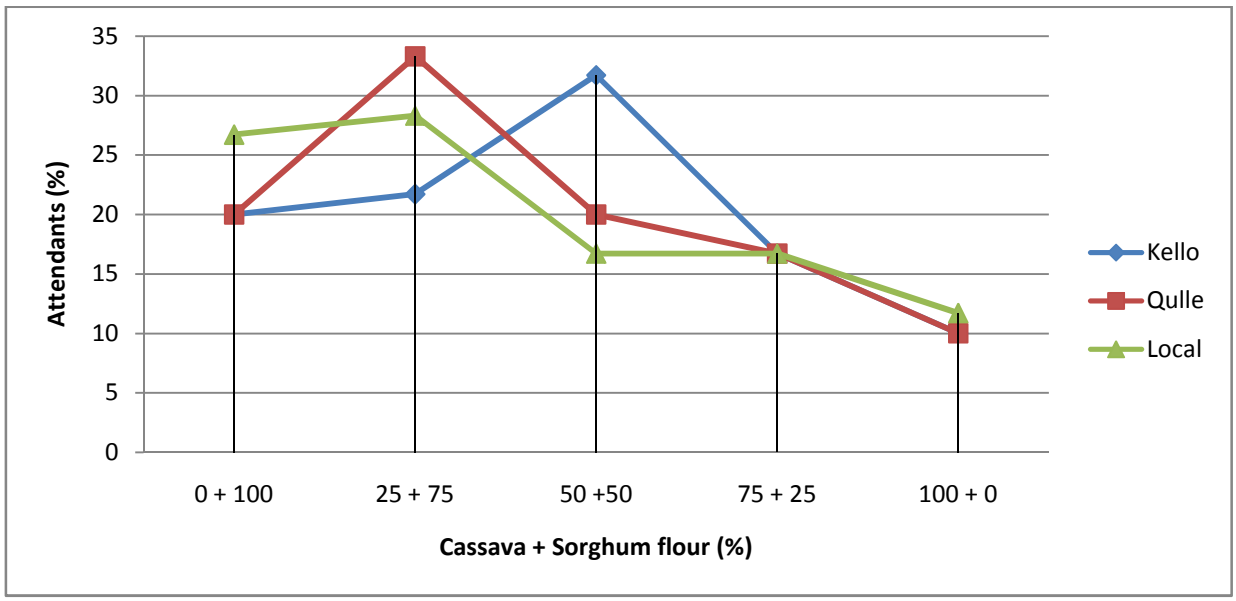

Figure 4. Porridge preparation preferences from cassava and sorghum flour by attendants

Figure 5. Food preparation from cassava roots: (A) Cassava *Injera*, (B) Cassava Cake, (C) Cassava porridge

There was significant variation ($P < 0.05$) between the two locations for all agronomic and yield components, except for root length. The differences among varieties due to locations was due to the shortage of rainfall at Erer than that of Fedis. It was observed that local/farmers variety formed more number of roots per plant, however, the roots were very small in size as compared to that of Kello and Qulle. Comparing root yields at Fedis and Erer (Babile) valley, there were significant differences among the three varieties due to location. Root yields at Fedis increased by about three times than that of at Erer (Babile) valley. This might be the occurrence of short and erratic rainfall at Erer valley than at Fedis. In general, there were root yields and root yield components advantages over farmers variety. There were also important qualitative advantages of variety Qulle and Kello over that of farmers variety. The quality advantages of these varieties were color, taste and other nutritional contents. These varieties were also well performed to the area, especially around lowlands of Harerghe (Fedis).

Cassava Food and Palatability Taste

The experiment of food preparation from cassava was conducted at Fedis research site. The three cassava varieties were evaluated for *Injera* making, porridge and Cake after mixed with different ratio of cassava and sorghum flour.

According to the sensory evaluation of cake, about 40, 28.3 and 38.3% of the attendants preferred sole flour of Kello, Qulle and farmers' cassava cake, respectively (Figure 2). Increasing cassava flour within sorghum flour in cake preparation increased the taste preference of the farmers, except Qulle which was the highest preferred at the ratio of 75 and 25%, cassava and sorghum flour, respectively. In line with this study, Mlingi and Ndunguru (2007) stated that the degree of liking or disliking of the cassava by a cross-section of people from a wide range of income groups showed that cassava cake was most preferred, probably because of its sweet taste while the cassava starch bread was highly preferred. Thus, the taste panelists indicated that sole cassava flour was preferred for cake preparation than mixed and sole sorghum flour. In contrast, *Injera* food prepared from mixed cassava and sorghum flour was rejected by attendants unlike that of cake taste. According to physical appearance and sensory taste evaluation, attendants for Injera preparation preferred the sole sorghum flour (Figure 3). Increasing cassava flour in sorghum flour linearly decreased the sensory taste and physical appearances, and preferences of attendants. In other way, attendants were also evaluated porridge taste, which was prepared from different ratio of cassava and sorghum flour (Figure 4). The result showed that 50% and 50% which was equal ratio of cassava and sorghum flour recorded the highest sensory value than the others mixed ratios for variety Kello

whereas 25 and 75% ratio of cassava and sorghum flour were more preferred for Qulle and farmers' variety.

Root Color Preferences

Color plays important role in marketing produces, especially in fruits, vegetables and root and tuber crops. Color is also important parameter in marketing cassava roots. Three cassava varieties were evaluated by farmers for their preferences and among the three varieties, variety Qulle got the first rank followed by Kello at both location of the experiment.

Conclusion

The experiment was conducted to evaluate the performance of two varieties (Qulle and Kello) of cassava with one locally known cassava variety for their root yield, agronomic traits and palatability of different cassava foods. It was observed that cassava performed well at Fedis and similar agro-ecology. Cassava roots were more preferred for cake making over mixing with sorghum flour. Accordingly, Kello variety was more preferred in sensory taste than both Qulle and local check whereas Qulle was the most attractive root color than the two varieties. Other study will be needed for cassava postharvest technology and food processing with other crops like wheat and other protein rich crops.

Acknowledgement

I am greatly indebted to the Oromia Agricultural Research Institute for funding the research. I am also most grateful to Amsalu Wegari and Adane Ashebir for their involvements in field data collection. Great thanks also go to Ms. Aster Asegid who technically assisted us in preparation of different cassava and sorghum flour through all the processes.

REFERENCES

Amsalu N. 2006. Phenotypic Diversity of Cassava (*Manihot esculenta* Cranz.) in Ethiopia. *Proceedings of the 12th Annual Conference of the Crop Science Society,* Ethiopia, 22-24 May 2006, Addis Ababa, Vol. 12, Pp 23-29.

Amsalu, N. 2003**.** Characterization and divergence analysis for Cassava (*Mannihot esculenta* L.) collection at Jimma. *M.Sc* thesis, Alemaya University, Alemaya.

Bainbridge, Z., Wellings, K. and Westhy, A. 1997. Village Level Cassava Processing (Field Guide). NRI, Chatham, UK. 28 pp.

Elias, M., Mikey, D., Panaud, O., Anstett, M.C. and Robert, T. 2001. Traditional management of morphological and genetic diversity by the Makushi Amerindians (Guyana, South America): Perspectives for on-farm conservation of crop genetic resources. *Euphytica,* 120(1): 143 –157.

Hahn, S.K. 1994. An overview of traditional processing and utilization of cassava in Africa. Pp .2-8. IITA (International Institute of Tropical Agriculture). 2009. http://www.iita. org/cassava OyoState, Nigeria

Kay, D. 1987. Root Crops. 2nd ed. Tropical Development and Research Institute, Clerkewell Road, London. Overseas Development Administration.

Mlingi N.V. and Ndunguru G.T. 2007. A review of post-harvest activities for cassava in Tanzania. *Proceedings of the 13th ISTRC Symposium*, pp. 506 - 513

Ngeve, J.M. 1999. Agronomic performance, yield stability and field disease reaction of cassava genotypes in the sub humid forest regions of Cameroon. *African Crop Science Journal,* 7(2): 129-142.

Onwueme, I.C. and Charles, W.B. 1994. Tropical root and tuber corps production, perspective and future prospects. FAO, Plant Production and Protection Paper No. 126. Rome, Italy.

Onwueme, I.C. and Sinha, T.D.1991. Field Crops Production in Tropical Africa. *CTA*. The Netherlands, 362 pp.

SAS Institute. 2003. SAS user's guide: Statistics. SAS Institute.

Tesfaye T., Daniel M., Fikre H., Molalish P. and Legesse H. 2012. Cassava production and utilization Manual. Tom publisher, Hawassa, Ethiopia.

Tewodros, M. and Getachew, WM. 2013. Evaluation of the adaptability and acceptability of improved varieties in Southern Ethiopia. *Greener Journal of Agricultural Sciences,* Vol.3(8), pp. 658 - 662.

****