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Research Article

Performance Evaluation of Sweet Potato Varieties (*Ipomoea Batatas (L) Lam*) at Kamashi area, Western Ethiopia

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Abstract

Sweet potato is one of the root crops grown in the country for food purpose. However, its potential to guarantee food security is under estimated. Kamashi area is one of the districts of Benishangul Gunuz region where sweet potato has been growing. However, planting materials of improved sweet potato varieties are unavailable since no research works are done on sweet potato in the region. In view of that, field experiments were conducted during 2013 and 2014 at Kamashi with the objective to evaluate the performance of different improved sweet potato varieties. Six improved and recommended varieties of sweet potato (Awassa 83, Beletech, Bueteca, 004/616, 004/6-vita, and Tulu) were brought from Awassa Agricultural research center and tried for their adaptation with two local varieties in RCBD with three replications.

The performance evaluation of different varieties was conducted by analyzing data on vegetative growth, and yield. The results revealed that there were significant differences on performance of different sweet potato varieties on number of tubers per plant, tuber fresh weight per plant, root dry weight per plant, root length and yield. No significant difference among varieties on root dry matter content. From all varieties tested the highest yield performance was observed on Awassa 83 sweet potato variety in both testing years (78.93ton ha^{-1} and 79.26ton ha^{-1}) respectively. However, since the experiment was conducted on one location for two growing seasons, it should be conducted on two different locations to generate more quality data.

Keywords: Sweet potato; Improved variety performance; Research work; Yield

Introduction

Sweet potato *Ipomoea batatas L.*, a member of convolvulaceae family, is a perennial crop usually grown as an annual and a starchy staple food crop in the tropical, sub-tropical and frost-free temperate climatic zones of the world Onuene et al. [1]. It ranks fifth as the most important food crop after rice, wheat, maize and cassava in developing countries Som [2]. In sub Saharan Africa, sweet potato is the third most important root crop after cassava and yam. In this region of Africa, over 7 million tons (5% of global production) of sweet potato is produced annually Cip [3].

The potential of sweet potato to guarantee food security is underestimated as its use is often limited to a substitute food in African countries. Sweet potato is valued for its roots which are boiled, fried, baked or roasted for humans or boiled and fed to livestock as a source of energy. The roots can also be processed into flour for bread making, starch for noodles as well as used as raw material for industrial starch and alcohol Merga et al. [4]. Globally, sweet potato is among the important food crops in the world, after wheat, rice, maize, Irish potato and barley and it also 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 Ukom et al. [5].

In Ethiopia, sweet potato has been cultivated for many years and is important in diet where population growth is highest, land holding is least and threat of large-scale starvation is ever present Lenne Jm [6]. Over 95 percent of the crop is produced in the South West, Eastern and Southern parts where it has remained for centuries as one of the major subsistence crops especially in the periods of drought Habtu [7]. Sweet potato is widely accepted and consumed in Benishangul Gumuz regional state, but its production and supply does not match since it is not extensively cultivated. The total area of land covered by sweet potato in the region was only 487.27ha and the total production was (14.92t ha^{-1}) Adhanom et al. [8].

Thus, Benishangul Gumuz Regional State is among the least sweet potato producing regions in Ethiopia and local demand is only met by trade from neighboring Oromia regional state. This was because of lack of high yielding and adapted varieties, low soil fertility, inclination of farmers to cereal crops. Currently, no

research was done on adaptation of sweet potato varieties and there are no recommended varieties for Benishangul gumuz region. In view of that, a systematic investigation was done on performance evaluation of sweet potato varieties at Kamashi, in Benishangul gumuz region.

Objective

To evaluate the performance of different improved sweet potato varieties at Kamash condition and select the varieties which have better performance and resistant to pest reaction.

Materials and Methods

Description of the study area

The experiment was conducted under rain fed condition at research farm of Assosa Agricultural Research Center (ASARC) at Kamashi sub center during 2013 and 2014 cropping year from mid June to December. Assosa Agricultural Research Center is 660km away from Addis Ababa which is located at latitude of 10°02' N and longitude of 34°34' E in western Ethiopia. The altitude of the site is 1553m asl. Which is in mid altitude and total annual rainfall of the cropping season was 1072.7mm. The rainy season extends from April to October and maximum rain is received in the months of June to August. It has a warm humid climate with mean maximum and minimum temperatures of 25 °C and 16 °C, respectively. The soil of the site was characteristically reddish brown (Nitosol), which is slightly acidic with pH of 5.7 and texturally clay.

Treatments and experimental design

The treatments consist of 6 improved varieties of sweet potatoes including two local sweet potatoes. The treatments were arranged in a randomized complete block design (RCBD) with three replications, making a total of 24 experimental plots.

Experimental procedures and field management

The experimental land was ploughed, disked and harrowed and ridges were prepared manually with traditional hoes. The plot size for each variety was 3m x 3m and spacing between ridges and plant were 0.6m and 0.3m, respectively. The experiment was done during 2013 and 2014 main cropping seasons. Uniform sweet potato apical vine cuttings of 30cm length according to Geleta [9] were taken and planted on Jun e 15/2013 in the experimental plot by burying two thirds of their lengths in to the soil at 45° angles with the recommended spacing of 30cm between plants and 60cm between rows on ridges [9]. One vine cutting was planted in each hole of the ridge and replanting was done to substitute the dead vines after one week of planting.

Nitrogen fertilizer was applied uniformly according to recommendation by Ethiopian Institute of Agricultural Research (EIAR) which is 150kg ha^{-1} in the form of Urea (46% N) (EIAR [10]. It was applied in two splits ½ of the dose at time of planting and the other ½ of the dose at active vegetative growth stage. All of the TSP (46 P_2O_5) fertilizer was applied in band along the rows just before planting the vines and covered with a 5cm thick soil. Hoeing of the experimental plot was done manually and the field was kept free of weeds during the growth period of the plants. Earthing-up was done not to expose the storage roots. Other agronomic practices were applied uniformly according to the recommendation for the crop. The crop was harvested on December 26/2014 when the color of the leaves completely changed to yellowish.

Result and Discussion

Root number per plant

Table 1: Means of sweet potato variety adaptation trial at Kamashi in 2013 cropping season.

Varieties	RNPP	RFWPP	RDWPP	RDM	RL	YLDPH
Beletech	2.16^{b}	0.22^{d}	0.09^{d}	30.5	10.60^{c}	12088^{d}
Tulu	2.73^{ab}	2.08^{a}	0.48^{b}	26.8	10.00^{c}	39649^{bc}
Awasa 83	2.53^{ab}	2.13^{a}	0.69^{a}	32.33	18.73^{a}	78930^{a}
Bueteca	3.6^{a}	0.92^{cd}	0.35^{bc}	39.08	10.47^{c}	22091^{cd}
Local 1 (Narrow leaved)	3.26^{ab}	0.91^{cd}	0.24^{cd}	29.58	13.86^{b}	13439^{d}
Local 2 (Broad leaved)	3.00^{ab}	1.83^{ab}	0.43^{bc}	24.09	17.60^{a}	70678^{a}
004/6-Vita	3.13^{ab}	1.28^{bc}	0.39^{bc}	31.07	19.33^{a}	45039^{b}
004/616	2.1^{b}	1.03^{c}	0.40^{bc}	26.76	20.13^{a}	26056^{bcd}
LSD (5%)	1.4	0.78	0.19	15.7	2.7	19438
CV (%)	28	34.62	28.66	29.85	10.22	28.7

RNPP=Average root number per plant, RFWPP= root fresh weight per plant, RDWPP= root dry weight per plant, DM= root dry matter, RL= Root length, YLDPH= yield per hectare.

Table 2: Means of sweet potato variety adaptation trial at Kamashi in 2014 cropping season.

Varieties	RNPP	RFWPP	RDWPP	RDM	RL	YLDPH
Beletech	2.3^{ab}	0.21^{ab}	0.07^{c}	33.277	11.47^{bc}	12755^{d}
Tulu	2.7^{ab}	1.95^{ab}	0.37^{b}	24.3	10.87^{c}	39983^{bc}

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Awasa 83	2.5^{ab}	1.99^{a}	0.63^{a}	31.6	19.53^{a}	79264^{a}
Bueteca	3.7^{a}	0.85^{cd}	0.26^{b}	30.893	11.2^{c}	22081^{cd}
Local 1 (Narrow leaved)	3.4^{ab}	0.83^{cd}	0.22^{bc}	29.027	14.40^{b}	13459^{d}
Local 2 (Broad leaved)	2.9^{ab}	1.81^{ab}	0.33^{b}	18.573	18.47^{a}	70712^{a}
004/6-Vita	3.1^{ab}	1.19^{bc}	0.36^{b}	30.467	20.67^{a}	45073^{b}
004/616	2.1^{c}	1.00^{c}	0.31^{b}	31.023	20.53^{a}	26087^{bcd}
LSD (5%)	1.4	0.78	0.17	18.61	2.94	19438
CV (%)	28	4.36	31	37.1	10.6	28.7

RNPP=Average root number per plant, RFWPP= root fresh weight per plant, RDWPP= root dry weight per plant, DM= root dry matter, RL= Root length, YLDPH= yield per hectare.

Table 3: Mean squares due to Variety and error for yield, and yield related traits of sweet potato varieties grown in 2013 and 2014 at Kamashi district in Benishangul Gumuz region.

Traits	2003			2004		
	Df=2	Df=7	Df=14	Df=2	Df=7	Df=14
	Rep	Variety	Error	Rep	Variety	Error
RNPP	1.32125*	0.86661*	0.60982	1.53167*	0.87238*	0.63452
RFWPP	0.27045**	1.33570**	0.20255	0.08487**	1.21905**	0.2003
RDWPP	0.049**	0.09248**	0.01231	0.00155**	0.07694**	0.0098
RDM	1.36ns	62.09ns	80.38	23.27ns	50.57ns	113
RL	44.6467**	56.5521**	2.3857	26.0867**	57.1312**	2.8333
YLDPH	1.293**	1.913E**	1.913	1.385**	1.911**	1.232

RNPP=Average root number per plant, RFWPP= root fresh weight per plant, RDWPP= root dry weight per plant, DM= root dry matter, RL= Root length, YLDPH= yield per hectare.

The analysis of variance showed that the sweet potato varieties Bueteca, narrow leaved sweet potato, and 004/6-vita were recorded the highest tuber number per plant in both years. The lowest tuber number per plant was observed on 004/616 variety (Table 1-3).

Root fresh weight per plant

From analysis of variance, all varieties showed significant difference in both years but Awassa 83 recorded the highest root fresh weight per plant in both years 2.13g and 1.99g respectively Table 1-3. This weight difference may be come from genetic capability of the sweet potato varieties Maniyam et al. [11].

Root dry weight per plant

The result showed that there was significance difference between the varieties at p< 0.05. The highest root dry weight per plant was recorded at Awassa 83 in both years 0.69g and 0.63g respectively. The lowest root dry weight per plant was recorded by Beletech (0.09g and 0.07g) respectively (Table 1 & 2).

Root dry matter content

Even though there was no significance difference between the varieties, the highest root dry matter was recorded at Bueteca (39.08) in 2013 and Beletech (33.27) in 2014. The lowest root dry matter was recorded by local broad leaved sweet potato 2 in both years (24.09 and 12.57) respectively (Table 1 & 2).

Root length

From the analysis, it was revealed that root length was highly significant at p<0.01.The highest root length per plant was recorded by 004/616 and 004/6-vita sweet potato varieties and the lowest length was recorded by local broad leaved sweet potato in both years (Table 1-3).

Yield

From the analysis of the result, there were high significance difference between the varieties at P<0.01. But the highest tuber yield was recorded by variety Awassa 83 (78.93.ton ha^{-1} in 2013 and 79.26ton ha^{-1} in 2014. The lowest tuber yield was recorded by varieties Beletech 12.08 ton ha^{-1} in 2013 and (12.75ton ha^{-1}) in 2014 (Table 1 & 2). Osiru in his research also showed that sweet potato yield varied among genotypes Mwololo et al. [12]. The variation in yield among locations may be attributed to weather or climatic factors, and the duration of growing periods [12,13]. Generally, the result of ANOVA showed that there is significant variation between varieties for yield and other parameters collected (Table 1 & 3). Desalegn et al. [14], also reported significant variation between sweet potato genotypes in yield and other desirable traits in their adaptation trial in different agro ecologies of Ethiopia [15].

Conclusion and Recommendations

The major constraints of sweet potato production in Benishangul Gumuz include poor agronomic practices, low soil fertility and low use of inputs such as poor planting materials, poor diseases and pest management practices. But the crop has high potential in food security for the increasing population. The most important method to increase production and productivity is using appropriate varieties beside other agronomic and plant protection

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activities. In the present study Awassa 83 sweet potato variety was high yielder and should be promoted to farmers of the study areas. Other agronomic packages, quality and nutritional trials should be done further for better use of the crop. Finally, Since the experiment was done on only in one location and two cropping seasons, further studies should be done in combination of locations and seasons to generate more reliable information on performance of varieties at different location.

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