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PRE EXTENSION DEMONSTRATION OF ORANGE FLESHED SWEET POTATO VARIETIES AT MIDLAND DISTRICTS OF GUJI ZONE, SOUTHERN OROMIA, ETHIOPIA

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ABSTRACT

This study examines an on-farm demonstration of an improved orange-fleshed sweet potato. The role of sweet potatoes in household nutrition and health benefits is highly recognized in developing countries like Ethiopia. Hence, promoting such nutrition-sensitive crops through demonstrations is significant for farmers. This demonstration was piloted to assess farmers' feedback on orange-fleshed sweet potatoes and evaluate the performance of improved varieties of two midlands of the Guji zone. This study used NASPOT 12 and NASPOT 13 to improve orange-fleshed and local varieties. Each variety was planted on 10mx10m plots of 10 farmers' land. Training and the mini-field day were used to promote orange-fleshed sweet potatoes. The collected data for this demonstration was analyzed through descriptive statistics and description forms. The result indicated that NASPOT 13, NASPOT 12, and the local variety gave 142 qt/ha, 114 qt/ha, and 93 qt/ha, respectively. There were more root tuber/ plants in NASPOT 13 and NASPOT 12 than in the local variety. Both improved varieties performed well in the Adola Rede and Wadera districts. The findings of this study suggest that despite the higher yield of improved varieties, farmers did not prefer NASPOT 13 and NASPOT 12 due to the sweetness of varieties that were not like the local variety. Farmers preferred the improved orange-fleshed sweet potato varieties for livestock feed. Breeding and adaptation of sweet potatoes in the study areas are needed to identify household consumption varieties. Therefore, until new varieties are identified, farmers should continue sweet potato production using the array in their hands.

INTRODUCTION

The nutrition aspect of food production is a recognized approach to increase maternal and child diets in the less developed countries (Mohammed, 2023). But the degree of progress seen with nutrition aspects frequently failed because of inappropriate strategy and operation of programs. Hence, strategies to advance the contribution of nutrition the consideration of projects in Sub Saharan African where deprived nutrition value and motherly and teenager below nourishment persevere (Girard *et al.*, 2021).

In sub-Saharan Africa, the sweet potato (Ipomoea batatas Lam) is the chief root plant esteemed for nutrition and nutritive safety (Sapakhova *et al.*, 2023; Mohammed, 2023). In Ethiopia there were different challenges of underfeeding, vitamin deficits, and other health problems. Crucial and concentrated strategies are compulsory to recover the nutritious position of susceptible populations, especially offspring and prenatal women, to block the problem of oxidative healthiness disarrays (Lamaro *et al.*, 2023).

Orange-fleshed sweet potato (OFSP) is important to solve micronutrient deficits (Mohammed, 2023). Consumption of orange-fleshed sweet potato diminishes the occurrence of vitamin A deficit and optical weakening in kids and expectant mothers (Barnabas *et al.*, 2023; Mbela *et al.*, 2021). In addition, it decreases the undernourishment and the danger of many diseases like cardiovascular illness, cancer, cataract and age-based muscular collapse, and impaired vision mostly in offspring and expectant and breastfeeding moms (Olasanmi *et al.*, 2023). The crop is rich in pro-vitamin A, which is used

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for standard vision, healthy skin and mucous tissues, vigorous cell development, and resistance to measles, respiratory and malaria illnesses (Bhuyan *et al.,* 2022). The nutritious qualities of sweet potato include beta-carotene, starch, protein, vitamins (C, B, and E), dry matter and mineral nutrients like zinc, iron, copper, calcium, phosphorus, manganese and potassium (Pati *et al.*, 2021; Iheonu *et al.,* 2023; Oyewole, and Sennuga, 2020). The nutritional values, nutrition and profits earning advantages of orange-fleshed sweet potato are through promotion of improved and new OFSP varieties (Girard *et al.,* 2021). Due to its high pro vitamin A, it is the prerequisite to encourage OFSP species production for-resource poor farmers and children (Barnabas *et al.,* 2023).Sweet potato is extensively produced in many parts of Ethiopia, mostly in eastern, southwestern and south and predominantly consumed in fresh (Ejigu *et al.,* 2022, Hendebo *et al.,* 2022). Since the crop is important to maintain food security, the government of Ethiopia gave consideration to the production of sweet potato (Gobena *et al.,* 2022). Nevertheless, productivity of the crop is very little to 8 $t \cdot ha^{-1}$ when compared to the prospective harvest of 30-73 $t\ ha^{-1}$ (Hendebo *et al.,* 2022). The low production of the crop is because of inaccessibility of better-quality varieties and traditional production techniques (Dawit and Habte, 2023; Olasanmi *et al.,* 2023; Ebem *et al.,* 2021).

Among the root crops, sweet potato is one of the best chief tubers in the Guji zone (Teshome *et al.,* 2020). In spite of its benefits and appropriateness, the use of OFSP varieties in the midlands of Guji zone is challenging due to the lack of promotion of improved varieties. To solve this problem, sweet potato researchers have adapted different orange sweet potato varieties. However, the adapted varieties were not evaluated in farmers' condition. Hence, this research experiment was designed to demonstrate OFSP with the objectives of evaluating productivity of improved orange fleshed sweet potato varieties, assess farmers' feedback on varieties and to boost the knowledge and skills of farmers' on the cultivation of orange fleshed sweet potato varieties.

LITERATURE REVIEW

As a form of agricultural extension, agricultural on-farm demonstration has attracted the attention of policymakers and academics as a means of promoting and studying farmers' learning and innovation (Burton, 2020). Demonstrations have proved to be an important and effective element of the agricultural knowledge and innovation system (Adamsone-Fiskovica *et al.,* 2021). Through on-farm demonstration, innovations and novel practices can be developed, tested, and exchanged in farming networks (Sutherland *et al.,* 2021). The effects go beyond increased productivity and profitability, to encompass enhanced capacity for adaptation, improved environmental sustainability, improved quality of life, and/or empowerment of farmers (Adamsone-Fiskovica *et al.,* 2021).

Agricultural research centers are releasing and adapting varieties for each agro-ecology. In line with the release of new and adapted varieties reaching farmers through demonstration and popularization are the main target of extension services in Ethiopia (Kebede and Bobo, 2023). Before the promotion of improved or new varieties to farmers, technology transfer researchers and development partners must evaluate the adapted and released varieties' performance under farmers' circumstance. This can be done either by demonstration, on farm demonstration or participatory variety selection by a few farmers prior to large production. In this situation, the role of researchers and development agents were facilitation while farmers learn on the field and share the results of demonstration to other farmers through peer learning on the specified variety. Through a farmers' test, the best and preferred variety by the farmers could be recommended for large production. If the variety is not promising in farmers' conditions, then it cannot be disseminated.

MATERIALS AND METHODS

Description of the Study Districts

Adola Rede and Wadera districts were one of the midland areas of Guji zone, Southern Oromia. Adola Rede district is 468 km from Addis Ababa. The district is positioned between 5º44'10"-6º12'38" latitudes and 38º45'10"-39º12'37" longitudes. It is surrounded by Ana Sora district in the North, Wadera district in the South and Odo Shakiso in the West and Girja district in the East. The agro-ecology of the districts includes humid, subhumid and dry arid. The area has an elevation range of 1350–2340 meters above sea level, an annual mean of 1000mm of rain and an annual average of 28°C of temperature. The district obtained bimodal rainfall for lowland and midland and mono-modal for highland kebeles. Most of the agricultural production of the district is based on rainfall. There are different soil types conducive for different crop cultivation, such as barley, maize, wheat, haricot bean and sweet potato. Bananas, avocado, and mango are produced by the farmers. The district also has the potential for coffee production (Korji *et al.,* 2023).

Wadera district is located 535 km away from Addis Ababa. Astronomically, the district is sited between 5º39'5"-6º2'28" northing latitudes and 39º5'30"-39º27'52" easting longitudes. Mixed farming is the major economic activity of the farmers. Wadera district is surrounded by the Bale zone to the East, Girja district to the North, Adola Rede and Odo Shakiso districts to the North West and South West respectively, and Gorodola district to the South East. The district is categorized by two types of distinctive climatic areas. Specifically, arid (60%) and semi-arid (40%) weather with an annual temperature ranging from 12^0C-34^0C, and it has a bimodal rainfall pattern. It is the maximum hot and sub-hot situation with a smaller growing period. The annual rainfall ranges between 915 mm and up to 1,900 mm. The district ranges from 500 m and the greater share of the district lies between 950 m to 1,900 m at mean sea level. The long wet season begins from mid-March to May (45–60 days) while the short wet period begins from mid-September to October (30–40 days) in years. The soils of the district are good for teff, maize, haricot bean, wheat, barley and sweet potato crops (Dembi *et al.,* 2021).

Farmers' Selection

This study was conducted at two midland districts of Guji zone during 2021 and 2022/23 years. Adola Rede and Wadera districts were purposively selected due to their sweet potato production. Two kebeles were purposively selected based on their potential and conducive for monitoring purpose. Derartu and Kiltu Sorsa kebeles were selected from Adola Rede while

Calo and Andewa Keno kebeles were selected from Wadera district. At Adola Rede there were four experimental farmers whereas at Wadera district there were 6 experimental farmers. Totally, the demonstration was conducted at 10 experimental farmers on plot size of 10mx10m.

Research Materials

NASPOT 13 and NASPOT 12 varieties were demonstrated with local variety. Materials were planted with the recommended space of 30 cm and 100 cm between rows and tillers, respectively. In all, farmers plot 100kg/ha of NPS and 100kg/ha of UREA was applied as the recommendation for the crop. Stems of tillers were cut and planted in early April.

Technology Promotion Methods

For sustainable crop production, appropriate technological promotion methods are needed. For this reason, this farm demonstration used training, exchange and mini-field day methods in order to promote OFSP in midland areas of Guji zone.

Data Collection and Analysis Methods

Both interview and measurement methods were used to collect the data. Yields of sweet potato varieties and experimental farmers' preference data were collected. Descriptive statistics were used to analyze the yield output from demonstrations. Farmers' preference was analyzed qualitatively through narration form.

RESULTS AND DISCUSSIONS

Promotion of Orange Fleshed Sweet Potato Varieties

This activity used training as a promotion approach for OFSP. Conceptual training was given to produce methods of OFSP and crop characteristics at the selected kebele. Practical training was also given to farmers to simplify the theoretical training in the field. Accordingly, 60 farmers (48 male and 12 women) were trained on sweet potato. Other stakeholders such as development agents who were assigned as technology facilitators at each kebele and district experts were refreshed, with their knowledge of sweet potato production. Totally, eight Development Agents and four agricultural experts were trained on the demonstration, production and promotion of OFSP. After establishment of OFSP at each kebele there was exchange visit between experimental farmers. This exchange visit was organized in order to share the experience of OFSP production and management practices between the experimental farmers and non-experimental farmers. Farmers can learn more from farmers themselves than researchers and development agents due to their social interaction aspects. Hence, this activity uses exchange visits by farmers for promoting OFSP varieties. Moreover, a mini-field day was organized for further promotion of OFSP in the midlands of Guji zone (Table 1).

Table 1. Number of participants attended the promotion of OFSP varieties

Promotion approaches	Number and types of stakeholders participant on OFSP											
	Farmers			Development Agents			Experts			Others		
	M	F	T	M	F	T	M	F	T	M	F	T
Training	48	12	60	8	-	8	4	-	4	3	-	3
Exchange visit	18	3	21	4	-	4	1	-	1	-	-	-
Mini-field day	13	7	20	3	1	4	2	-	2	-	-	-

M= Male, F= Female, T=Total

Performance of Demonstrated Orange Fleshed Sweet Potato on Farmers Land

Both improved OFSP gave a result over local variety. From demonstrated varieties, more yield (142.20 qt/ha) was obtained from NASPOT 13 followed by NASPOT 12 (114.50). The least yield was harvested from a local variety at 93.70 qt/ha (Table 2). This indicated that the use of improved OFSP variety could a give a good yield which could maintain household and community food availability and dietary diversity. The yield result of this study was similar to Bikamo and Ebrhim (2023) as the white fleshed sweet potato of the Hawassa-09 variety generated a fresh root yield of 144.40qt/ha. However, the yield performance obtained from orange fleshed sweet potato in this study was less than the national sweet potato yield (228.79 qt/ha) (ESS, 2022). Adaptation result of NASPOT 13, NASPOT 12 and local varieties in the midlands of Guji zone were 650.8qt/ha, 626.9 qt and 571.9 qt/ha root tuber, respectively (Teshome *et al.*, 2020). This root tuber yield variation with the current yield might be due to the performance of varieties in diverse locations. Findings were reported by Gurmu and Mekonen (2019) as the yield performance of sweet potato is determined by the genotypes and different environments. In addition, Ejigu *et al.*, (2022) confirmed that the variation in yield of OFSP could be because of ecological influence and genomic changeability between varieties.

A greater number of tubers per plant were obtained from NASPOT 13 followed by NASPOT 12 and the least root tuber per plant was obtained from a local variety (Table 2). The number of tubers per plant had a direct relationship with total tuber yield per hectare. Therefore, a higher number of tubers/ plants of variety were important for farmers. The number of root tubers/ plants in this demonstration was higher in all varieties than the study of Dawit and Habte (2023) who recorded 6.43 root tubers/plants from the Awassa-83 sweet potato variety. The difference in number of roots between the varieties might be influenced by the genetic variance, as the variability in generic character affects the growth performance of varieties.

2. Performance of root yield (qt/ha) and number of tuber/plants of OFSP varieties

Districts		Root yield of varieties			Number of tuber/plant		
		NASPOT 13	NASPOT 12	Local	NASPOT 13	NASPOT 12	Local
Adola Rede	N	4	4	4	4	4	4
	Minimum	120	100	85	6	4	4
	Maximum	190	150	110	22	16	12
	Mean	156.25	121.25	96.25	14.00	9.75	6.50
	Std. Dev.	34.00	20.97	11.09	6.73	4.92	3.70
Wadera	N	6	6	6	6	6	6
	Minimum	115	90	85	8	8	5
	Maximum	145	124	100	18	14	10
	Mean	132.83	110.00	92.00	12.00	10.75	6.83
	Std. Dev.	10.97	12.78	5.10	4.05	2.23	1.94
Total	N	10	10	10	10	10	10
	Minimum	115	90	85	6	4	4
	Maximum	190	150	110	22	16	12
	Mean	142.20	114.50	93.70	12.80	10.35	6.70
	Std. Dev.	24.46	16.46	7.76	5.30	3.33	2.58

Both NASPOT 13 and NASPOT 12 performed better in Adola Rede than in Wadera district. At Adola Rede, 156 qt/ha was obtained from NASPOT 13 followed by a yield of 138 qt/ha from NASPOT 13 at Wadera district. Figure 1 showed that NASPOT 12 gave higher tuber yields in Adola Rede experimental farmers than in the Wadera district. This indicated that Adola Rede district was more suitable for sweet potato production when compared to Wadera district.

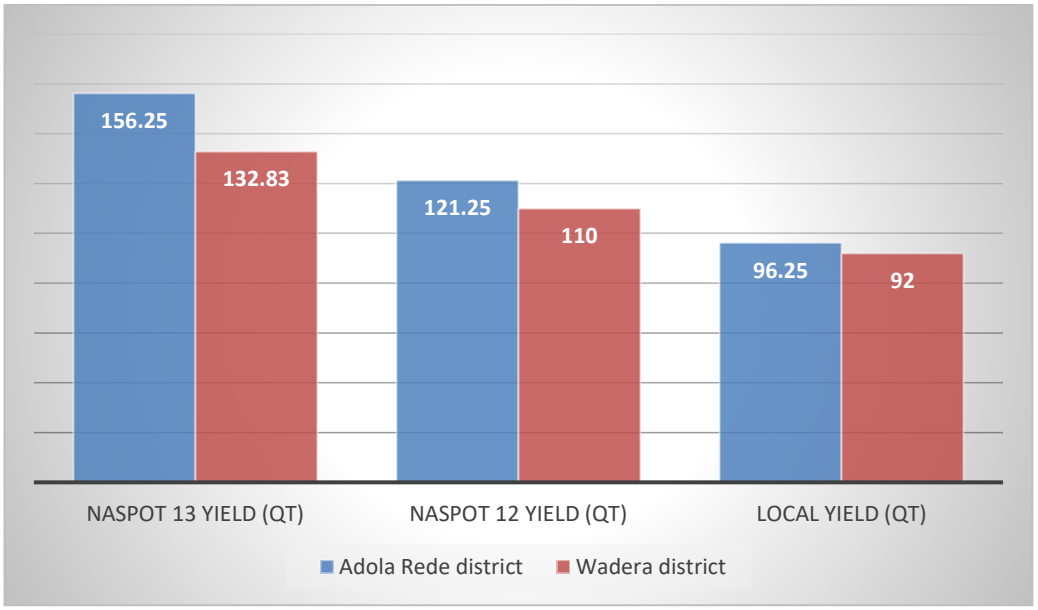

Figure 1. Performance of OFSP varieties across districts

Despite numerical variation in yield of the varieties, there is no statistical significant variation between the four selected kebeles in the two districts. This indicated from the demonstrated varieties accessible variety can be used for OFSP produce in the midland districts of Guji zone.

Table 3. The analysis of variance on kebele factor

Varieties		Sum of Squares	Df	Mean Square	F	Sig.
NASPOT 13	Between Groups	3347.933	3	1115.978	3.286	.100
	Within Groups	2037.667	6	339.611		
	Total	5385.600	9			
NASPOT 12	Between Groups	1021.167	3	340.389	1.441	.321
	Within Groups	1417.333	6	236.222		
	Total	2438.500	9			
Local	Between Groups	247.600	3	82.533	1.681	.269
	Within Groups	294.500	6	49.083		
	Total	542.100	9			

Farmers' preference for orange fleshed sweet potato varieties

Farmers' preference and feedback on the demonstration stage is important prior to large production of a crop. It is important to suggest farmers' feedback back to the research system for the improvement of variety, and it is also essential in minimizing the drawbacks of the variety in larger areas. For sustainable production of sweet potato, assessing farmers' preference on demonstrated is important. This is because farmers have their own criteria for further production of varieties

on their land. During this demonstration, farmers' preferences for varieties were assessed. Despite the higher root yield of the NASPOT 13 and NASPOT 12 farmers preferred local variety due to the local variety having more nutritional status over the improved varieties. Both NASPOT 13 and NASPOT 12 were not as sweet as the local variety. In addition, the tubers of improved varieties were oversize and not attracted to the market. Farmers mentioned that NASPOT 13 and NASPOT 12 were preferred for fattening animals as varieties had a greater number of branches, leave and root tubers than local variety. Midland areas of Guji zone were frequently affected by drought which has a direct impact on forage production for livestock. Surveillance of improved varieties was higher and this might help farmers to feed their livestock. Generally, farmers preferred improved varieties for livestock feed instead of household consumption.

CONCLUSIONS

Based on the findings, it can be concluded that NASPOT 12 and NASPOT 13 orange fleshed sweet potato varieties gave higher yield compared to the local cultivars in the midlands of the Guji zone. Though good yield was harvested from the improved varieties, all experimental farmers preferred the locally produced variety due to its better sweetness over the improved varieties. On the other hand, farmers preferred the demonstrated NASPOT 12 and NASPOT 13 for fattening of animals rather than household consumption. For human consumption, releasing OFSP varieties with a good nutrition status is expected from agricultural research center. Farmers should continue the use of varieties in their hand for sweet potato production until other new varieties are recommended for the midlands areas of the Guji zone.

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