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Popularization of Medium Maturing Orange Fleshed Sweet Potato (OFSP) Variety (Alamura) and on Farm Evaluation of Its Root Yield Performance at Halaba Zone, Weira District, SNNPR, Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Orange-fleshed sweet potatoes are one of the most important root crops for their high -carotene content, which protects against vitamin A deficiency. But in the most rural areas of the country, there is a serious health problem related to vitamin A deficiency. The associated causes of inadequate intake and production of this crop are lower adoption, weak extension support, and inaccessibility of improved varieties. For that, demonstration of a recent variety of sweet potato is a necessary action. Hence, it improves the adoption rate, creates awareness, and contributes to food and nutritional security. Accordingly, two farmer training centers and ten farmers were purposely selected to

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conduct the demonstration. The variety "Kulfo" was used for the experiment by using a 10m x 20m plot size for each variety. Evaluations were conducted during the mid-maturity stage, through the field day, and field visits with concerned stakeholders, beneficiaries, and surrounding farmers. Based on the result, the yield of the new variety and the standard check are 22.5 tons/ha and 10.5 tons/ha, respectively. The result shows that the yield of the improved variety has a 114.3 percent yield advantage compared to the standard check. In addition, the result of cost-benefit analysis reveals that the new variety has 65250.1 Ethiopian Birr more return than the standard check and is ranked by farmers by its disease resistance, taste, and productivity. Therefore, the new variety is recommended for further scale up in the Halaba zone and other similar agro-ecologies, and agricultural extension personnel will be encouraged to facilitate communication among farmers-researchers and vein multiple cooperatives.

Keywords: Demonstration; orange-fleshed sweet potato; pre-extension; variety alamura; vitamin-A.

1. INTRODUCTION

The orange-fleshed sweet potato (OFSP) is a significant staple crop on a global scale. Due to its abundant amounts of minerals and fiber, OFSP has significant health benefits, especially for populations whose diets are at danger of becoming malnourished [1]. This crop has a role in lowering VAD based on reliable scientific evidence that has been produced. As a result, promoting OFSP as a food-based strategy to combat VAD is successful in supplying vitamin A to consumers [2,3] Konan Everard). Brice Dibi et al., [4] The prevalence of VAD was reduced by 15% as a result of OFSP use among kids under the age of five [4]. In addition, OFSP is an excellent food security crop due to its characteristics of being a good source of energy (293 to 460 kJ/100 g), being easy to cultivate, vegetatively propagated, and fairly drought resistant, and high productivity [5].

In general, sweet potatoes and OFSP in particular have the potential to produce a root output of 50–60 tons per hectare in Ethiopian conditions, but the actual production collected from farmer fields is only around 10 tons per hectare. This significant variance is a result of both biotic and abiotic stressors, including a dearth of better varieties, a negative social perception of sweet potatoes, ineffective technology transfer methods, and insufficient packaging recommendations [6].

However, different research works have been conducted at national and regional agricultural research teams. As a result, Hawassa agricultural research center has extensive experience in white-fleshed and orange-fleshed sweet potato research, with a focus on variety improvement. In fact, in 2020, three OFSP varieties were officially released and registered by Hawassa Agricultural Research Center as new varieties due to their outstanding performance. The variety alamura is one of them. It is a best-adapted variety with medium-sized roots, good resistance to sweet potato viral disease, and has great potential to respond to vitamin A requirements for farming families due to its rich source of beta carotene. But production of OFSP was not adopted in the halaba zone generally and the demonstration district specifically due to weak extension support and inaccessibility of improved variety. Hence, this pre-extension demonstration was conducted to demonstrate and popularize the newly released OFSP variety (Alamura) for farmers, to evaluate on-farm root yield performance and farmers' preference analysis on the newly released OFSP variety (Alamura), and to conduct a cost-benefit analysis. As a result, to ultimately contribute to the improvement of farmers' food and nutritional security.

2. MATERIALS AND METHODS

2.1 Description of the Demonstration Area

The Halaba zone is located in Ethiopia's southern nation-nationalities and peoples' area. It bears the name of the Halaba people and encompasses a portion of their country in the vast Refit valley. An exclusive Hadiya zone borders Halaba Zone on the south, Kambata Tembaro Zone on the southwest, Hadiya Zone on the west and north, Lake Shala on the northeast, and Oromiya Region on the east. The western boundary of the Halaba Zone is defined by the Bilate River, which is its main body of water. The administrative center is Halaba Kulito. The elevation of this zone ranges from 1700 to 2200 meters above sea level. The climate is characterized as a temperate region or locally

called *woinadega. The* mean annual temperature is about 17.6–22.5 ^{o}C and the mean annual rainfall falls between 601–1200 mm. The economy is largely based on subsistence agriculture in the form of dryland farming and raising livestock, with some apiculture. The main cash crops include pepper, maize, sorghum, haricot beans, and wheat. The total population of the zone is a total population of 232,325, of whom 117,291 are men and 115,034 women. with an area of 994.66 square kilometers.

2.2 Site Selection Procedures

Effective conversation about OFSP technology, goals, and expected demonstration output was conducted at the zonal level prior to the choice of trial locations (woreda and kebele). The demonstration area (Atoti ulo) was then purposefully chosen by taking into account accessibility and the potential for sweet potato production (land and road). Additionally, at the district level, further discussion has been held regarding the goals, anticipated results, potential for production, and anticipated share of responsibilities for running and supervising the demonstration. As a result, the purposeful selection of the demonstrating kebeles (Guba shiraro and Gurura) was made based on their capacity for production, accessibility, and representativeness.

2.3 Beneficiary Farmers Selection Procedures

Beneficiary farmers were chosen in collaboration with the coordinators of the kebele development agents and crop experts, taking into account factors such as representativeness (serving as a role model to others), prior experience growing sweet potatoes, willingness to take part in the demonstration, cooperation with all methods of data collection, and willingness to impart the lessons learned and results of the demonstration to neighboring farmers. In light of the aforementioned difficulties, 10 recipient farmers and 2 FTC were chosen among the applicants (Guba shiraro and Gurura kebeles).

2.4 Demonstration Design

The demonstration consisted of two treatments; plot1 with the newly released OFSP variety (Alamura) and plot2 with the standard check (kulfo). Both were planted on a separate plot size of 10*20m = 200m of each variety on 1FTC and 10 farmers' fields. Due to the lack of other OFSP variations that were utilized before the demonstration, the variety "kulfo" was used as a standard check. The vein spacing and intera were 30 cm and 60 cm, respectively, and only compost was used as fertilizer both before and after planting (harrowing time).

2.5 Mode of Implementation and Evaluation of Demonstration

As the participant list indicated in Table 1, before starting implementation, farmers and other concerned bodies were well trained about the newly released OFSP variety, its agronomic practices, its contribution to nutritional security (richness of beta carotene), organic fertilizer(compost) preparation and application, and overall awareness of the variety from planting to marketing (consumption) by the biological breeder. The farmers were then given the essential inputs (just released and standard checked OFSP Vein) by the Hawassa Agricultural Research Center (HwARC). Additionally, regular updates and necessary technical support (advice) were provided by the relevant research discipline.

Early establishment, mid-growth, early maturity/root setting, and late maturity/harvesting stages were all used to evaluate the demonstration plots. Furthermore, participating farmers (beneficiary and neighboring), multidisciplinary researchers, extension agents, and other relevant bodies promoted and further evaluated the variety through field day sessions. Participants in the field day evaluated the variety by noting its field performance, root size, and number of roots per single pit, as well as by tasting boiling OFSP and prepared dishes made from it to assess its food quality and nutritional value.

2.6 Methods of Data Collection

The agronomic data was gathered by examining the variety's growth stage and field performance. The chosen sample area's root yield was harvested, and root mass was weighted (measured) on-site to get yield data. Through the use of a prepared checklist, farmers' preferences regarding disease resistance, the number of tubers per plant, the capacity to withstand drought, ripeness, root size, and marketability were gathered. The responses from focused group discussions (FGD) with beneficiary farmers were asked and recorded. Also, feedback was collected from Keble development

agents, surrounding farmers, and host farmers by conducting FGD and field visits at different evaluation sessions. Evaluation of culinary/eating quality was conducted on a field day session by preparing boiled and other foodstuffs of OFSP and allowing field day participants to evaluate the root yield test and promote foods that could be prepared from the variety. The evaluation criterion of the boiled root test is based on appearance/color, taste, flavor, starchiness, and fibrousness. Then, they were asked independently to give scores for the above-mentioned criteria using a prepared checklist including preference measuring questions (very good, good, and poor) for each preferred criterion. Twenty farmers (15 male farmers and 5 female farmers) were selected among field day participants, so among evaluators, 10 farmers were the hosts for the demonstration plot and 10 others were surrounding farmers who were invited for field day participation. Their responses were recorded separately on the independent datasheet. Economic data and market price of OFSP root were collected from the local market by visiting the market.

Table 1. Participant list in training

S. no	Participants	Sex			Location
		Male	Female	Total	
1	Farmers	8	2	10	Atoti ulo district
2	Extension personnel	6	1	7	
3	Researchers	6	2	8	
4	TA	1	-	1	
5	Other stakeholders	6	3	9	
6	Total	27	8	35	

Table 2. Participant list in field day

S. no	Participants	Sex			Location
		Male	Female	Total	
1	Farmers	36	20	56	Atoti ulo district
2	Extension personnel	12	4	16	
3	Researchers	10	5	15	
4	TA	2	-	2	
5	Other stakeholders	13	5	18	
6	Total	73	34	107	

Source: Author (2021)

Fig. 1. Photo from field day session at Atoti Ulo district

Fig. 2. Photho from field when potato root yied data collection

2.7 Methods of Data Analysis

The yield data collected from the field was analyzed by using descriptive statistics by applying SPSS ver.20. Qualitative data (farmers' preferences) were analyzed by using a rank matrix and scoring farmers' responses, then ranking the mean score regarding each of their preference criteria.

Food evaluations of the cooked roots of OFSP from each shown variety separately were used to analyze the food taste. A unique datasheet with information about the culinary merits of each variety is then registered to reclaim ownership of each farmer. Finally, rank the mean score and score the cumulative responses for each culinary characteristic of each variety.

3. RESULT AND DISCUSSION

As indicated in Table-3, the average tuber yield performance of the new and standard check OFSP verities was 22.5 t/ha and 10.5 t/ha, respectively. This result reveals that the new OFSP variety (Alamura) has higher root yield producing potential than its standard check, which leaves a great role in nutritional and food security for farming families due to its high productivity per unit area and richness in important nutrients.

3.1 Farmers' Preferences

Farmers, researchers, and extension staff reviewed the demonstration throughout various follow-up times. As a result, the evaluation was done on-site, starting with the early establishment stage and concluding with the late maturity stage. Farmers then assessed the demonstration using their preferred criteria, which depended on the physical attributes of each variety exhibited. Additionally, recipient farmers' final preferences were gathered using a prepared check and the choice criteria indicated in Table 4.

As indicated in farmers' preference evaluation Table 4, the evaluation means score value of newly introduced OFSP variety (Alamura) was greater than that of the standard check. This indicates that at the demonstration location, farmers selected improved variety (Alamura) as first based on their selective criteria: earliness, productivity, root color, and disease resistance.

3.2 Cost-Benefit Analysis

As indicated in Table 5 the production costs of the two verities were equal. It indicates that the required vein number/ha and required agronomic practices of two varieties were equally applied. As indicated in Table 6, the total root sale benefit obtained from the new variety and standard checks was 112500 ETB and 47250 ETB, respectively. As Table 7 indicated, the net benefit obtained from the new variety and standard checks was 83833.5 ETB and 18583.4 ETB, respectively, from the area of land/one hectare. This result reveals that producing the new OFSP variety/Alamura/on one hectare of land can gain 65250.1 ETB of additional net benefit advantages comparable to those gained by producing standard check/kulfo/on the same area of land.

As indicated in Table 3 the new OFSP variety has higher on farm root yield performance over its standard check, which leaves a great role on nutritional and food security for farming families due to its high productivity per unit area and richness in important nutrients. This result was consistently indicated in the research result of Chilala, A. [7], which indicated that the OFSP

Table 3. Yield performance in ton/hectare

Variety	min yield in ton/ha	max yield in ton/ha	Mean yield in ton/ha	Mean Yield in ton/ha on FTC	Mean difference (yield on farmers field)	Relative yd. adv.
New variety alamura (N=10)	22	28	22.5	31	12	114.3%
Standard check /kulfol(N=10)	8.6	12.5	10.5	14		

Table 4. Farmer's preferences

s/no	Evaluation Criteria	Farmers' rank					
		New variety (Alamura)			Standard check (kulfo)		
		Very good (3)	Good (2)	Poor (1)	Very good (3)	Good (2)	Poor (1)
1	Earliness	8	1	1	2	3	5
2	Productivity	9	1	-	4	6	-
3	Food taste	8	2	-	2	4	4
4	Root thickness	5	5	-	6	4	-
5	Number of roots per a pit	8	2	-	4	3	3
6	Disease/sweet potato virus resistant	9	1	-	2	3	5
7	Marketability	7	3	-	6	6	-
	Mean score	2.3	0.43	0.3	1.1	0.83	0.23
	Rank	1st			2nd		

Table 5. Total production cost

S. no	Cost reason	Measurement	Required amount	Unit price	Total cost in ETB Alamura/new	Kulfo/standard check
1	Vein	number	55555	0.30	16666.5	16666.5
2	Land preparation	Person/day	100	40	4000	4000
3	Weeding	Person/day	100	40	4000	4000
4	Harvesting	Person/day	100	40	4000	4000
Total cost=A					**28666.5**	**28666.5**

Table 6. Total benefit from root yield sale

S. no	Benefit reason	Measurement	average tuber yield in quintal		Unit price in ETB		Total benefit in ETB	
			new	Std check	New variety	Standard check	Alamura/new	Kulfo/standard check
1	Root sale	kg	22500	10500	5	4.5	112500	47250
Total benefit=B							**112500**	**47250**

Table 7. The net benefit

s. no	Demonstrated variety	Total production cost	The total benefit of root sale	Net benefit(A-B)	Net benefit advantage in ETB
1	Alamura/new	28666.5	112500	83833.5	+65250.1
2	Kulfo/standard check	28666.5	47250	18583.4	-65250.1

contributed to the household food security because the adopters had additional food from the OFSP. Besides, the research result of Schmidt, V. [8] indicates that OFSP contains bioactive compounds such as polyphenols, carotenoids, ascorbic acid, and anthocyanins with health-promoting benefits, as well as macronutrients including carbohydrates, vitamins, and dietary fiber, so it has a peerless role in nutritional security. Amy Webb [9] indicated that OFSP stands out as a sustainable food crop that supports household resiliency, food security, health and is recognized as one of the cheapest sources of vitamin A (VA).

Also, the result indicated in Table 7 shows that new OFSP variety has higher net benefit advantages over standard check. Thus, adopting the new OFSP variety has an important role in boosting household income, thereby improving their livelihood. The research result of Chilala, A. [7] shows that the farmers who adopted OFSP have improved their livelihoods because they were able to raise money to buy household goods and manage to buy family goods and services. The research result of Nyekanyeka, T [10] indicates that OFSP-growing households earn at least $100 USD per year from OFSP sales and increase their average sweetpotato yields by 50%.

4. CONCLUSION AND RECOMMENDATION

Agronomic practices and general information about the new OFSP variety (Alamura) were demonstrated for selected farmers through providing training and conducting participatory agronomic practices, thereby popularized through field visits, conducting field days, and promoting it by inviting all stakeholders and displaying it on different printed and electronic mass media.

On farm root yield performance evaluation of newly introduced OFSP variety (alamura) showed better yield performance on both farmers' fields and FTC, over its standard check. Producing the newly introduced OFSP variety has a relative yield advantage of 114.3% compared to standard check, which contributes a great share to household food security and income generation.

Also, the newly introduced OFSP variety has a high mean score value of farmers' preference and was selected as first regarding its selective characteristics: productivity, marketability, color, and sweet potato virus-resistant relative to its respective standard check, so it was selected as first.

Therefore, expanding the production of the variety (alamura) for Atoti Ulo district and similar agro-ecological conditions is recommended to improve the OFSP production and productivity of smallholder farmers, which ultimately leaves a great share of household food and nutritional security. Thus, all concerned bodies (extension workers, woreda, and zone agricultural officers and seed multipliers) need to play their major role by making the technology accessible to farmers.

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DECLARATION

Hereby, I declare that this submission is entirely my own work, written entirely in my own words, and that all sources used in research are fully acknowledged, as are all quotations. It has not been submitted for publication, in whole or in part, by me or another person. I am aware of the ethical implications of my research, and this work satisfies the requirements of the Ethics Committee of the Southern Ethiopia Agricultural Research Institution.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bowser T, Ojwang F. Promotion of orange flesh sweet potato by the demonstration of

acceptance and food product development; 2017.

2. Hotz C, Loechl C, Lubowa A, Tumwine JK, Ndeezi G, Nandutu Masawi A, Baingana R, Carriquiry A, de Brauw A, Meenakshi JV, Gilligan DO. Introduction of β-carotene–rich orange sweet potato in rural Uganda resulted in increased vitamin A intakes among children and women and improved vitamin A status among children. The Journal of nutrition. 2012a;142 (10):1871-80.
3. Hotz C, Loechl C, de Brauw A, Eozenou P, Gilligan D, Moursi M, Munhaua B, van Jaarsveld P, Carriquiry A, Meenakshi JV. A large-scale intervention to introduce orange sweet potato in rural Mozambique increases vitamin A intakes among children and women. British Journal of Nutrition. 2012b;108(1):163-76.
4. Dibi KE, Essis BS, N'zué B, Kouakou AM, Zohouri GP, Assouan AB, Van Mourik T. Participatory selection of orange-fleshed sweet potato varieties in north and north-east Côte d'Ivoire. Open Agriculture. 2017;2(1):83-90.
5. Carey L. Evaluation of Orange Fleshed Sweet Potato (*Ipomoea batatas* L.) Genotypes for Higher Yield and Quality; 2007.
6. Markos D, Loha G. Sweet potato agronomy reseach in Ethiopia:summary of past finding and future reseach directions;2016.
7. Chilala A. Diffusion of the orange fleshed sweet potatoes (OFSP) and its impact on household food security and livelihoods in Petauke district, Zambia (Doctoral dissertation, University of Zambia); 2019.
8. Schmidt V. Nutrition security in Tanzania: Orange-fleshed sweet potatoes and their contribution to health. Anchor Academic Publishing (aap_verlag); 2013.
9. Amy Webb Girard, Anthony Brouwer, Emily Faerber, Frederick K. Grant, Jan W. Low.Orange-fleshed sweet potato: Strategies and lessons learned for achieving food security and health at scale in Sub-Saharan Africa; 2021.
10. Nyekanyeka T, Kapalasa E, Chipungu FP, Botha B, Abidin PE. Improving food security, nutrition and gender empowerment; 2013.

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