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Evaluating the Performance of Improved Sweet Potato (Ipomoea Batatas) Varieties at Shishir, Southern Ethiopia

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Abstract
Field trial was conducted in 2014 rainy season at the Shishir Kebele of South Ari Woreda. The objective of the study was to evaluate the performance of improved sweet potato varieties with a view to identify those that may be adaptable with high yielding potential in the study area. The treatments consisted of 7 sweet potato varieties: Awassa-83, Temesgen, Beletech, Kulfo, Tula, Belela, Guntutea and a local check. These were laid out in a Randomized complete block design with 3 replications. Significant differences were observed on the parameters mean number of roots per plot, total fruit weight per hectare, marketable fruit weight per hectare, unmarketable fruit weight per hectare, mean vine weight per plot, average root diameter and average root length. Maximum number of roots per plot was recorded on varieties Beletech (87.00) and Local check; whereas minimum number of roots per plot was recorded on Guntutea and Kulfo. Awassa-83 (135.66 ton ha^{-1}) and Kulfo (124.66 ton ha^{-1}) recorded maximum marketable fresh weight per hectare; whereas minimum mean marketable fresh weight per hectare was recorded on Local check (43.00 ton $ha^{-1)}$. Sweet potato need to be cultivated as a stable food crop for food security and nutritional security to feed the ever increasing population of Ethiopia. To increase production and productivity appropriate varieties has to be looked for beside other agronomic and plant protection activities. In the present experiment, since the local variety performed less as compared to the improved ones farmers should avoid using of the Local variety and replace with the well performed white fleshed and orange fleshed sweet potato varieties.
Keywords: Orange fleshed; Sothern Ethiopia; sweet potato; variety evaluation; white fleshed

1. INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a dicotyledonous plant that belongs to the family Convolvulaceae (Austin, 1988). It is among the important food crops in the world, after wheat, rice, maize, Irish potato, and barley and it ranks second following Irish potato in the world's root and tuber crops production and third after Irish potato and cassava in consumption in several parts of tropical Africa (Lenne', 1991 and Talekar, 1987). Sweet potato is both a staple and a vegetable crop, containing a significant amount of proteins, provitamin A, B, and C and minerals such as Ca, Fe and Na (Alvarez, 1986 and Lenne', 1991). It is drought resistant, hardy and can grow in marginal areas, thus contributing to improved food security. Considering its importance, sweet potato is seen as a major root crops cultivated in global food crop production. It is grown widely throughout Sub Saharan Africa and is one of the most important food crops in Africa (FAOSTAT, 2013).

Ethiopia ranks fifteenth in the world in terms of sweet potato production (Dan *et al*., 2013). The annual production of sweet potato in Ethiopia is 2,701,599 tons. About53, 369 ha of land are annually covered by sweet potato in the main rainy season (FAOSTAT, 2014). In Ethiopia sweet potato ranks the first in total production (42.84%) and the second in area coverage (25.43%) next to Irish potato from root and tuber crops cultivated (CSA, 2014). It is an attractive food crop among farmers because it requires less care and input (CIP, 1995). Sweet potato is commonly grown around densely populated areas in the South, South Western and Eastern parts of the country. At least 20 million Ethiopians depend on this crop as their source of food (Assefa *et al*., 2007). It grows in the lowland and mid altitude areas of the Southern region and grows both in belg/short rainy season/and meher/main rainy seasons/ in small plots by subsistence farmers (Tenaw *et al*., 2011).

Sweet potato has received increased attention because it can adapt to a wide range of environmental conditions and grows even on marginal areas with poor soils of limited fertility and inadequate moisture (Bioethics Nuffield Council, 2004). In Ethiopia, sweet potato is widely grown on about 50,000 ha with an average yield of only 7 t/ha (Geleta, 1996). This is quite low as compared to the world average yield of 14.9 t ha^{-1} (FAO, 2001) and experimental storage root yield ranging between 30 to 73 t ha^{-1} (Bhagsari and Ashley, 1990 and Varma *et al*., 1994).

According to Geleta (1996), the reason for its low productivity in Ethiopia is low soil fertility, lack of agronomic packages especially plant nutrient management. In addition, poor seedbed preparation, the diverse and complex biotic, abiotic and human factors have contributed to the existing low productivity of sweet potato in Ethiopia. Some of the production constraints include lack of good quality planting materials, poor soil management practices, lack of suitable seedbed preparation, disease, insect pests, weeds and improper time of planting and harvesting (Enyi, 1977; Onwueme and Sinha, 1991).

2. Materials and Methods

2.1. Description of the Study Area

The experiment was conducted at South Ari woreda *Shishir Kebele*, in Southern Ethiopia. The site is located at N 06.43520 and E038.25425 with altitude of 1442 m.a.s.l.The soil at the site is characterized as sandy clay loam with PH of 7.68. The livelihood of the people of the zone is mostly pastoral and agro-pastoral.

2.2. Planting Materials and Experiment Methodology

Seven improved and recommended varieties of sweet potato (Awassa 83, Beletech, Belela, Temesgen, Kulfo, Guntutea and Tula) were brought from Hawassa research center and tried for their adaptation with local variety in RCBD with three replications in 2014 with the objective to identify Sweet potato variety/ies that is/are better in yield and other agronomic characteristics. Six rows with recommended spacing of 30 cm between plant and 60 cm between rows were followed. No fertilizer and other chemicals were applied to this experiment.

2.3. Data Collection and Statistical Analysis

Data were collected on parameters like average root number per plot, total fresh weight per hectare, marketable fresh weight per hectare, unmarketable fresh weight per hectare, average vine weight per plot, average root diameter and average root length. Diseased, deformed and tubers with a weight of less than 100 gram were recorded as unmarketable. Analysis of variance for the collected parameters was performed as per the methods described by Gomez and Gomez (1984) using SAS computer software (SAS, 2009). Least Significant difference (LSD) test was used to separate the means at 5% probability level.

3. Result and Discussion

The result of ANOVA showed that there is significant variation ($P < 0.05$) between varieties for yield and yield related parameters (Table 1). Maximum number of roots per plot was recorded on varieties Beletech (87.00) and Local check (90.66) with no significant difference over Belela (76.33); whereas minimum number of roots per plot was recorded on Guntutea and Kulfo with no significant difference over the varieties Tula, Temesgen and Awassa-83.

Total fresh weight per hectare showed a significant difference ($P < 0.05$) among varieties (Table 1). Highest total fresh weight per hectare was recorded on the varieties Awassa-83 (162.33 ton ha^{-1}) and Kulfo (140.66 ton ha^{-1}); lowest total fresh weight per hectare was recorded on Local check (55.00 ton $ha^{-1)}$ with no significant difference over Temesgen (63.66 ton $ha^{-1)}$.

Tesfaye *et al*. (2011), also reported significant variation between sweet potato genotypes in yield and other desirable traits in their adaptation trial in different agro ecologies of Ethiopia.

Mean marketable fresh weight per hectare also showed a significant difference ($P < 0.05$) among varieties (Table 1). Maximum marketable fresh weight per hectare was recorded on the varieties Awassa-83 (135.66 ton ha^{-1}) and Kulfo (124.66 ton ha^{-1}); whereas minimum mean marketable fresh weight per hectare was recorded on Local check (43.00 ton $ha^{-1)}$.

Mean unmarketable fresh weight per hectare also showed a significant difference ($P < 0.05$) among varieties (Table 1). Maximum unmarketable fresh weight per hectare was recorded on the varieties Awassa-83 (26.66 ton ha^{-1}) and minimum mean unmarketable fresh weight per hectare was recorded on varieties Beletech, Belela, Guntutea and Local check with no significant difference over the varieties Temesgen and Kulfo.

Again mean vine weight per plot also showed a significant difference ($P < 0.05$) among varieties (Table 1). Awassa-83 (18.66 kg) and Kulfo (19.00 kg) recorded the heaviest vine weight with no significant difference over the variety Tula (16.33 kg). Local check (12.00 kg) recorded the lightest vine weight with no significant difference over the varieties Temesgen (14.66 kg), Beletech (15.00 kg), Belela (14.33 kg) and Guntutea (15.00 kg).

Average root diameter and length showed a significant difference ($P < 0.05$) among varieties (Table 1). Variety Kulfo recorded the thickest (49.33 cm) and shortest (6.63 cm) average root diameter and length respectively; in contrast the variety Awassa-83 recorded the thinnest (31.00 cm) and longest (12.16 cm) average root diameter and length respectively.

Table 1: Mean values for yield and yield components of eight sweet potato varieties grown at Shishir in 2014 cropping season.

Varieties	MNRPP	TFWPH	MFWPH	UMFWPH	MVW	ARD	ARL
Awassa 83	69.00^{BC}	162.33^{A}	135.66^{A}	26.66^{A}	18.66^{A}	49.33^{A}	12.16^{A}
Temesgen	63.66^{BC}	73.66^{ED}	58.66^{CD}	15.00^{BC}	14.66^{BC}	35.66^{CD}	11.00^{A}
Beletech	87.00^{A}	104.66^{BC}	93.33^{B}	11.33^{C}	15.00^{BC}	46.66^{AB}	8.45^{B}
Belela	76.33^{AB}	96.66^{BCD}	83.33^{BC}	13.33^{C}	14.33^{BC}	35.00^{CD}	8.35^{B}
Guntutea	58.33^{C}	83.00^{CD}	71.00^{BC}	12.00^{C}	15.00^{BC}	28.33^{E}	6.53^{B}
Kulfo	55.00^{C}	140.66^{A}	124.66^{A}	16.00B^{C}	19.00^{A}	31.00^{DE}	6.63^{B}
Tula	66.66^{BC}	110.33^{B}	90.33^{B}	20.00^{B}	16.33^{AB}	44.00^{B}	7.36^{B}
Local	90.66^{A}	55.00^{E}	43.00^{D}	12.00^{C}	12.00^{C}	37.66^{C}	11.66^{A}
Significance	*	*	*	*	*	*	*
Mean ±	70.83±	103.29±	87.50±	15.79±	15.62±1.	38.45±	9.02±
SE	5.15	8.87	9.12	2.09	17	1.74	0.75
LSD(0.05)	15.64	26.91	27.68	6.34	3.55	5.29	2.27
CV (%)	12.60	14.88	18.06	22.93	12.98	7.85	14.42

Means followed by the same letter in the same column are not significantly different at 5 % LSD test and the reverse is true for different letters. SE= standard error MNRPP=mean number of roots per plot, TFWPH=total fresh weight per hectare, MFWPH = marketable fresh weight per hectare, UMFWPH=unmarketable fresh weight per hectare, MVW=mean vine weight, ARD=average root diameter, ARL=average root length

Table 2: Mean square values for yield and yield components of eight sweet potato varieties grown at Senegal, in 2015 to 2016.

Source	DF	MNRPP	TFWPH	MFWPH	UMFWPH	MVW	ARD	ARL
Replication	2	23.29ns	350.04ns	307.12ns	21.16ns	12.50ns	5.79ns	1.43ns
Variety	7	498.85*	3685.56*	2933.42*	81.99*	16.13*	169.23*	15.52*
Error	14	79.76	236.27	249.83	13.11	4.11	9.12	1.69

*=significant, ns =non significant, MNRPP=mean number of roots per plot, TFWPH=total fresh weight per hectare, MFWPH = marketable fresh weight per hectare, UMFWPH=unmarketable fresh weight per hectare, MVW=mean vine weight, ARD=average root diameter, ARL=average root length

4. Conclusions and Recommendation

Sweet potato need to be cultivated as stable and food security crop to feed the ever increasing population of Ethiopia. To increase production and productivity appropriate varieties has to be looked for beside other agronomic and plant protection activities. In the present experiment, since the local variety performed less as compared to the improved ones farmers should avoid using of the Local variety and replace with the well performed white fleshed and orange fleshed sweet potato varieties. Other agronomic trials should be done for the success of production and productivity of sweet potato in the area. Nutrient content and other quality parameter analysis and also suitable post harvest management practices needs to be done to improve the quality and longtime use of the crop. Especially the beta-carotene content of the orange fleshed sweet potato variety should be studied in advance to overcome the nutritional security problem in the studied area.

Using improved varieties of sweet potato especially Awassa-83 from the white fleshed and Kulfo from orange fleshed could make an important contribution to increase agricultural production and productivity in areas like Shishir where there is low practice of using improved crop varieties. To this end, use of improved sweet potato technologies such as improved varieties could be one of the alternatives to improve productivity by small farmers. However, the use of improved sweet potato varieties is not yet studied in the area. Thus, this research work is initiated to investigate the impact of including improved hot pepper varieties on the existing production system is of paramount important.

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