**Participatory Variety Selection and Promotion of Orange Flashed Sweet Potato varieties in North Western Amhara Region**

**Abstract**

*Orange flashed sweet potato is one of the most important nutrients dense and widely demanded for its vitamin A content. The crop is crucially important for Amhara region in areas where stanting is over 38 percent. Despite it orange fleshed sweet potato is a new crop to the region as opposed to white flushed sweet potato. Hence the experiment was conducted with the objective of evaluating the performance of high yielder orange fleshed sweet potato varieties, to create a wider demand for orange-flashed sweet potato technologies, to assess farmers' and extension workers' reactions to the demonstrated varieties and production techniques and to create and strengthen a linkage among possible actors in orange flashed sweet potato production from 2020-2022 main cropping season. This activity was conducted in two phases in the first phase participatory variety selection was done at Dera and Bahir Dar woreda. In phase two the best selected varieties was promoted to large producers of Western Amhara region, Jabi Tehnan, dera and Bahir Dar City areas. The analytical result show that, kulfo gave a significant yield of 19690 kg/ha. During promotion time Kabode variety also gives about 17519kg/ha which is a second-yielding variety as compared with the other five varieties. The Kabode variety was the next preferred variety by the farmers before the Alamora variety. Wider demand was created by the farmers and they show their demand to produce Kabode orange flashed sweet potato variety widely. Therefore widening of nutritionally important orange flashed sweet potato varieties should be done in similar agro ecological areas of Western Amhara Region.*

***Keywords:***Orange flashed, Sweet potato, Westren Amhara

**Introduction**

Sweet potato (*Ipomoea batatas L*.) is an herbaceous perennial root crop belonging to *Convolvulaceae* family. It is characterized by creeping vines and adventitious roots (Chagonda *et al.,* 2014). The crop came into Africa through trade from South America where it originated (Nedunchezhiyan *et al.,* 2012). Africa’s average yield is 6 t/ha while the world production reaches the average yield of 14 t/ha (Mutandwa, 2008). Among the most important root and tuber crop, sweet potato is one of the major traditional food crop of Ethiopia (Endale *et al*., 1994). It is an attractive crop due to its high productivity, universal users, high caloric content and good test.

It is a known crop gifted with high potential to tolerant adverse environmental conditions such as drought, low soil fertility and requires vary little labor and care compared to other crops (CIP, 1995). Sweet potato is widely produced and rich in carbohydrates, protein, calcium, iron, potassium, [carotenoids](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/carotenoid), [dietary fiber](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/dietary-fiber), and vitamins (especially C, folate, and B6), and very low in fat and sodium ([Bovell-Benjamin, 2007](https://www.sciencedirect.com/science/article/pii/S0378429017315691)).

Sweet potato is also one of the cheapest potential sources of vitamin A to alleviate problem of night blindness and infant mortality from which millions of children from sub-Saharan Africa are facing. Vitamin A is an essential nutrient that prevents blindness in children and pregnant women. With all its desirable traits, Sweet potato greatly contributes to food security and farmers’ income (Terefe, 1994). Sweet potato production in Africa has doubled from 1.0 to 2.0 million tons between 2002 and 2012 ([FAO, 2017](https://www.sciencedirect.com/science/article/pii/S0378429017315691)). Predominantly white or yellow fleshed varieties are cultivated, while orange-fleshed sweet potato (OFSP) is rich in [beta-carotene](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/beta-carotene) which is converted into [vitamin A](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/retinol) in the human body.

Hence the experiment was conducted with the objective of evaluating the performance of high yielder orange fleshed sweet potato varieties, to create a wider demand for orange-flashed sweet potato technologies, to assess farmers' and extension workers' reactions to the demonstrated varieties and production techniques and to create and strengthen a linkage among possible actors in orange flashed sweet potato production from 2020 to 2022 main cropping season.

**Objectives**

* To evaluate the performance and adaptability of orange fleshed sweet potato varieties
* To create a wider demand for orange-flashed sweet potato technologies
* To assess farmers' and extension workers' reactions to the demonstrated sweet potato varieties and production techniques
* To create and strengthen a linkage among possible actors in orange flashed sweet potato production

**Materials and Methods**

**Participant farmer selection and training**

Multi-stage purposive sampling techniques were used to select the research area. Based on the availability of farmers’ interest to participate as a host farmer and willing to provide land. First west Gojjam and South Gonder Zones were selected purposively based on adaptation and an evaluation trial was done earlier. Similarly, Dera and Bahirdar Zuria woreda were selected from the South Gonder and West Gojjam zones respectively. Next one potential kebele was selected from each woreda. Finally, 20 potential host farmers were selected purposively by discussing with woreda and Kebele agricultural experts about the farmer's interests and potential land access. Farmer selection criteria were based on their interest in participating as a host farmer for other follower farmers on the demonstration and their interest in allocating land for free.

Both theoretical and practical training were delivered to the farmers and experts from Woreda and kebele agriculture offices. The training was focused on improved orange flashed sweet potato production and postharvest management techniques. The farmers become well-informed about the detailed objectives and procedures of the activity and data sharing and data capturing.

**Treatment and design**

Five orange fleshed sweet potato varieties namely Alamora, Dilla, Kabode, Kulfo and Birtukanie were tested. The design was randomized complete block (RCB) with three replications. Vine cuttings will be 30 cm length with 4- 5 nodes was produced. Cuttings was planted on the ridges with about three nodes (3/4 of the vine cut) buried in the soil uniformly. Spacing was based on national recommendation of 60cm between rows and 30 cm between plants and Fertilizer 92N and 46P2O5/ha. Gross plots size was 2.4 m×3 m.

Table 1. Training participants

|  |  |  |  |
| --- | --- | --- | --- |
| Woreda  | Kebele  |  Farmers  | Experts  |
| M  | F  | T  | M  | F  | T  |
| Jabi Tehnan  | Jiga  | 20 | 0 | 20 | 4 | 1 | 5 |
| Gonji  | Zema  | 10 | 0 | 10 | 4 | 0 | 4 |
| Bahir Dar  | Meshenti  | 20 | 0 | 20 | 4 | 0 | 4 |
| Dera  | Dera  | 10 | 0 | 10 | 6 | 0 | 6 |
|  Total  |   | 60 | 0 | 60 | 18 | 1 | 19 |

**Monitoring and Evaluation**

Joint monitoring and evaluation (JME) of the pre-scaling-up activity at farmers' fields was done at different plantation stages. The JME team was organized as FREG members, researchers, and experts from the Woreda and Kebele Office of Agriculture. During the monitoring and evaluation, the field performance and farmers' and extension experts' perceptions were recorded and evaluated.

**Field day organization-** both result and method demonstration were organized to evaluate and demonstrate orange flashed sweet potato production techniques and results respectively for the FREG members and other stakeholders of sweet potato production.

**Data collection and analysis techniques**

Marketable and unmarketable yield and farmers' and extension workers' perception data was collected by using a semi-structural data collection sheet. Data analysis was done by using simple descriptive statistics such as a mean, SD, and percentage. Farmers’ and experts’ perceptions were analyzed by using narration and five scale Likert scale analysis techniques.

**Field day**

The field day was organized to evaluate and demonstrate orange-fleshed sweet potatoes. Production and utilization techniques and results respectively, for the participant and non-participant farmers and other stakeholders of sweet potato production.

**Farmers’ criteria (PVS)**

The farmers selected four parameters for the evaluation of five varieties of sweet potato from their points of view. The criteria were tuber yield, vine length, drought tolerance and tuber size. The farmers also give weight to their criteria based on the voting method. The rank of criteria yield, vine length, drought tolerance and tuber size were settled as the first to fourth criteria respectively.

Table 2. Pair-wise Matrix for variety selection criteria

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Criteria  | Yield  | Vine length | Drought Tolerance  | Tuber Size | SCORE | RANK |
| Yield | X  | Y  | Y | Y | 3 | 1 |
| Vine length | X  | X  | LL | LL | 2 | 2 |
| Drought Tolerance  | X  | X  | X  | TS | 1 | 3 |
| Root Size | X  | X  | X  | X  | 0 | 4 |

**Results and Discussions**

**Yield Result**

In the first stage, five varieties were selected and evaluated with the participation of farmers and extension workers. As indicated in Table 1, below kulfo gave a significant yield of 19690 kg/ha. Kabode variety also gave about 17519kg/ha which is a second-yielding variety as compared with the other five varieties. The Kabode variety was the next preferred variety by the farmers before the Alamora variety.

By taking the selected variety pre-scaling up activities were conducted. During the pre-scaling up activity a promising result, on average 20.87 tons/ha was gained at farmers' fields on demonstrated varieties. In addition to food consumption farmers try to sell for market and gain income about 3000 ETB.

Table 5. Yield result

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variety | RD(cm)  | RL(cm) | VL(cm) | VNPP | RNPP | RWt(g) | MRYPH(kg ha-1) | UMRYPH(kg ha-1) |
| Alamura | 5.18b | 19.40a | 111b | 9.50b | 3.36bc | 299bc | 16407b | 1421 |
| Dilla | 5.11b | 18.56ab | 140a | 8.93b | 3.23bc | 305b | 12838c | 2221 |
| Kabode | 5.18b | 17.83ab | 83d | 7.88c | 3.98a | 270d | 17519ab | 2148 |
| Kulfo | 6.50a | 13.60c | 97c | 11.63a | 3.06c | 404a | 19690a | 1305 |
| Birtukane | 5.05b | 16.80b | 140a | 9.06b | 3.56b | 279cd | 19171ab | 1486 |
| SL  | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* | ns |
| Location |  |  |  |  |  |  |  |  |
| Dera | 6.30a | 19.33a | 127a | 10.99a | 3.20b | 418a | 24094a | 2055a |
| B/Dar | 4.51b | 15.14b | 101b | 7.81b | 3.68a | 205b | 10155b | 1377b |
| SL | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* | \*\* | \* |
| CV (%) | 7.54 | 9.92 | 6.79 | 7.89 | 8.40 | 5.94 | 13.25 | 40.92 |

Table 6. Yield result

|  |  |  |  |
| --- | --- | --- | --- |
| No  | Location  | Mean tuber yield ton/ha  | Income gained/h/10\*10m |
| 1 | Jabi Thehnan | 27.65 |  |
| 2 | Bahir Dar(Meshenti) | 14.09 | 3000 ETB |
| Overall mean  | 20.87 |  |

**Farmers' criteria for Variety selection**

As the result indicated in the table 3 below Alamora, Kabode, Dilla, Kulfoand and Birtukanie were selected from first to fifth preferred variety by the farmers. Alamora variety was not selected based on the yield result and yield-related parameters but the farmers preferred it from market preference perspective. By considering the yield and farmers' second preference the second preferred variety was recommended to be pre-scaled up for further development.

Table 3. Preferred varieties by the farmers'

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Varieties | Yield  | Leaf length | Drought Tolerance  | Tuber Size | Total Score  | Share(%)  | Rank  |
| Alamora | 54 | 6 | 12 | 13 | 85 | 22.84 | 1 |
| Dilla | 3 | 29 | 30 | 13 | 75 | 20.16 | 3 |
| Kaboda | 33 | 14 | 18 | 13 | 78 | 20.96 | 2 |
| Kulfo | 2 | 21 | 24 | 21 | 68 | 18.27 | 4 |
| Burtukane | 11 | 20 | 6 | 29 | 66 | 17.74 | 5 |
| Total | 103 | 90 | 90 | 89 | 372 | 100 | - |

**Sensory evaluation**

During the variety selection cooking and test selection were done. Based on the sensory evaluation result shown below the time for cooking was equal and it takes about 50 minutes. The test of five sweet potato varieties was varied and Dilla, Aalamora, Kabode, Birtukanie and Kulfo were selected from the first to fifth testy variety.

Table 4. Sensory evaluation result

|  |  |  |  |
| --- | --- | --- | --- |
| Variety  | Cooking time | Cooking quality | Test preference |
| Alamura |  50 minutes | Very good | 2 |
| Dilla | Very good | 1 |
| Kabode | Very good | 3 |
| Kulfo | Very good | 5 |
| Birtkane | Good | 4 |

**Field Day**

The field day was organized at Jabi Thenan and Bahir Dar city. During the field day, the farmers and stakeholders visited the results gained from the farmer's field and they also viewed and tested the alternative consumption techniques. Detail discussions were made between the farmers and other stakeholders on the sustainable production of the crop

Table 7. Field day participants

|  |  |  |  |
| --- | --- | --- | --- |
| List of participants  | Jabi Tehnan | Bahir Dar | Overall total  |
| Female | Male | Total | Female | Male | Total |
| Farmers | 32 | 36 | 68 | 5 | 10 | 20 | 88 |
| Extension workers | 2 | 16 | 18 | 3 | 4 | 7 | 25 |
| Researchers | 0 | 16 | 16 | 0 | 6 | 6 | 22 |
| Mass Media | 0 | 5 | 5 | 0 | 2 | 2 | 7 |
| Total  | 34 | 73 | 107 | 8 | 22 | 34 | 142 |

**Conclusion and Recommendations**

An encouraging yield was gained at the farmers' field. The farmers were interested in the demonstrated orange flashed sweet potato varieties. New nutritional food and consumption techniques were introduced in Western Amhara areas which increase the nutritional status of the farmers. Therefore scaling up and out of nutritionally rich orange sweet potato should be done in similar agro-ecology areas.

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