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Diagnostic assessment of sweetpotato production in Ethiopia : Constraints, post-harvest handling and farmers' preferences

FEKADU GURMU*[1], SHIMELIS HUSSEIN AND MARK LAING

African Centre for Crop Improvement, Private Bag X01
Scottsville 3209, Pietermaritzburg, University of KwaZulu-Natal, South Africa
**(e-mail : fekadugurmu@yahoo.com)*

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ABSTRACT

Production and post-harvest handling of sweetpotato are constrained by many factors. The objective of the study was assessing and documenting the major constraints affecting production, pre- and post-harvest handling and farmers' preferences for sweetpotato in Ethiopia. It was conducted in three selected major sweetpotato growing zones in Ethiopia using a participatory rural appraisal methodology. The identified production constraints were heat and drought at 21.6%, shortage of planting materials (20.1%), shortage of land (15.7%), diseases (10.0%), insect-pests (9.4%), a lack of draft power (8.1%), shortage of money (7.9%), a lack of labour (5.1%) and weeds (2.0%). Poor access to markets at 22.6%, poor market prices (19.1%), low yields (14.2%), low root dry matter content (13.6%), a lack of knowledge on processing (11.7%), a lack of processing equipment (11.1%) and transportation problem (7.7%) were identified as the major post-harvest constraints. The major farmers' selection criteria for sweetpotato varieties were resistance to heat and drought (19.6%), dry matter content (16.4%), taste (14.3%), root yield (13.6%), resistance to disease and insects (13.3%), earliness (11.6%) and cookability (8.9%). Results of this study can serve as a baseline reference for strategic breeding and other interventions to develop sweetpotato varieties according to the needs of the farmers.

Key words : *Ipomoea batatas*, participatory rural appraisal, post-harvest handling, production constraints, selection criteria

INTRODUCTION

Sweet potato [*Ipomoea batatas* (L.) Lam] plays a significant role as a food security crop in the sub-Saharan Africa and Asia. Compared to other storage root crops, sweetpotato has the advantages of a high yield potential and adaptability to a wide range of agro-ecologies including drought affected environments (Lebot, 2010; Wang *et al.*, 2011). Also, the crop is a source of vitamin A that serves in prevention of vitamin A deficiency related health problems.

In Ethiopia, sweetpotato is the second most important root crop after ensete [*Ensete ventricosum* (Welw.) Cheesman] (CSA, 2010, 2011). It is widely grown in two regions, the Southern Nations, Nationalities and Peoples' Region (SNNPRS) and Oromia. In SNNPRS sweetpotato production is concentrated mainly in three zones : Sidama, Wolayta and Gamo Gofa. Especially Wolayta and Gamo Gofa zones are well known for their production of sweetpotato and they are heavily dependent upon this crop for food security (Belehu, 2003; Tadesse, 2006; Tofu *et al.*, 2007; Tesfaye, 2010).

Production of sweetpotato is constrained by biotic, abiotic and socio-economic factors. The biotic stresses include diseases, insect-pests and weeds, whereas the abiotic factors are drought, heat and low soil fertility (Kapinga and Carey, 2003; Ndunguru *et al.,* 2009). These factors have a direct effect on storage root yield. Constraints related to socio-economic and quality attributes are the lack of improved varieties, lack of planting materials, low storage root yield, low β-carotene content in the white fleshed sweetpotato and low storage root dry matter content (SRDMC) in the orange fleshed sweetpotato (OFSP) varieties currently available.

Varieties with high SRDMC are preferred by most African households since this trait is correlated with a good taste of the

[1]Southern Agricultural Research Institute, Hawassa Research Centre, P. O. Box 6, Hawassa, Ethiopia.

varieties (Belehu, 1987, 2003; Kapinga and Carey, 2003; Tadesse, 2006; Tofu *et al.*, 2007). Therefore, the white fleshed sweetpotato varieties are more accepted by farmers than the orange fleshed sweetpotato (OFSP) varieties due to their high SRDMC. OFSP varieties have low SRDMC and are not accepted by farmers in many of the African countries producing sweetpotato. However, the OFSP varieties are recommended for household consumption since they have high pro-vitamin A, which is essential for human health, specifically for regular growth and development, improved eyesight, metabolic functions, and an effective immune system (Bhaskarachary *et al.*, 1995; Kapinga *et al.*, 2005; Burri, 2011). Lack of proper post-harvest handling is also among the key factors that reduce the yield and quality of the crop. Different approaches are followed to assess these constraints and one of the approaches is participatory rural appraisal (PRA).

PRA is an approach and method that is used to enable rural people to share, enhance and analyse their own knowledge of life and conditions, in order to make plans and take actions (Chambers, 1994a, b). PRA methods are useful for gaining a preliminary understanding of the research area in a relatively short period of time. It is based on interdisciplinary, exploratory studies relying on a high use of community interaction and indigenous knowledge (Mark *et al.*, 1992). Different PRA tools were used for discussion with farmers and for data collection (Mark *et al.*, 1992; Chambers, 1994a, b). The objective of the study was to assess and document the major constraints affecting production, pre- and post-harvest handling, and farmers' preferences for sweetpotato in Ethiopia. The information may help researchers to devise a better breeding strategy that considers farmers' preferences.

MATERIALS AND METHODS

Description of Study Areas and Sampling

The PRA study was conducted in three major sweetpotato growing administrative zones in the SNNPRS of Ethiopia during 2013. The zones were Sidama, Wolayta and Gamo Gofa. The multi-stage random sampling techniques were used to create a representative sample of the population. First-stage sampling included a simple random sample to select two districts from each zone. The second stage of sampling selected two villages from each district. The third stage of sampling selected 15 farmers from each of the villages and questionnaires were administered to these farmers, except in Gamo Gofa zone where 16 farmers participated. This provided a total of 183 participants in the study (Table 1).

Data Collection

Different PRA methods and techniques such as semi-structured interviews and group discussion, discussion with key informants, focus group discussions, ranking and scoring (preference ranking, pair-wise ranking and

Table 1. Description of zones, districts and villages selected for the PRA study in the Southern Nations, Nationalities and Peoples' Region of Ethiopia

Zone	District	Village	Number of respondents		
			Male	Female	Total
Sidama	Hawassa Zuria	Kajima	11	4	15
		Lab Koromo	13	2	15
	Boricha	Medo Mukanka	7	8	15
		Shelo Elancho	9	6	15
Wolayta	SodoZuria	Warazasho	10	5	15
		Wojakeru	12	3	15
	Damot Gale	Ade Aro	13	2	15
		Buge	11	4	15
Gamo Gofa	Demba Gofa	Borda	12	4	16
		Uzete	13	3	16
	Kucha	Baso	11	4	15
		Zanga	14	2	16
Total	6	12	136	47	183
			74.3	25.7	100

matrix scoring and ranking), proportional piling, transect walk, and triangulation (using more than one source of information to cross check answers) were used for the study. Secondary data were also included. In the process of data collection, different actors participated. These were farmers (the central point and sources of information), researchers (breeder and socio-economists), technical assistant, extension officers (agricultural experts at district level and development agents at village level) and NGOs working in the area of food security and health. All members of the team participated during group discussions and a transect walk. In the case of focus group discussions and discussions with key informants, only some of the teams were included in the study. However, in all cases, the team consisted of researchers and farmers.

For the primary data, semi-structured interviews (SSI) were administered and discussions were made with farmers from each selected village on the farmers' preference for new sweetpotato varieties, especially the OFSPs.

Data Analysis

The data were coded, entered and analyzed using Statistical Package for Social Scientists (SPSS) Windows Version 19.0 (SPSS Inc, 2009). Data were analyzed and summarized using cross tabulations, means, frequencies, percentages, graphical representations and chi-square tests.

RESULTS AND DISCUSSION

General Description of the Study Areas

The three study zones, Sidama, Wolayta and Gamo Gofa were selected among 14 administrative zones and four special districts in the SNNPRS of Ethiopia. Sidama is well known for its coffee production. In this zone, among root and tuber crops, enset is the leading crop followed by potato and sweetpotato. Khat (*Catha edulis*), a stimulant crop, is also widely grown as a cash crop. Wolayta is a densely populated zone where land shortage is a major problem. Many crops are grown on small plots of land. Enset, sweetpotato and potato are the leading root and tuber crops. Gamo Gofa neighbours the Wolayta Zone. Sweetpotato, enset and cassava are the major root crops produced in this zone. The zones, districts, villages and number of farmers participated in the PRA study are presented in Table 1.

Sources of Income

The major sources of income of households in the study area are crop production at 82.3% followed by livestock (9.4%) and poultry (6.5%) farming. Other sources of income include off-farm employment and tuck-shops that have insignificant contributions (Fig. 1). More respondents indicated livestock as a major source of income in Sidama and Gamo Gofa zones than Wolayta.

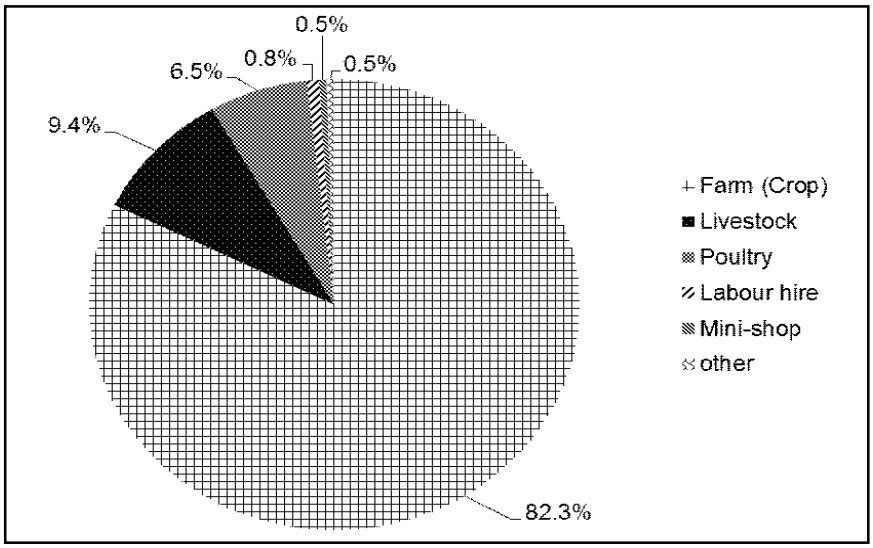

Fig.1. Proportion of income sources of the respondents in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia.

Types of Crops Grown

More than 13 different crops are grown in the study sites. However, the dominant crops grown are maize, enset, common bean, sweetpotato and potato (Fig. 2). Maize is the number one crop mentioned by all farmers at all places as an indispensable crop for their livelihood. The second is enset followed by common bean and sweetpotato, depending on the locality. This was also confirmed via pair-wise ranking of these crops (Table 2) and from group discussions. Apart from these dominant crops, other crops were also mentioned by farmers as valuable ones in their farming systems. For instance, in Sidama coffee and khat, in Wolayta taro and Gamo Gofa ground nut are some of the important crops in their farming system.

Status of Sweet Potato Production

Sweet potato is one of the priority food security crops in the region. In Gamo Gofa farmers placed sweetpotato second after maize. In Wolayta, it was ranked after maize and enset. In Sidama, it is the sixth crop after maize, enset, common bean, coffee and khat. Overall, sweetpotato stands the fourth important food crop in the study zones. Among root and tuber crops, it is the second after enset. The majority of the respondents, 58.3, 94.8 and 91.9% in Sidama, Wolayta and Gamo Gofa zones, respectively, indicated that sweetpotato was among their priority crops (Table 3). The remaining respondents i. e. 41.7, 5.2 and 8.1% in that order either did not grow sweetpotato or grew it as a complementary crop in their backyards.

According to the Ethiopian Central Statistical Agency reports of 2011-13, the SNNPRS is the major sweetpotato growing region in Ethiopia followed by Oromia except in the first half of 2013 where Oromia was the leading zone (CSA, 2011, 2012, 2013). The trend of sweetpotato production over the last three years (2011-13) is displayed in Fig. 3. Sidama, Wolayta and Gamo Gofa are the leading sweetpotato producing zones in SNNPRS. These zones contributed for 88.0, 86 9 and 91.7% of the total sweetpotato production in SNNPRS in 2011, 2012 and 2013, respectively.

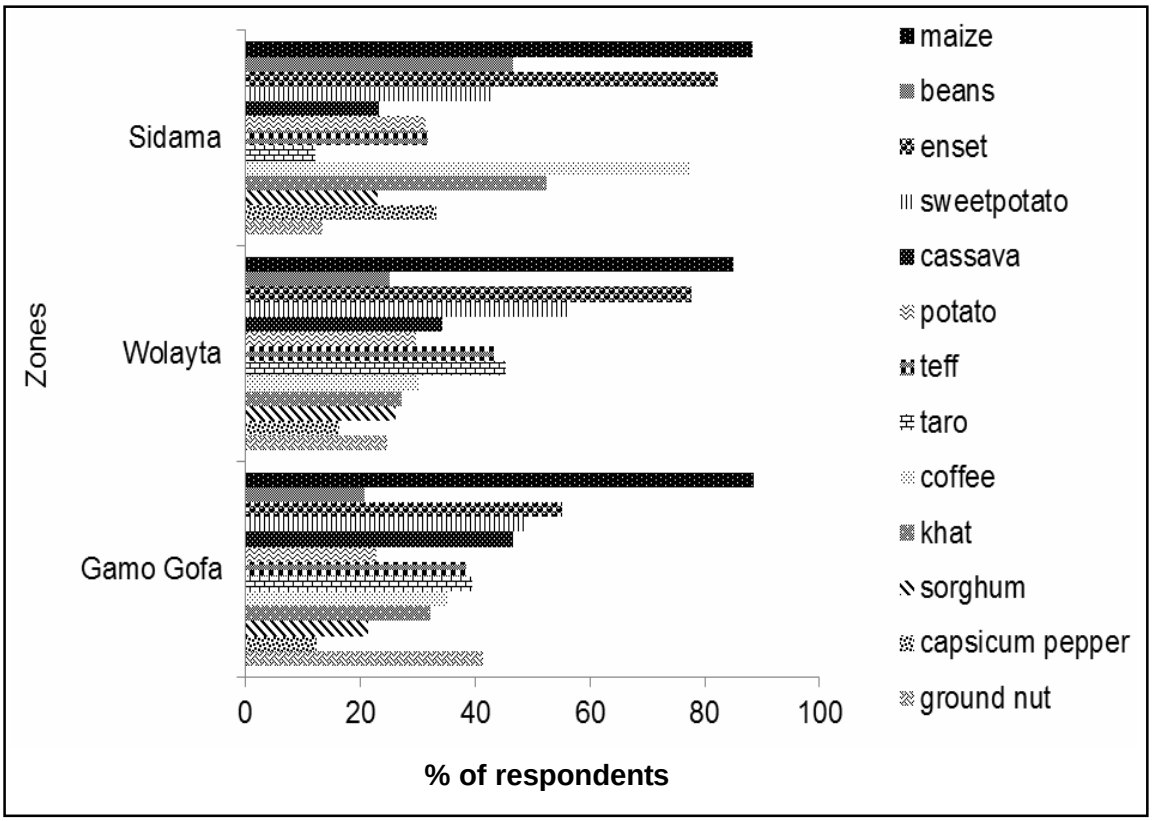

Fig. 2. Major crops grown in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia.

Table 2. Pair-wise ranking of crops grown in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia

Crop	A	B	C	D	E	F	G	Score	Rank
A		A	A	A	A	A	A	6	1
B			C	D	E	B	G	1	6
C				C	C	C	C	5	2
D					E	D	D	3	4
E						E	E	4	3
F							G	0	7
G								2	5

A–maize, B–Potato, C–Enset, D–Sweetpotato, E–Common bean, F–Sorghum and G–Teff.

Table 3. Farmers' response towards sweetpotato production in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia

Sweetpotato production	Zone			Average
	Sidama (%)	Wolayta (%)	Gamo Gofa (%)	
Yes	58.3	94.8	91.9	81.7
No	41.7	5.2	8.1	18.3
Total	100.0	100.0	100.0	100.0

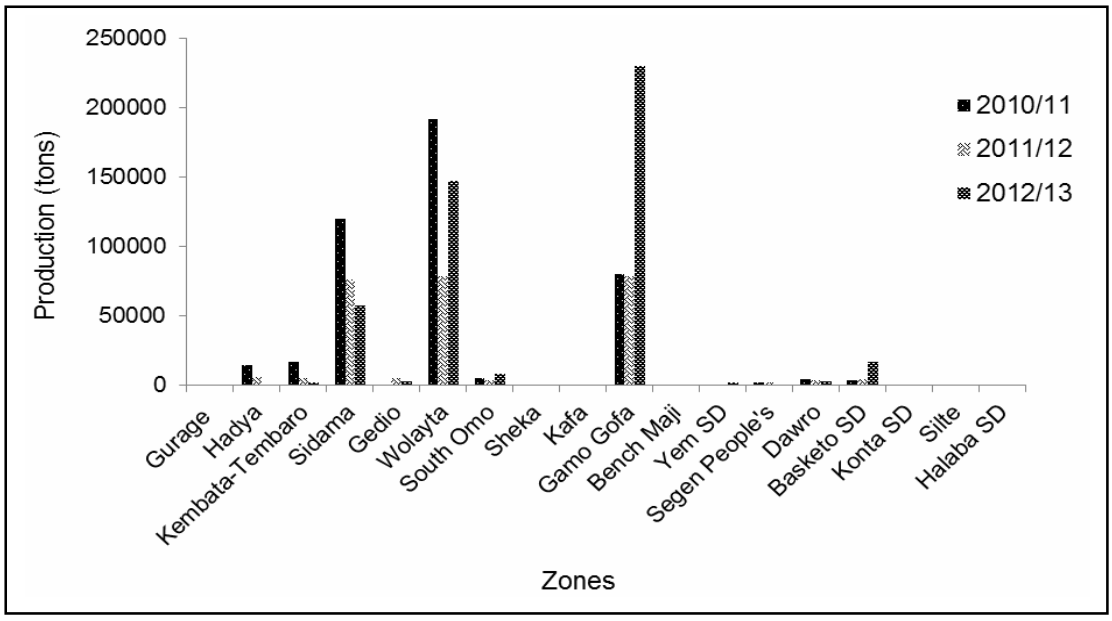

Fig. 3. Trends of sweetpotato production in the Southern Nations, Nationalities and Peoples' Region of Ethiopia from 2011-13.

Constraints Affecting Sweetpotato Production

Different sweetpotato production constraints were identified. The major sweetpotato production constraints in Ethiopia as described by respondent farmers included heat and drought at 21.6%, shortage of planting materials (20.1%), shortage of land (15.7%), diseases (10.0%), insect-pests (9.4%), a lack of draft power (oxen, donkeys, horses and mules) (8.1%), shortage of money to cover input costs (7.9%), a lack of labour (5.1%) and weeds (2.0%). There were highly significant ($P < 0.001$) differences among the respondents regarding the major constraints affecting sweetpotato production in the study areas (Table 4). Pair-wise ranking of major production constraints in the three zones is summarized in Table 5.

Of the respondent farmers, 86.3% grew sweetpotato when there was a drought or when their major cereal crops such as maize, sorghum and wheat failed. Many of the farmers

Table 4. Sweetpotato production constraints in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region (SNNPR) of Ethiopia

Production constraints	Farmers	
	Number	Per cent
Heat and drought	40	21.6
Shortage of planting materials	37	20.1
Shortage of land	29	15.7
Diseases	18	10.0
Insect-pests	17	9.4
Lack of draft power (oxen, donkeys, etc.)	15	8.1
Shortage of money to purchase inputs	14	7.9
Shortage of labour	9	5.1
Weeds	4	2.0
Total	183	100
Chi-square	60.00	
Significance level	0.000	

(87.6%) indicated that a shortage of planting material was one of the serious impediments affecting sweetpotato production.

Post-harvest Constraints

The major post-harvest constraints of sweetpotato were identified by the farmers as : poor access to markets at 22.6%, poor market prices (19.1%), low yield (14.2%), low dry matter content of storage roots of existing varieties (13.6%), a lack of knowledge about sweetpotato processing and preservation (11.7%), access to processing equipment (11.1%) and the logistics of transporting a heavy, bulky crop (7.7%) to market (Fig. 4).

In Ethiopia, sweetpotato is traditionally

Table 5. Pair-wise ranking of sweetpotato production constraints in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region (SNNPR) of Ethiopia

Constraints	A	B	C	D	E	F	G	H	I	Score	Rank
A		A	A	A	A	A	A	A	A	8	1
B			B	B	E	F	G	H	B	3	6
C				C	E	F	G	H	C	2	7
D					E	F	G	H	D	1	8
E						E	E	E	E	7	2
F							F	F	F	6	3
G								G	G	5	4
H									H	4	5
I										0	9

A–Heat and drought, B–A lack of draft power, C–Shortage of money, D–Labour shortage, E–Shortage of planting materials, F–Shortage of land, G–Diseases, H–Insects and I–Weeds.

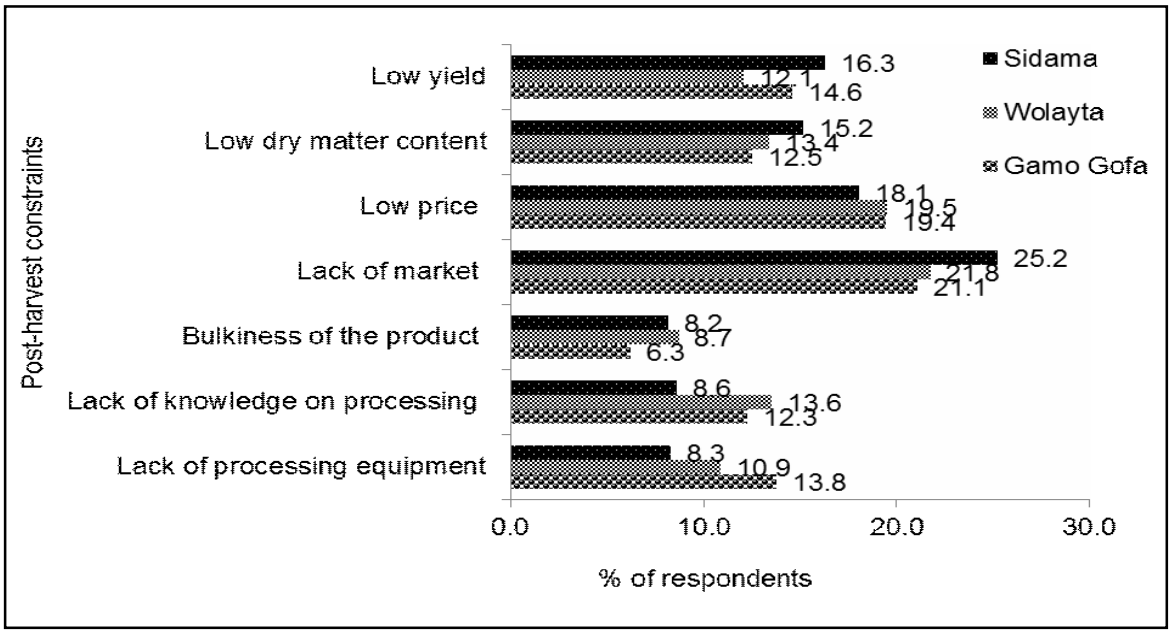

Fig. 4. Post-harvest constraints affecting sweetpotato in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia.

processed into numerous products, including : bread, enjera, flour, cookies, wot (stew), local beer and juice. Given proper training and access to appropriate equipment, farmers could make a range of food items from sweetpotato. This would reduce the post-harvest losses of the crop and would help to optimize its utilization.

Post-harvest problems affecting sweetpotato are mostly related to its short shelf-life, which is affected by the quality of the storage roots. Of all the farmers, 1.6% in Gamo Gofa used solar energy to dry sweetpotato storage root slices after harvest. The rest of the respondents (98.4%) stored the storage roots *in-situ* in the soil, harvesting them as and when they were needed for food. The major constraints that affect sweetpotato storage roots while leaving them in the soil were described by the respondents as heat at 31.6%, insect-pests (mainly weevil) (25.6%), diseases (21.8%) and rodents (20.9%) (Fig. 5). The respondent farmers believed that some rain was favourable for prolonging the lives of the storage roots in the soil, which was an unexpected observation.

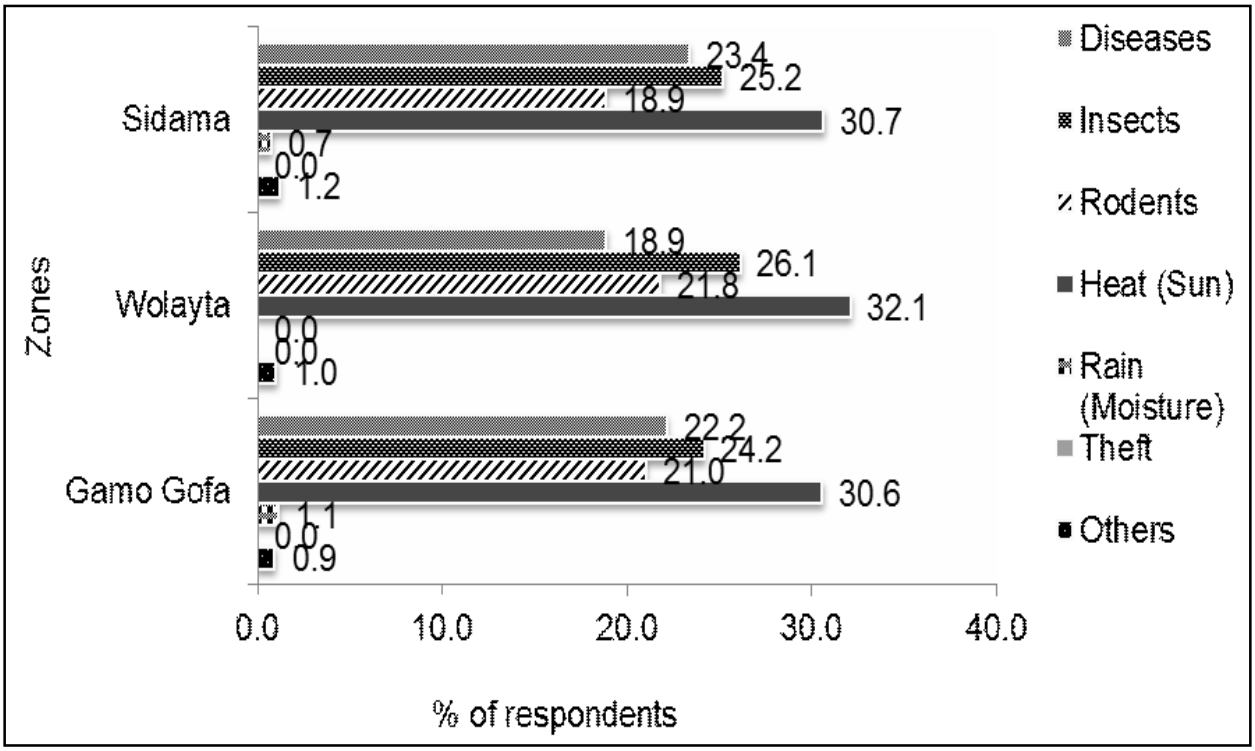

Fig. 5. Post-harvest root storage problems in Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia.

Farmers' Preferences for Sweetpotato Varieties

The major sweetpotato variety selection criteria as described by respondent farmers in the three study zones were resistance to heat and drought at19.6%, dryness of storage root after boiling i. e storage root dry matter content (SRDMC) (16.4%), taste (14.3%), storage root yield (13.6%), resistance to disease and insects (13.3%), earliness (11.6%) and cookability (8.9%) (Table 6). There were significant ($P < 0.05$) differences among the respondents with respect to their selection criteria for sweetpotato varieties in Wolayta and Gamo Gofa, but not in the Sidama zone. When the total number of respondents in the three zones was considered, the selection criteria significantly differed (Table 6). Skin and flesh colour, and flavour were ranked relatively low.

Farmers' Awareness on Orange Fleshed Sweetpotato (OFSP)

Orange fleshed sweetpotato (OFSP) is a β-carotene-rich crop that is a good, low-priced and sustainable source of vitamin A (van Jaarsveld *et al.*, 2005). In Sidama 78.3%,

Table 6. Different selection criteria of sweetpotato varieties in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia

Selection criteria	Zone						Total	
	Sidama		Wolayta		Gamo Gofa		Number	Per cent
	Number	Per cent	Number	Per cent	Number	Per cent		
Resistance to heat and drought	12	20.0	13	21.7	11	17.5	36	19.7
Dryness of root after boiling (SRDMC)	10	16.7	10	16.7	10	15.9	30	16.4
Taste	9	15.0	8	13.3	9	14.3	26	14.2
Root yield	8	13.3	9	15.0	8	12.7	25	13.7
Resistance to disease and insects	7	11.7	7	11.7	9	14.3	23	12.6
Earliness	7	11.7	7	11.7	7	11.1	21	11.5
Cookability	7	11.7	4	6.7	6	9.5	17	9.3
Root skin colour	0	0.0	1	1.7	1	1.6	2	1.1
Root flesh colour	0	0.0	1	1.7	1	1.6	2	1.1
Flavour	0	0.0	0	0.0	1	1.6	1	0.5
Total	60	100	60	100	63	100	183	100
Chi-square	2.53		19.50		21.92		77.38	
Significance level	0.865		0.012		0.009		0.000	

SRDMC–Storage root dry matter content.

Wolayta 83.1% and Gamo Gofa 67.7% of the respondents were familiar about OFSPs. Given a chance to choose and grow among the white fleshed sweetpotato (WFSP) and OFSP, 54.7% responded to grow both WFSP and OFSP, while 27.6% indicated WFSP and 17.8% preferred OFSP only (Table 7). Of the respondents who were aware about OFSPs, 77.7% disliked the varieties due to the inherent wateriness on cooking (low SRDMC) and hence its associated poor taste.

In the present study, crop production remains the key source of income of the households. Maize is the number one crop followed by root and tuber crops such as enset, sweetpotato and potato. These crops play a crucial role in sustaining food security in the SNNPRS of Ethiopia. Although sweetpotato is a very valuable crop in the region, its production shows an overall declining trend, primarily due to heat and drought, and lack of planting materials, which in turn related to the former.

The major sweetpotato production constraints mentioned by farmers were similar to previous reports from Tanzania and included drought, shortage of planting materials, land and labour shortages and, pests and diseases (Kapinga *et al.*, 1995). Tesfaye (2010) reported that fungal, viral and bacterial pathogens were the major causes of economic losses for sweetpotato worldwide. Sweetpotato viruses such as sweetpotato feathery mottle virus (SPFMV), sweetpotato chlorotic stunt virus (SPCSV) and sweetpotato virus G (SPVG) were reported as affecting sweetpotato production in some parts of Ethiopia. Among sweetpotato insect-pests, stem and root feeders such as weevils, sweet potato butterfly, sweetpotato hornworm, tortoise beetles and virus transmitter aphids were reported as yield limiting factors of sweetpotato production in

Table 7. Preference of farmers to grow white and/or orange fleshed sweetpotato in the Sidama, Wolayta and Gamo Gofa zones of the Southern Nations, Nationalities and Peoples' Region of Ethiopia

Preference	Zone			Average
	Sidama (%)	Wolayta (%)	Gamo Gofa (%)	
OFSP	1.9	31.4	20.0	17.8
WFSP	22.2	29.4	31.1	27.6
Both	75.9	39.2	48.9	54.7
Total	100.0	100.0	100.0	100.0

Ethiopia. Among these pests, sweetpotato weevil and sweetpotato butterfly were the major ones in the country (Getu and Adahanom, 1989; Azerefegn, 1999; Shonga *et al.*, 2013).

Sweetpotato is known as a relatively drought tolerant crop. However, due to the global climate change, even this crop is now affected by heat and drought, and its yield potential is being diminished. This also holds true for other regional crops that have been considered to be highly drought tolerant, such as cassava and enset (Belehu, 2003; Tesfaye, 2010).

Shortage of planting materials, affecting sweetpotato production, is partly caused by severe heat and drought that was described by many of the respondents. A shortage of suitable land was considered to be another challenge. This is because the land holdings of most of the households are small, averaging less than one hectare (CSA, 2003). Although disease and pests are among major constraints of sweetpotato, the farmers in the study area were less concerned about these constraints because the lack of planting materials and shortage of suitable land were the dominant constraints, stopping production of the crop entirely.

The post-harvest constraints mentioned by the respondents are comparable to those reported by Fawole (2007) in Nigeria. The report indicated that limited access to credit, lack of storage facilities, lack of processing technologies, poor market channels, limited support from the government, high labour cost and high incidence of pests and diseases were the major constraints affecting sweetpotato production, processing and marketing. The problem of low yield and low dry matter content can be solved through breeding and agronomic interventions, whereas the problems related to the marketing and processing of the products are more complex socio-economic issues.

Most of the farmers store their storage roots *in-situ* in the soil and harvest them gradually when they need them. A similar trend was reported from Uganda where farmers practised harvesting of sweetpotato in a piece meal manner by storing them in pits (CIP, 2005).

The farmers' selection criteria for sweetpotato varieties were similar to those reported from Rwanda where plant establishment, early maturity, drought tolerance, tolerance to pests and diseases, high SRDMC, high storage root yield and cooking qualities were the major selection criteria for sweetpotato varieties (Ndirigwe *et al.*, 2005).

Generally, farmers value resistance to heat and drought as the number one criterion for selecting sweetpotato varieties. SRDMC, which is expressed by farmers as dryness of storage root after boiling, was considered to be the second important selection criterion. Heat and drought have a direct effect on the yield of storage roots. Hence, breeding for heat and drought tolerance can significantly improve storage root yields in areas where these problems are prevailing. Early maturity was not expressed by the respondents as immediate solution to the problem of heat and drought. Farmers realize that early maturing varieties generate lower yields than medium and late maturing types.

Some of the respondents chose both WFSP and OFSP varieties because they need to ensure food security and to test the new OFSP varieties. Some respondents indicated their preference to grow either of the two as far as they are available. The preference towards the WFSP was mainly due to its high SRDMC. Farmers who preferred OFSP have tested it before and found out to be good, except for its wateriness on boiling due to its low SRDMC.

African farmers producing sweetpotato prefer varieties with high SRDMC (Kapinga and Carey, 2003; Tumwegamire *et al.*, 2004; Ssebuliba *et al.*, 2006; Kwach *et al.*, 2010). This is also true in Ethiopia as reported by Tadesse (2006) and Tofu *et al.* (2007). SRDMC has direct relation with the taste of sweetpotato varieties. Varieties with low SRDMC are watery and have poor taste in the opinion of farmers. This indicates that farmers are not only concerned about yield *per se* but also culinary taste. Hence, varieties with high SRDMC are preferred and this trait has direct relevance in sweetpotato breeding.

In general, OFSP is a staple food source of vitamin A, which is cheap and most accessible than other food items which are unavailable or unaffordable to poor farmers (Hagenimana *et al.*, 1997; Low *et al.*, 2001; Mwanga *et al.*, 2003; Kapinga *et al.*, 2005; van Jaarsveld *et al.*, 2005; Low *et al.*, 2009; Kaguongo *et al.*, 2010). Therefore, enhancing farmers' awareness on the importance of OFSPs as a source of vitamin A is very essential with concomitant increase of its dry matter content

through targeted breeding.

CONCLUSION

Sweetpotato is among the most important food crops in Ethiopia. It is widely grown in the SNNPRS and Oromia regional state. In SNNPRS, Sidama, Wolayta and Gamo Gofa are the major sweetpotato producing zones. Sweetpotato is not only a food security crop but can play a significant role in prevention of vitamin A deficiency related health problems. Orange fleshed sweetpotato (OFSP), which is rich in β-carotene, is a good source of vitamin A. However, sweetpotato production and its post-harvest handling is constrained by many factors that need to be alleviated. The major constraints such as heat and drought, disease and insect-pests and shortage of planting materials, can be solved through integrated research approaches with different disciplines and institutions. Other constraints such as shortage of land, shortage of draft power and shortage of money may need further interventions such as access to credit and entrepreneurship.

The OFSP varieties currently in use have achieved a low level of consumer acceptance due to their low SRDMC. Therefore, there should be a systematic breeding program that aims at improving the SRDMC of the OFSP varieties in order to increase their rate of adoption by farmers. On the other hand, there should also be other strategies such as awareness creation to consumers through training on the importance of OFSP in terms of its health benefits. This will help to increase the adoption of OFSP by the communities and to successfully fight the health consequences of vitamin A deficiency.

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