PARTICIPATORY VARIETIES SELECTION AND EVALUATION OF IMPROVED SWEET POTATO (*Ipomoea Batatas* (L.)VARIETIES ON-FARM AT DIFFERENT AGRO-ECOLOGIES IN WOLAITA ZONES SOUTHERN, ETHIOPIA

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Abstract:

Ethiopia is considered to be one of the major producers of sweet potato and involves major lands for this purpose. Whereas, varieties of sweet potato that yields maximum are not yet known. So this particular study is aimed to identify the variety for high yield, quality sweet potato, as well as its quantitative evaluation to be done.

Materials and methods: Area situated at Wolaita zone of SNNP regional state is considered as study venue; whereas the performance of fields is evaluated and specified the number of crop yield of that particular area. Result and Discussion: Eleven sweet potato varieties and four local varieties were prepared for the preliminary evaluation. Observations came up with the following varieties namely OFSP1, Kulfo, Koka 6 and Hawassa 83 which were mostly preferred by farmers. Both sweet potatoes had high acceptability; with an average score of 10,11,12,16, (A) and 17, 18 19, (B) out of a maximum of 20, without any significant differences in preference. The varieties were divided into four sets, with each set having two test varieties and the check variety. This is to ensure that farmers will not have difficulty in evaluating and comparing too many varieties.

Conclusion: Variety of the potatoes that are preferred by the farmers is different from each other, which are come up with Participatory varietal selection (PVS) technique. So as differences in ranking are also preferred by them, which later ensure the genetically diverse factors and differentials in growing yield of the crops.

***Keywords**: sweet potato (Ipomoea batatas* L.), *Variety analysis, sensory evaluation, consumer satisfaction, acceptability preferences.*

1. **INTRODUCTION**

Sweet potato [*1pomoea batatas* (L) Lam] is a herbaceous dicotyledonous plant, which the family *Convolvulaceae*. It was originated in Central America and it was domesticated more than 5000 years ago. Currently, it is widely grown throughout the tropics and temperate regions of the world between latitude 400 North and South of the equator and between sea level 2300 m.a.s.l. It is an important crop for food security and cultivated in over 100 among the six most important food crops after rice, wheat, maze, Potato and cassava. Over 95% of the global sweet potato production is in developing countries. China is the largest grower of sweet potato, producing 80% of the world's supply followed by producing each about 2.5% of the world's supply (FAOSTAT, 2012; FAO, 2010). Sweet potato is an important food security crop grown in many of the poorest regions of the world mainly by women for household consumption and a source of family cash income (Aritua and Gibson, 2002; Scott *et al.*, 2000). It is considered as a poor man's crop because of its low input requirement, ease of production and ability to produce under and marginal soil condition (Aritua and Gibson, 2002; Care *et al*: 1997). Most small-scale farmers in Africa and Asia used sweet potato both the vegetative and storage roots as a source of protein and vitamin for human food (Woolfe, 1992; and Scott *et al.,* 2000).

Sweet potato produces storage roots rich in carbohydrates and β-carotene, a precursor of vitamin A, and its leaves are rich in proteins. The roots also contain vitamins C, B complex, and E as well as potassium, calcium, and iron. Purple-fleshed ones contain antioxidants such as anthocyanins. In world crop statistics, the sweet potato is ranked seventh, just after cassava, with an annual production around 126.18 Mt and a cultivated area of 13.6ton ha^{-1} (Woolf, 1992). In most developing countries, it is a smallholder crop tolerant of a wide range of edaphic and climatic conditions and grown with limited inputs. It is also quite tolerant of cold and being cultivated at altitudes as high as 2,500 m, it has become the staple of communities living in the highlands of Uganda, Rwanda, and Burundi in Eastern Africa and in Papua New Guinea where annual per capita fresh roots consumption is over 150 kg. Asia is the largest producing region and China alone accounts for almost 60% of world production. In the southern provinces of Sichuan and Shandong, sweet potato is a major source of raw material for food processing industries ILSI (2008). Nearly half of the Chinese production is for animal feed (roots and leaves), with the remainder primarily used for human consumption, either as fresh (boiled roots) or processed products (noodles and

alcohol). In some temperate countries such as the United States, Japan, and New Zealand, the sweet potato is a high-quality luxury vegetable.

In Ethiopia, sweet potato production ranks third after Enset(*Enset ventricosum*(W.) Cheesman) and potato (*Solanum tuberosum* L.) compared to other root and tuber crops. It is one of the major traditional food crops in the country. The crop cultivation is common in densely populated areas of the South, South-West and Eastern parts of the country and Southern Nation and Nationalities People Regions (SNNPR). It is an important food crop during hunger periods in areas such as Wolaita, Sidama, Kambat-Tanbaro, Gamo-Gofa and Hadiya zones in SNNPR from February to May (Endale *et al.*, 1994) Ethiopia has a wide range of agro-climatic conditions and cropping system in the country is highly diversified with a wide variety of cereals, vegetables, tuber and root crops (CSA, 1995). Among root and tuber crops especially sweet potato is one of the third important crops after enset and potato (Endale *et al.*, 1994). The total area under sweet potato in Ethiopia is 75000ha with an average yield ha-^{1}of sweet potato in Ethiopia is 33.74 ton ha^{-1}(CSA 2014). It is also grown as a food crop. Sweet potato is consumed in traditional food and It is one of the cheapest sources of vitamin A.. The crop is produced highly for consumption than export. Different sweet potatoes cultivars have (shapes, colours sizes and maturity dates), popular for their taste and crack ability. Since a research is a crop lifetime process, it is expected to bring newly released common varieties to be selected by the end users called farmers. Different marker classes like speckled, red, white, black and etc. were released in different production years in the country as well as in the region. However, the genetic potential of those varieties deteriorates as they pass through a long time production year in the hand of farmers unless they are either maintained or substituted by better yielding and recently released varieties of sweet potato. Thus, newly released sweet potato varieties have to be selected in the participation of farmers. It is tolerant to adverse conditions like drought. It is an attractive food crop among farmers because it requires less care and input (CIP, 1995). It is a popular food in many parts of Eastern Africa. It is drought resistant, hardy marginal areas, thus contributing to improved food security. The young leaves and vines can be consumed as vegetables or fed to livestock (CTA, 2007).

Sweet potato propagation purchasing planting material or cuttings from adjoining areas. As a result of this, they have to pay very expensive prices and still there is no guarantee for the good quality plant materials, disease-free vine cutting.

The average yield ha-^{1}of sweet potato in Ethiopia is 33.74 ton ha^{-1}(CSA 2014). One of constraints among others in increasing yield ha^{-1}is lack of varieties of the crop which is adapted to specific condition of the area.

The existing issue of sweet potato production is the major concern of zone and the region as well. Therefore, the following general objectives: to recommend better yielder, disease and insect pest attack resistant farmers preferred trait sweet potato

- To identify variety for high yield, quality sweet potato
- To evaluate the varieties, acceptance under farm or consumer condition

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The experiment was conducted at Sodo Zuria at Gurumo Koish and Bakuluwa Segno Kebele and Boloso Sore Woreda at Sore Homba Kebele, Wolaita zone, SNNP regional state, which is located 390 km south west of Addis Ababa, 229 km south-west of Awassa. The site is located at 37^{o} 45' E longitude and 6^{o} 49' N latitude. The area has an average annual rainfall range of 1212 mm with the main growing season (August-October) 639mm and average minimum and maximum temperatures of 13.5^{0}C and 23 ^{0}C, respectively. It is also situated at an altitude of 1850 meters above sea level. The soil type of the site is Sandy clay loam (BOSW, 2003).

According to the 2000 E.C. data, Sodo Zuria has 307 households with a population of 4350 while Boloso bombe has 3056 households with a population of 17004. These areas are characterized by severe heat, lack of water, limited rain and unfavourable soil conditions, i.e. arable land is composed of rock and soil. Despite these marginal conditions, farming is still a major source of food and income. Farmer's major one Ginger, grow corn, yam, cassava, sweet potato, mango and banana.

2.2. Field performance evaluation

Six varieties were collected from the field biodiversity institutes of Ethiopia, four varieties from local farmer garde and two varieties from Areka Agricultural Research Center (AARC),a research institution working on maintained and conservation of root crops. These varieties were mostly collections from a different region in Ethiopia while some were advanced lines (or elite lines) and recommended varieties. They were selected based on their abundance and availability in the gene-bank. Passport and characterisation data were not available during collection.

The varieties were distributed to selected farmers in Sodo Zuria in Bakuluwa Segno and Gurumo Koish) and Boloso sore Homba Keble was selected for the study since OVOP (Jica) one village for one production has established several farmer-partners in the areas on September 2017. Distribution was limited to selected farmers and selected Boloso sore in Homba Keble for monitoring purposes. The distributed varieties were disseminated to neighbouring farmers and Homba through the local seed supply system since farmers usually exchange and share varieties as also noted by Endrias, et., *al* (2006).

3. Result and Discussion

The participatory variety selection ensured farmers to be a participant in the selection of improved sweet potato crop varieties in comparison with a local check based on their preference criteria. Accordingly, sweet potato varieties such as Falaha1, OFSP1 and Kulfo, Koka 6 and Hawassa 83, Beletech, Guntutea, Belela, Tula, Temesgen and Local were preferred at Sodo Zuria in Bakuluwa Segno and Gurumo Koish) site as 1^{st},2^{nd}, 3^{rd} , 4^{th},5^{th} and 6^{th} respectively. It can be said that improved sweet potato varieties evaluated in this site were superior to local check and best adapted to the specific environment and similar agro ecology provided that other factors kept constant. Both sweet potato had high acceptability; with an average score of 10,11,12,16, (A) and 17,18 19, (B) out of a maximum of 20, without any significant differences in preference. In the same taken, the yield of Falaha1, OFSP1 and Kulfo, Koka 6 and Hawassa 83,
Beletech,Guntute,Belela,Tula,TemesgenandLocalwere1300kg/ha,1500kg/ha,1410kg/ha,1120kg/ha,1350kg/ha,1300kg/ha,1100kg/ha,11055kg/ha,1000kg/ha,1200kg/ha and 800kg/ha in Gurumo Koisha and Bakuluwa Segno in sodo Zuria woreda of kebele. According to CSA 2014/2015, area in hectares, production in Quintals and yield per hectare of sweet potato was 239,755.25, 4,586,822.55, and 19.13 during Meher season in Ethiopia. Similarly, area in hectares,

production in Quintals and yield per hectare of sweet potato was 5,662.23, 93,892.80, and 16.58 during Meher (the main season) in SNNPR (CSA, 2014/2015)

These varieties were sweet and had fine flesh texture and beside three varieties Temesgen, Tula and Beletech have been showing less preference, On the other hand, Local were not preferred since these varieties were watery and too fibrous.

3.1. Sensory Evaluation of Sweet potato

The sensory evaluation was carried out for consumer acceptance to evaluate leaf attributes such as appearance, aroma, taste, mouth feel. Farmers participated during the final evaluation. Moreover, from taste, flesh texture and water content, farmers added selection criteria evaluated sweet potato varieties based on colour and aroma. This suggests that when equally good varieties are compared, farmers look for more desired characteristics to determine the best variety and overall acceptability of the sweet potato sample within two hours after boiling. Twenty panelists comprising of farmers and staff members from Biology Department, plant science and Horticulture Msc program of WSU and farmers and staff members of Rural Development department were randomly selected to perform the evaluation. Nine-point category scales were used to rate the attributes ranging from like extremely to dislike extremely as used by (Mepba *et al.*,2007). Samples were evaluated on a desk placed an open well-illuminated laboratory, which provided a quiet and comfortable environment.

In the sensory evaluation session, the sweet potato samples were sliced into pieces of uniform thickness using a knife and coded with arbitrary three digit numbers. The panellists were seated individually in order to avoid dependency of one panel on the other. The coded samples were presented in random to each panellist on identical white plastic tray at ambient temperature. Unsliced loaf was also provided along with sliced in order to evaluate general appearance of the cooked sweet potato sample. Panellists were asked to indicate their degree of liking for each attribute of the coded samples by choosing the appropriate category. Panelists were provided with palatable water to rinse their mouth before and after evaluating each sample to eliminate bias between evaluations.

Eleven sweet potato varieties and four local variety) were prepared for the preliminary evaluation. The varieties were divided into four sets, with each set having two test varieties and the check

variety. This is to ensure that farmers will not have difficulty in evaluating and comparing too many varieties.

Twelve farmers participated in the activity from each kebele. They were divided into four groups wherein each group was given a set of varieties for evaluation. Farmers tried the varieties one at a time. They were given water to drink after tasting each variety to reduce error. After tasting all samples, farmers determined their preferred and non-preferred varieties.

Table 1 **Results** and Rank of evaluated sweet potato varieties in PVS (participatory variety selection) trial at Sodo Zuria in Bakuluwa Segno and Gurumo Koish) Kebele during on September 2016/17 G.C

No	Variety	Individual Scores (panelists) F1	Individual Scores (panelists) F2	Individual Scores Farmer3	Individual Scores Staff 4	Total sum	Rank
1	Falaha 1	4 very little aroma	1(fine flesh texture, aromatic, sweet)	1 (sweet, fine flesh texture)	6	20	1
2	Belela	3	2	2	4	14	6
3	Tula	2	3	4	1	13	7
4	Beletech	4	2	2	7	15	4
5	Hawassa 83	4 watery	8	4(very little taste)	1 sweet	17	3
6	Temesgen	3	2	4	3	12	9
7	OFSP 1	5 (sweet)	6(Size ,color)	6(sweet, fine flesh texture	2	19	2
8	Guntute	4	3	7	3	17	5
9	Koka 6	2 color	3	8	5	18	3
10	Kulfo	4	4	2	5	19	2
11	Local	3	2(white color	2	4	11	8
	Total score					**20**	

1,2,3,4,5. Score given by each farmer on the variety and rank of each variety (based on total scores)
11,12,13....20. sum of individual scores

Conclusion

Participatory varietal selection (PVS) on sweet potato indicated a difference of improved varieties preferences among farmers as well as from districts to districts. For instance, Falaha 1 was selected as 4th variety at Belela and Guntutea whereas it was preferred as 5th at Sodo Zuria in Gurumo Koish and Bakuluwa Segno Kebele. Beside this, there was a little difference between farmers' preference rank and rank based on the estimated yield obtained from each variety. Taking as a whole, continuous evaluation of diverse sweet potato varieties; which is aimed to substitute local varieties, might accelerate the adoption of improved varieties and at the same time maintain genetic diversity of the sweet potato.

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