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On farm Demonstration and Evaluation of Sweet Potato (*Ipomoea batatas Lam*) Varieties: The case of Kellem and West Wollega Zones, West Oromia, Ethiopia

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Abstract
Sweet potatoes are an important traditional food crop in Ethiopia, valued by farmers for their versatility, high caloric content, and taste. An improved, disease resistant and high yielding variety of sweet potato is very important to improve farmers' productivities and income. Objective of this study was to demonstrate the already verified and improved varieties of sweet potatoes on selected districts of West and Kellem Wollega Zones. The demonstration and on farm evaluation result of this study revealed that the Balo variety was best by comparing it with the local one. The average yield of Balo variety is 46.81 kg per $100m^2$ plots of land and 24 kg per $100m^2$ plots of land for local variety. The mean value of Balo variety at local market is 140.43 birr per $100m^2$ plots of land, which is preferable to local type. The net benefit per hectare for Balo variety, 39,613 birr per hectare, is larger than that of local variety, 21,945 birr per hectare. The mean weight of marketable tuber per plot is 0.9875 kg for Balo variety which is larger than that of local variety, 0.324 kg. Farmers' have got training through Farmer Research Group (FRG) approach, in which they have practically seen and tested two varieties through by applying full extension packages.
Keywords: On farm, Demonstration and Evaluation, Sweet Potato Varieties, Haro Sabu, Ethiopia

1. Introduction

Sweet potato is one of the twelve principal plant species utilized as a human feed trhoighout the world. It can be cultivated in many different climatic conditions, an d as a result large areas of sweet pootato are cultivated in Asia, Africa, Europe, America and Oceania (Paneque Ramirez, 1991). It is also one of the most widely grown root crops in SSA, it is particularly important in countries surrounding the Great Lakes in Eastern (Vital Hagenimana, 1999) and Central Africa, in Angola, Madagascar, Malawi and Mozambique in Southern Africa, Nigeria in West Africa and China being the largest producer worldwide. In Africa, it is grown predominantly in small plots by poorer farmers and hence known as the poor man's food (Ermias *et al*, 2013). According to Ermias et al (2013) the sweet potato, *Ipomoea batatas* (Lam.) is a dicotyledonous plant that belongs to the family Convolvulaceae, and a tuberous root crop important for food security. Globally it is among the important food crops in the world, after wheat, rice, maize, Irish potato, and barley and it 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 (Teshome A., Nigussie D., and Yibekal A., 2012).

Ethiopia ranks fifteenth in the world in terms of sweet potato production (Dan *et al*, 2013). Sweet potatoes are an important traditional food crop in Ethiopia, valued by farmers for their versatility, high caloric content, and taste. Sweet potatoes are also a resilient food security crop than can withstand drought, low soil fertility, and high levels of rainfall. Sweet potatoes are grown both in the short rainy season (February through April) and the long rainy season (July through September). Sweet potatoes are grown mainly in the southern, southwestern, and eastern parts of Ethiopia, where the climate is warm and humid.

One of the constraints facing crop production and productivity is unavailability of improved seeds. In relation to this majority of Sub-Saharan African countries are unable to utilize the result of crop improvement works at different agricultural centers (Girma Abera, *et al.,* 2004). Improved and high yielding varieties of sweet potato have been developed by different research centers to improve farmers' productivities and income by enabling them adopt high yielding, adaptable and disease resistant varieties. For this reason, Haro Sabu Agricultural Research Center has evaluated for demonstration selected varieties of sweet potatoes on station. Therefore, it is important to demonstrate these varieties on farmers' fields and Farmers Training Centers in the two Zones to compare it with their local material for future selection for scaling up.

On-farm research is a problem-oriented approach to agricultural research that begins by diagnosing the conditions, practices, and problems of particular groups of farmers (John, 1997). Once the problems are identified, a research demonstration program is designed to address them. A key part of any such program is conducting experiments or demonstrations on farmers' fields under farmers' conditions and management. Those experiments are then evaluated using criteria that are important to farmers, and the results are used to make recommendations. The process of conducting on-farm demonstrations can be divided into the following five

steps such as diagnosis, planning, establishment and Management, evaluation, recommendation and diffusion (John, 1997). The general objective of this study was to demonstrate the already verified and improved varieties of sweet potatoes on selected districts of West and Kellem Wollega Zones and specifically it was conducted to create awareness about newly released sweet potato varieties in the area and to test significance of verified seed by looking it with local seed.

2. Materials and Methods

Some selected varieties of sweet potatoes such as Dimtu and Balo that has been released from different research center were further evaluated at Haro Sabbu on station and was grown for demonstration both on farmers field through Farmers Research Group (FRG) and Farmer's Training Center of the selected districts of the two zones. Two peasant associations were selected purposively for Farmers Research Group (FRG) from Dalle Sadi (appendix 3) district of Kellem Wollega Zone and Gulliso (appendix 2) district of West Wollega Zone each consisting of 10-15 interested farmers and easily manageable. The groups were formed and managed based on their interests to produce sweet potatoes, landownership, and other important socioeconomic variables with the main objective of demonstration and participatory evaluation of improved sweet potatoes varieties thereby enhancing scaling up in the coming seasons. At the same time, two peasant associations (Gulliso and Dale Sadi) were used for Farmer's Training Center farm demonstration.

The demonstration was done on farmers' field with plot size of 10m x 10m in the two (Dale Sadi and Gulliso) districts of West and Kellem Wollega zones. The technology that have been released from different research centers were grown side by side to demonstrate and compare their performance thus the best performing varieties were selected based on criteria like adaptability ,disease resistance ability and yields.

Training was given to the farmers to support the farmers' indigenous knowledge and skills of crop production by scientific knowledge and skills of researchers in order to generate the technologies that fits the environments, the needs and realities of the farmers with the full packages there by increasing the relevance of extension messages to the farmers' conditions through enhancing/helping them acquire knowledge and skills of sweet potato production and management practices. Meanwhile, appropriate training relevant to their professions was also given to the district's development agents and coordinators as well.

3. Result and Discussion

Most of the sweet potato varieties grown in East Africa have white or cream-colored flesh (Dan et al, 2013). But color of sweet potato (Balo variety) demonstrated is red. Sweet potatoes are also a resilient food security crop than can withstand drought, low soil fertility, and high levels of rainfall. They are grown mostly by small-scale, resource-poor farmers for both human consumption and animal feed. Women typically have most of the responsibility for growing sweet potatoes.

In Sweet potato, varieties play significant role in yield improvement (Maniyam Nedunchezhiyan, Gangadharan Byju and Susantha K.Jata, 2012). Among factors that contribute to the increment of production and productivity is availability of verified, tested, demonstrated and socially accepted seed is crucial. Towards this from the demonstration activity undertaken in both zones, Kellem Wollega and West Wollega, the following findings were prevailed.

Yield:- The comparison was done using their yield after equal treatment of both seeds. According to table 1 Balo variety of sweet potatoes with average yield of 46.81 kg per $100m^2$ plots of land was selected to local variety with 24 kg per $100m^2$ plots of land given the equal treatment.

Value of yield at local market:- The final goal of seed improvement is to increase the financial position of smallholder farmers. Towards this end on farm demonstration and evaluation of sweet potato varieties result shows that the mean value of Balo variety at local market is 140.43 birr per $100m^2$ plots of land, which is preferable to local type. This result was gained given the statement explained by Dan et al (2013) which says many parts of East Africa, marketing systems for sweet potatoes are underdeveloped, due to the short shelf life of sweet potatoes. Other common issues for sweet potato marketing include distant or inaccessible markets, lack of available traders, and overproduction during the high season.

Net benefit:- The net benefit per hectare for Balo variety, 39,613 birr per hectare, is larger than that of local variety, 21,945 birr per hectare. Factors that constrain sweet potato production and yields in Ethiopia include drought, frost at high altitudes, lack of irrigation, lack of high yielding and adapted cultivars, lack of quality cuttings, damage from handling, lack of appropriate management techniques, and pests and disease (Dan et al, 2013).

Table 1 Summary of yield obtained, value of yield at local market and net benefit per hectare of both varieties

	Variety treatment	Mean	Std. Deviation
Yield obtained	Balo	46.8096	4.35695
	Local	24.0535	4.23347
Value of yield at local market	Balo	140.4294	13.07012
	Local	96.2485	16.94388
Net benefit per hectare	Balo	39,613.0000	5,486.28993
	Local	21,945.0000	7,233.95667

Source: On farm demonstration and evaluation data

The mean weight of marketable tuber per plot is 0.9875 kg for Balo variety which is larger than that of local variety, 0.324 kg. The mean number of marketable tuber per plot is 129.5 for Balo and 87.125 for local variety while the mean number of unmarketable tuber per plot is 80.5 for Balo and 55.38 for local variety.

Table 2 Summary of number marketable and unmarketable tuber and weight of marketable and unmarketable tubers of both varieties

	Variety treatment	Mean	Std. Deviation
Number of marketable tuber per plant	Balo	7.50000	.925820
	Local	5.00000	1.309307
Weight of marketable tuber per plant (in kg)	Balo	.9875	.34446
	Local	.3238	.02925
Number of marketable tuber per plot	Balo	129.5000	9.14955
	Local	87.1250	11.23054
Weight of un-marketable tuber per plot (in kg)	Balo	.5988	.06402
	Local	.2425	.04166
Number of unmarketable tuber per plot	Balo	80.5000	12.77274
	Local	55.3750	6.69621

Source: On farm demonstration and evaluation data

Sweet potato vines are a major source of animal feed in Ethiopia (Dan et al, 2013). One survey (Beyero, Tolera, and Abebe, 2010) that focused on livestock production found that crop residues, including sweet potato vines, were the main feed resource during the dry season; natural pasture was the main source of feed during the rainy seasons. Approximately 88% and 99% of the farmers in this survey used sweet potato vines for animal feed. Sweet potato vines were fed to livestock either fresh or after curing. During sweet potato harvesting, farmers fed most of the collected sweet potato vines to livestock, and used the remainder for sweet potato propagation.

Sweet potatoes can be propagated either through vine cuttings or through sprouts from tubers. Vine cuttings are the preferred method, as they lead to higher yields, avoid soil-based diseases, and enable the farmer to save the whole tuber for consumption or marketing, rather than using part of it for planting. However, root sprouts or storage root pieces are sometimes used when vines are unavailable (Dan et al, 2013).

Table 3 Summary of root length, vine length and yield in quintals per hectare of both varieties

	Variety treatment	Mean	Std. Deviation
Root length (in m)	Balo	.2038	.02722
	Local	.3000	.02619
Vine length(cm)	Balo	38.3875	5.25912
	Local	123.8750	12.85343
`Yield in quintals per hectare	Balo	18.7238	1.74293
	Local	9.6249	1.69444

Source: On farm demonstration and evaluation data

4. Conclusion

Sweet potatoes are an important traditional food crop in Ethiopia, valued by farmers for their versatility, high caloric content, and taste. On-farm research is a problem-oriented approach to agricultural research that begins by diagnosing the conditions, practices, and problems of particular groups of farmers. Once the problems are identified, a research demonstration program is designed to address them. A key part of any such program is conducting experiments or demonstrations on farmers' fields under farmers' conditions and management.

The general objective of this study was to demonstrate the already verified and improved varieties of

sweet potatoes on selected districts of West and Kellem Wollega Zones and specifically it was conducted to create awareness about newly released sweet potato varieties in the area and to test significance of verified seed by looking it with local seed. The demonstration was done on farmers' field with plot size of 10m x 10m in the two (Dale Sadi and Gulliso) districts of West and Kellem Wollega zones. The technology that have been released from different research centers were grown side by side to demonstrate and compare their performance thus the best performing varieties were selected based on criteria like adaptability ,disease resistance ability and yields.

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Acknowledgement
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6. Appendix

Appendix 1 Summary statistics

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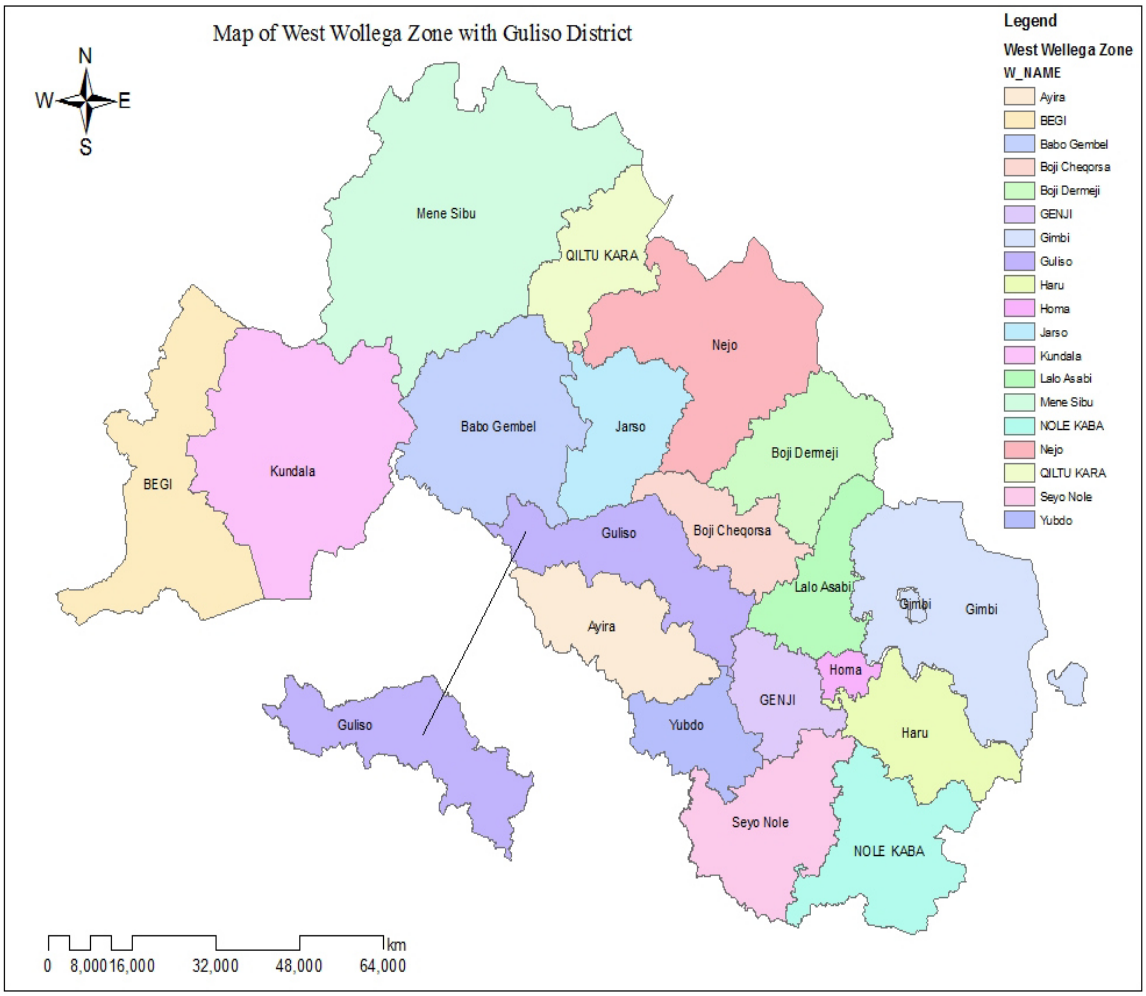
	Local	123.8750	12.85343
`Yield in quintals per hectare	Balo	18.7238	1.74293
	Local	9.6249	1.69444

Appendix 2 Map of Guliso District from West Wollega Zone


Map of West Wollega Zone with Guliso District
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West Wellega Zone
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BEGI
Babo Gembel
Boji Cheqorsa
Boji Dermeji
GENJI
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Haru
Homa
Jarso
Kundala
Lalo Asabi
Mene Sibu
NOLE KABA
Nejo
QILTU KARA
Seyo Nole
Yubdo
Mene Sibu
QILTU KARA
Nejo
Babo Gembel
Jarso
Boji Dermeji
Kundala
BEGI
Guliso
Boji Cheqorsa
Lalo Asabi
Gimbi
Gimbi
Ayira
Homa
GENJI
Yubdo
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NOLE KABA
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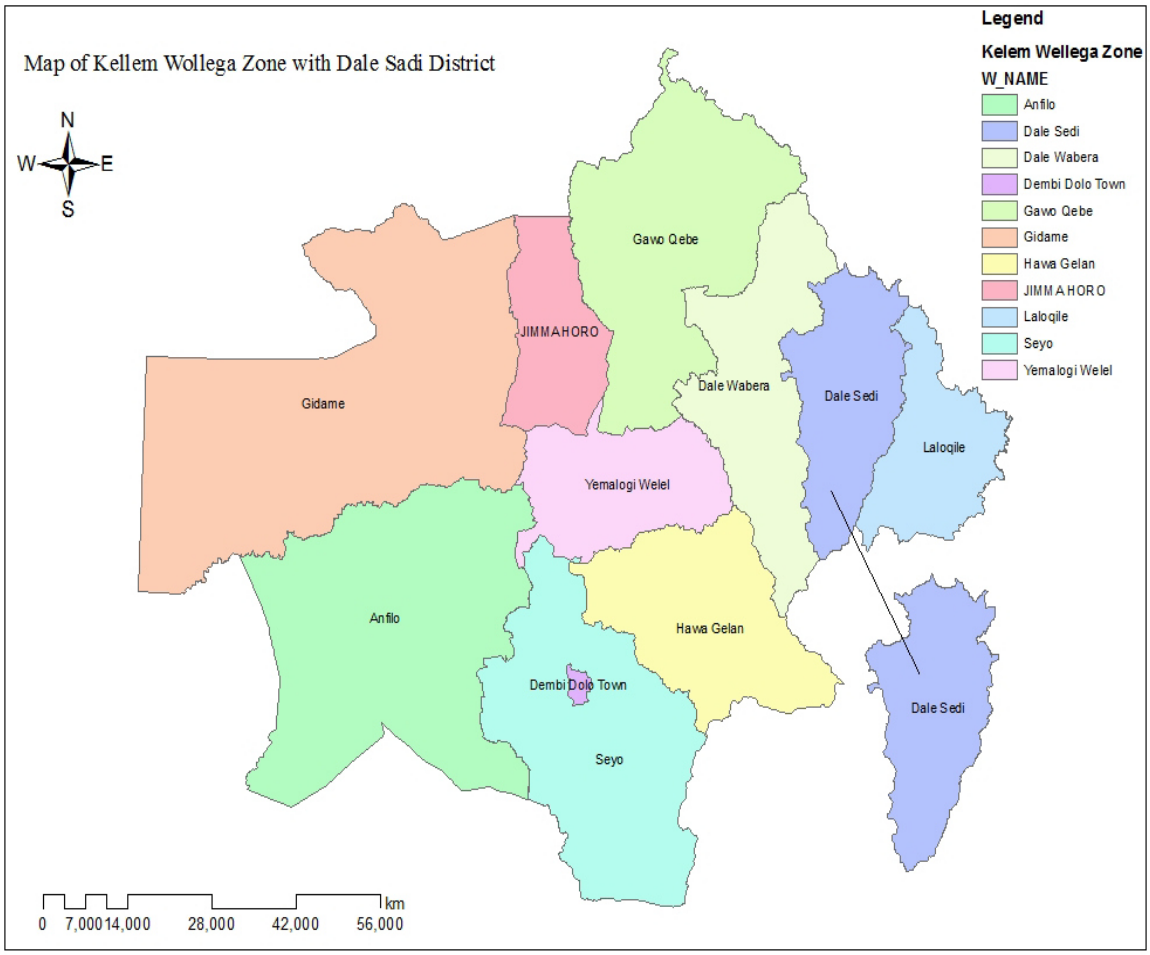
km

Appendix 3 Map of Dale Sadi District from Kellem Wollega Zone



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