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Adaptability Evaluation of White Fleshed Sweet Potato Variety Trial at Silte and Gurage Zones, Ethiopia

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ABSTRACT

Background and Objective: Sweet potato is an important food security crop for millions of people in Africa. The present study was conducted to select white-fleshed sweet potato varieties in terms of their growth parameters and adaptability. **Materials and Methods:** The adaptability evaluation was conducted in the Sankurra District (in Silte Zone) and Meskan District (in Gurage Zone). The experiment was conducted using five white-fleshed sweet potato varieties laid out in RCBD with three replications. Data were collected on the number of branches per plant, number of leaves per plant, vine length, root fresh weight and root dry matter content. **Results:** Analysis of Variance (ANOVA) revealed that there was a significant difference ($p \leq 0.05$) for the number of leaves per plant among tested varieties and varieties*across environments and a highly significant ($p \leq 0.01$) for fresh root weight yield while, a non-significant difference among tested varieties for the remaining parameters. **Conclusion:** Based on the mean values, varieties Adu was the first and Hawassa-83 the second by root fresh weight yield whereas, the least yielder was Barkume. Therefore, in the future, it is essential to demonstrate those selected varieties to farmers for production in the study area after participatory evaluation through pre-extension and demonstrations.

KEYWORDS

Sweet potato, adaptability, growth, demonstrate, participatory

INTRODUCTION

The sweet potato (*Ipomoea batatas* (L.) Lam.) is an important crop for millions of people in Africa. It is one of the most important crops in the world, ranking seventh and fifth in global production and Africa, respectively. The sweet potato is used nationwide as an aid in natural and man-made disasters. It is an entirely useful plant: Roots for human consumption and roots and tops for animal nutrition, other deficiencies such as A, B, C and E complexes and minerals such as potassium, calcium and iron[1,2]. Topping the list are root crops like potatoes, yams and taro, which are eaten across the country.

Sweet potatoes are grown on a large scale in the South, Southwest and East by small farmers with limited land, labor and capital in Ethiopia. Ethiopia is one of the countries with the largest sweet potato cultivation in the world. According to a CSA report, sweet potatoes covered approximately 53,499 hectares of land with an annual production of 1.85 million tons during the flowering period alone[3].

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On the other hand, the national average productivity of the crops is low compared to the production potential yield of the varieties[3]. Frequent droughts in production environments, the emergence of viral diseases in sweet potatoes and the lack of markets and alternative uses have severely hampered the expansion of sweet potato production in Ethiopia[4].

Among the major biotic constraints for sweet potato production insect pests are recorded as the major one[5]. Although sweet potatoes have many potential uses and benefits, their yield in many areas of Ethiopia is below the potential yield of 30-73 ton ha^{-1} due to abiotic, biotic and socioeconomic constraints before and after harvest[6].

Over the years, several white-fleshed varieties have been evaluated and released by national and regional agricultural research centers. However, farmers do not grow improved white-fleshed sweet potato varieties which are high-yielding, disease and pest resistant as there is no adaptability study in the considered area. Therefore, research strategies like adaptability study give a selection of best-performed, high-yielding and disease-resistant white-fleshed sweet potato varieties that will be ideal and important for addressing the gap in the Silte and Gurage Zones. The objective of the study is to select sweet potato varieties in terms of their growth parameters and adaptability.

MATERIALS AND METHODS

Site description: The present study was conducted in Silte (Sankurra District) and Gurage Zones (Meskan District). For conducting the trial by the year 2021, first season the materials were not enough so maintenance for increment was done at the Albazar Site of the Worabe Agricultural Research Center. The trial was conducted in Meskan and Sankurra Districts after an increment in the next year. It was done with recommended agronomic practices like fertilizer application NPs 100 kg ha^{-1}, urea 100 kg ha^{-1}, weeding, cultivation and earth up was done.

Experimental treatments: Five white-fleshed varieties of sweet potato namely Hawassa-09, tola, Adu, Barkume and Hawassa-83. The varieties were collected from Hawassa Agricultural Research Center.

Experimental design: The RCBD with three replications was used in Meskan and Sankurra Districts. The plot size was 2.4 m×3 m and the spacing was 60 cm with 30 cm between rows of plants, respectively.

Data collected and statistical analysis: Data were collected on the number of branches per plant, the number of leaves per plant, vine length, root fresh weight and root dry matter content. The collected Data were analyzed by using SAS software, 9.3 version and means were compared with LSD of 1 and 5% level of significance.

RESULTS AND DISCUSSION

Analysis of variance: Analysis of Variance (ANOVA) revealed that there was a significant difference ($p \leq 0.05$) for the number of leaves per plant among tested varieties and varieties*across environments and a highly significant ($p \leq 0.01$) for fresh root weight yield while, a non-significant difference among tested varieties for the remaining parameters (Table 1). It implied that there was variation among tested varieties in yield and other desirable traits in their adaptation performance. The observed yield variation between varieties may be due to meteorological or climatic factors and the genetic potential of the varieties grown under Sankurra and Meskan conditions. Osiru *et al.*[1] also found that the yield of sweet potato yields varies by genotype. Again, Habtie[7] also reported significant differences between sweet potato varieties in yield and other desirable traits. Similarly, Awel[8] also reported significant variability ($p \leq 0.05$) between sweet potato cultivars in yield and yield-related parameters.

Table 1: Combined analysis of variances for some agronomic characters on white flesh sweet potato varieties tested at Meskan and Sankura Districts

		Mean squares					
Source of variance	DF	NBPP	NLPP	VLPP	RFWPP	RDMPP	RFWY
Location	1	4.033 Ns	10509.41*	3.67 Ns	397.48 Ns	64218.13 Ns	924.74**
Replication	2	0.03 Ns	1225.06 Ns	343.43 Ns	13.41 Ns	33514.63 Ns	10.36 Ns
Varieties	4	1.12 Ns	599.58 Ns	871.55 Ns	26.23 Ns	78502.13 Ns	59.48**
Loc*Var	4	1.62 Ns	2228.95 Ns	931.80 Ns	14.60 Ns	7111.13 Ns	36.34*
Error	18	1.77	1793.10	967.43	11.71	42294.63	9.08
Mean		8.63	149.41	88.48	9.22	319.93	13.94
CV (%)		15.42	28.34	35.15	37.09	64	21.60

**: Highly significant at $p \leq 0.01$, *: Significant at $p \leq 0.05$, NBPP: Number of branches per plant, NLPP: Number of leaf per plant, VLPP: Vine length per plant, RFWPP: Root fresh weight per plant (g), RDMPP: Root dry matter per plant (g), RFWY: Root fresh weight yield per hectare ton/hectare) and CV: Coefficient of variation

Table 2: Mean performance of wight flesh sweet potato varieties combined over the location

Treatment	NBPP	NLPP	VLPP	RFWPP	RDMPP	RFWY
Hawassa-09	8.50	160.67	108.92	9.62^{ab}	423.2^{ab}	14.44^{ab}
Tola	8.67	161.17	89.33	8.57^{ab}	444.2^{a}	11.89^{bc}
Adu	8.00	142.92	79.67	10.62^{a}	232.7^{ab}	17.40^{a}
Barkume	9.17	156.33	84.17	5.98^{b}	183.5^{b}	9.72^{c}
Hawassa-83	8.83	136.00	80.33	11.33^{a}	316.2^{ab}	16.27^{a}
Grand Mean	8.63	149.42	88.48	9.23	319.93	13.95
LSD 5%	1.62	51.36	37.73	4.15	249.45	3.65
Meskan	9.0	168.13^{a}	88.13	5.59^{b}	273.67	8.39^{b}
Sankura	8.27	130.70^{b}	88.83	12.89^{a}	366.20	19.49^{a}
LSD 5%	1.02	32.48	23.86	2.63	157.77	2.31

NBPP: Number of branches per plant, NLPP: Number of leaf per plant, VLPP: Vine length per plant, RFWPP: Root fresh weight per plant (g), RDMPP: Root dry matter per plant (g), RFWY: Root fresh weight yield per hectare ton/hectare) and LSD: Least significant difference

Mean performance of growth parameters: According to the result from mean values of tested varieties, it was recorded significant differences in root fresh weight per plant (g), root dry matter per plant (g) and root fresh weight yield per hectare tone/hectare) as indicated in Table 2. The maximum root fresh weight per plant was recorded on variety Hawassa-83 (11.33^{a}) and Adu (10.6^{a}), while the minimum was recorded from Barkume (5.98^{b}) variety. The highest root dry matter per plant was observed from Tola (444.2^{a}) followed by Adu, (232.7^{ab}) while the lowest was observed from Barkume (183.5^{b}) variety. The highest total fresh weight per hectare was recorded on the varieties Adu (17.40^{a}), whereas, the lowest total fresh weight per hectare was recorded on Barkume (9.72^{c}). In general, the Adu variety was the first and Hawassa-83 the second by root fresh weight yield whereas, the least yielder was Barkume. The present finding is inconsistent with the finding of Abewoy *et al.*[9] who reported the maximum root yield was obtained from Hawasssa-09 which was statistically similar to Barkume and the minimum root yield was recorded from the Adu variety. This might be due to varieties responding differently to different environments. Similar findings were reported by different authors[1,10,11], who found that sweet potato genotypes had significant differences with their yield traits and responded differently to different environments.

Analysis of Variance (ANOVA) revealed that there was a significant difference ($p \leq 0.05$) for the number of leaves per plant among tested varieties and varieties*across environments and a highly significant ($p \leq 0.01$) for fresh root weight yield while, a non-significant difference among tested varieties for the remaining parameters. Overall, the present study gives great implications for small-scale farmers that are sweet potato producers found in the study areas to use the best cultivars for increasing the production of sweet potatoes. The results revealed the presence of potential white-fleshed sweet potato varieties to be expanded for farmers for production in the study area. However, farmer's preference is not studied or

included in this particular study, therefore, future PVS study could be addressed in this particular area after that the best cultivars with farmers preferred ones could be recommended for production for farmers in the study area for the future.

CONCLUSION

In the study, it was investigated highly significant variation observed among white-fleshed sweet potato varieties for their adaptability. The study revealed that presence of potential white-fleshed sweet potato varieties to be expanded for farmers for production in the study area. The two white-fleshed sweet potato varieties specifically Adu and Hawassa-83 were selected with better fresh root weight and recommended for production for farmers in the study area for the future.

SIGNIFICANCE STATEMENT

The present study will contribute the basic information for horticulturist professionals for further study in white sweet potato crops for agronomic, pathology and pre-extension study in the considered areas. One of the most important points here the adaptable variety was identified for further PVS and demonstration study.

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