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On Farm Demonstration and Evaluation of Improved Dessert Type Banana Varieties in Daro Lebu District of West Hararghe Zone, Oromia National Regional State, Ethiopia

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Abstract
The study was conducted in Daro Lebu district of West Hararghe Zone with objective to evaluate improved banana variety on farmer's field and create linkage and networking among stakeholders. Three kebeles namely, Oda Laku, Chafe Hara and Sororo were selected purposively based on banana production potential. A total of eight farmers were selected based on their interest towards technologies, access of irrigation, willingness to manage and allocate field trial for the activity. Three improved banana varieties namely Giant Cavendish, William I and Robust were evaluated with local variety. Four suckers of each improved variety and local banana were planted on single plot design of 2.5mx2.5m area for each. Quantitative and qualitative data was collected though observation, focus group discussion and recording with collaboration of farmers and extension agents. The collected quantitative data was analyzed through descriptive and inferential statistics where as qualitative data was analyzed through interpretation and summarization. The result of the study indicated that Giant Cavendish and William I ranked 1st and 2nd based on yield, respectively and selected by farmers in terms of fruit size, early maturity, height, disease resistant, preferable at market & sweetness of fruit. A paired sample t-test result indicate that mean comparison of Giant Cavendish and William I along local check cultivar were statistical significant at $P<0.05$ level on weights per bunch and mean of number hands per bunch. Therefore, Giant Cavendish and William I varieties were recommend for further scale up for Daro Lebu district and other similar agro-ecologies.
Keywords: Banana production, Demonstration, Evaluation, Dessert Type, Varieties.

1. Introduction

Banana (*Musa paradisiacal var. sapiertum*) is one of the most important tropical fruits and evolved in the humid tropical regions of South East Asia with India as one of its centers of origin. Banana represents the world's second largest fruit crop with an annual production of 129,906,098 metric tons (FAOSTAT, 2010). It ranks as the fourth most important global food commodity after rice, wheat and maize in terms of gross value of production (INIBAP, 1992). About 70 million people are estimated to depend on banana fruit for a large proportion of their daily carbohydrate intake (Swennen R, Wilson GF, 1983). Banana is the major staple food in developing countries. The fact that it produces fruit throughout the year adds to its importance as a food security crop in Africa. It is a primary food and cash crop for over 30 million people in East Africa. Banana is now a major food crop in Africa estimated to meet more than a quarter of the food energy requirements in the continent (Robinson, J.C., 1996).

Banana is a staple food and good source of income for a number of African countries especially East and Central Africa (Viljoen, A. 2010). Bananas believed to have entered in the East African highland regions between the first and sixth century AD (Price, 1995). As a result of wide range of unique varieties available that are belonging to the East African highland bananas and the region has been considered as secondary centre of Musa diversity (Swennen and Vuylsteke 1988; Stover and Simmonds 1987).

In Ethiopia, banana is produced throughout the country wherever there is adequate rainfall or irrigation opportunity. It is the second major fruit crop produced next to citrus. The major banana producing regions in Ethiopia are Southern, Oromia and Amhara regions. About 92,362.36 hectares of land is under fruit crops in Ethiopia. Bananas contributed about 58.13% of the fruit crop area followed by avocadoes that contributed 14.80% of the area. More than 6,797,428.30 quintals of fruits was produced in the country. Bananas, Mangoes Avocados, Papayas, and Oranges took up 64.75%, 14.76%, 7.92%, 7.08% and 4.16% of the fruit production, respectively. About 39.39 Qt/ha of banana were produced in 2015/16 cropping season in country (CSA, 2016).

Banana is the most important crop in Ethiopia, but over the years a number of problems tend to faced against the production of this crop in the country. Out of these, lack of improved varieties is the critical problem to banana. However, the research on banana was started in the country very recently (in early 1970s) as compared to other major crops. As a result few cultivars such as Dwarf Cavendish, Poyo, Giant Cavendish, and

Ducasse hybrid were recommended for production (EARO, 1999). In West Hararghe Zone, banana was grown on farmers' field both through rain fed and irrigation as means of food consumption and income generation activities. Banana was produced on 742.28 ha of land with 60Qt/ha in 2015/16 cropping season in West Hararghe Zone (CSA, 2016). Similarly, it was major fruits produced next to mango in the area. However, most of banana produced in the study area was local cultivar which is low yielder, susceptible to disease resistant and due to this the productivity of the crop decreased hence farmers was not harvest required fruits and fetch income from their fields. Therefore, the activity proposed with the following objectives.

2. Objectives

- To evaluate improved dessert type banana variety under farmers condition;
- To create linkage and awareness among stakeholders on banana production.

3. Methods and Materials

3.1. Description of the Study Area

Daro Lebu is one of district found under West Hararghe Zone. The capital town of the district Mechara is found at about 434 km South East of Addis Ababa. The district is situated between 7052°10ºº and 8042°30ºº N and 40023°57ºº and 4109°14ºº E. The district is characterized mostly by flat and undulating land features with altitude ranging from 1350 up to 2450 m.a.s.l. Ambient temperature of the district ranges from 14 to 26^{0}C with average of 16^{0}C with average annual rainfall of 963 mm/year. The pattern of rain fall is bimodal and its distribution is mostly uneven. Generally, there are two rainy seasons: the short rainy season '*Belg*' lasts from mid-February to April whereas the long rainy season '*kiremt*' is from June to September. The rainfall is erratic; onset is unpredictable, its distribution and amount are also quite irregular. Consequently most *kebeles* frequently face shortage of rain; hence moisture stress is one of major production constraints in the district (Daro Lebu WADO, 2008). Based on figures published by the Central Statistical Agency (2007), this district has an estimated total population of 198,918 from which 102, 014 were males and 96,904 were females; 26,404 of its population are urban dwellers, where as182, 057 are rural dwellers.

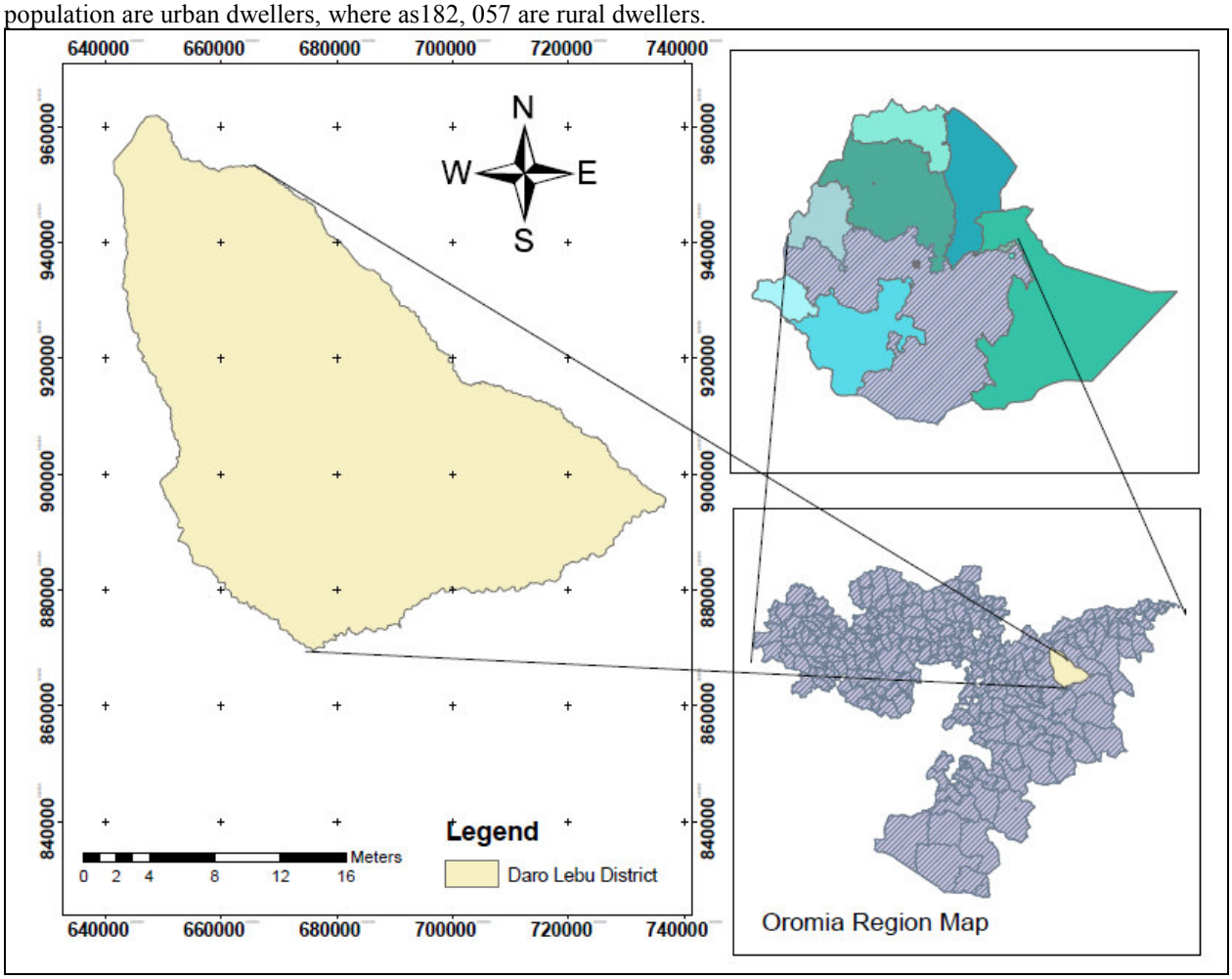

Figure 1: Map of Daro Lebu district.

3.2. Farmers and Site Selection

The experiment was conducted for four successive years at Daro Lebu district of West Hararghe Zone. Oda Leku, Chafe Hara and Sororo *kebele* were selected purposively based on potential of banana production and availability of irrigation with respective district Agricultural Office. A total of eight farmers were selected for evaluation based their interest towards technologies, access of irrigation, willingness to manage and allocate field trial for the activity with collaboration of extension agents and *Kebeles* administration leaders.

A total of three improved banana varieties namely Giant Cavendish, William I and Robust were evaluated with local variety. Four suckers of each improved variety and local banana were planted on single plot design of 2.5mx2.5m area for each. A total of 96 suckers of improved banana varieties were delivered for all farmers.

Table 1: Summaries of participants and materials used for the demonstration.

District	*Kebeles*	Number of farmers	Suckers distributed per *Kebeles*	Varieties
Daro Lebu	Sororo	3	36	Giant Cavendish, William I Robusta four sucker from each variety for each farmer.
	Chafe Hara	3	36	
	Oda Leku	2	24	
Total		**8**	**96**	

3.3. Method of Data Collection and Analysis

Yield of the crop and farmers preference toward the crop were collected through supervision and organizing mini field day. Farmers' and experts' idea was collected at the time of field day. To collect their real feeling and opinion, group discussion was undertaken. Checklist was used for interviewing the participants of the field day to assess the real interest of farmers towards technologies for further scaling up and promotion. Finally, the collected data (quantitative data) was analyzed by using descriptive statistics such as mean, standard deviation and frequency distribution and inferential statistics like t-test was used to compare mean of varieties while qualitative data were analyzed through qualitative interpretation and summarization.

4. Result and Discussion

4.1. Number of hands per bunch

Table 2: Number of hands per bunch among varieties

No.	Varieties	Number of hands per bunch (N=8)			
		Mean	Std. Deviation	Minimum	Maximum
1	Giant Cavendish	19	3.8	16	23
2	William I	17	3.8	14	21
3	Robusta	15	4.6	13	21
4	Local	12	2.9	10	15

Source: Own computation, 2015

The result of the study indicated that the minimum and maximum number of hands per bunch for Giant Cavendish were 16 and 23 per bunch with average of 19 per bunch. On the other hand the mean average number of hands per bunch per were 17, 15 and 12 for William I, Robusta and Local, respectively (Table 2). Therefore, Giant Cavendish gives higher number of hands per bunch than other improved varieties and local check. Similarly, the study conducted by Wassu et al., (2014) indicates that the highest mean numbers of hands per bunch were recorded from William I and Giant Cavendish varieties.

4.2. Number of fruits per bunch

Table 3: Number of fruits per bunch among varieties

No.	Varieties	Number of fruits per bunch (N=8)			
		Mean	Std. Deviation	Minimum	Maximum
1	Giant Cavendish	127	16.6	115	146
2	William I	114	24.3	94	141
3	Robusta	102	27.2	82	133
4	Local	91	42.7	65	140

Source: Own computation, 2015

The result indicated that Giant Cavendish was give higher number of fruits per bunch as compared to William I, Robusta and local check varieties (Table 3). The average mean numbers of fruits obtained from Giant Cavendish were 127 while for William I, Robusta and local check were 114, 102 and 91, respectively on trial farmer's field. This indicated that Giant Cavendish variety showed yield advantage over others and has contribution for income of farmers. Similarly, study conducted by Tesfa and Mekias (2015) revealed that the

highest mean number of fruits per bunch were obtained from Giant Cavendish and William I varieties next to Dwarf Cavendish variety.

4.3. Weight of fruits per bunch (Kg)

Table 4: Mean weight of fruits per bunch on farmer's field.

No.	Varieties	Weights per bunch (Kg) (N=8)			
		Mean	Std. Deviation	Minimum	Maximum
1	Giant Cavendish	22.41	4.46	19.17	27.5
2	William I	18.63	4.95	13.6	23.5
3	Robusta	16.24	3.63	13.67	18.8
4	Local	12.09	5.69	8.67	18.67

Source: Own computation, 2015

A sample of ripe fruits from each bunch was collected and measured using sensitive balance to observe weight difference among varieties from trial farmers. The average mean weight of Giant Cavendish accounted 22.41kg per bunch was higher as compared to William I accounted 18.63kg per bunch, Robusta accounted 16.24kg per bunch and local check accounted 12.09kg on experimental farmers filed. The study conducted by Takle *et al*., 2014 indicates that the highest fruit weights were recorded under Dwarf Cavendish and Giant Cavendish which is similar with this study.

4.4. Paired sample t-test result

Table 5: Paired sample t-test of mean of varieties (N=8).

No.	Varieties	Number of hands per bunch				Number of fruits per bunch				Weights per bunch (Kg)			
		Mean	SD	t-value	Sig.	Mean	SD	t-value	Sig.	Mean	SD	t-value	Sig.
1	Gaint Cavendish Local	7	1	12.1**	0.007	36.3	26.3	2.4	0.139	10.32	1.4	12.7**	0.006
2	William I Local	5	1	8.7**	0.013	23.3	20.1	2	0.182	6.54	3.12	3.6	0.068
3	Robusta Local	4.5	2.12	3	0.205	5	16.97	0.42	0.749	2.56	3.44	1.1	0.483

**, Indicates significant at P<0.05 level

Source: Own computation result, 2015

A paired sample t-test was conducted to evaluate the mean of improved varieties along mean of local check variety. The result indicates that there was statistical significant between Giant Cavendish and local cultivars on number of hands per bunch and weights per bunch at 95% confidence interval on (Table 5). There was significant increase from mean number of hands per bunch of local check (M=12, SD=2.9) to Giant Cavendish (M=19, SD=3.9), t(2)= 12.1, p<0.05 (two-tailed). The significant difference of mean weights per bunch was increase from local check (M= 12.09, SD=5.7) to Giant Cavendish (M=22.41, SD=4.5), t(2)=12.7, p<0.05(two-tailed). There was significant difference between William I and Local check on number of hands per bunch that increase from local check ((M=12, SD=2.9) to William I (M=17, SD= 3.9) t(2)= 8.7, p<0.05 (two-tailed).

4.5. Farmers preference among the varieties

Field day was organized to collect the preference and create awareness of the trial farmers and other stakeholders. Accordingly, a total of 104 (82 male, 22 female) participants consisting of farmers, extension agents, experts and researchers were participated. Fruit size, early maturity, plant height, disease resistant, preferable at market & sweetness of fruit were criteria's set by participants of selection process among the varieties. A group of integrated participants from different discipline (farmers, extension agents and experts) were settled to facilitate selection process. The results of groups toward the improved variety of banana indicated below (table 4).

Table 6: Feedback of participants (N=104)

Varieties	**Selection of variety by Participant's by %**										**Rank**
	Fruit size		Early maturity		Disease resistant		Market Preference		Sweetness		
	No	%	No	%	No	%	No	%	No	%	
Giant Cavendish	50	48	60	57.1	42	40	41	39	30	28.6	1st
William I	45	43	32	30.5	38	36.2	50	48	50	48	2nd
Robusta	9	8.6	12	11.4	24	22.9	13	12.4	16	15.2	3rd
Local	0	0	0	0	0	0	0	0	8	7.6	4th

Source: own result, 2015

Farmer's feedback results revealed that fruit size of Giant Cavendish variety was larger than William I and other varieties which account, 48 %, 43 %, 8.6% and 0%, respectively. Farmers were preferred Giant Cavendish due to its big fruits, early maturity, market preference, medium in height and sweetness than others (Table 6). Giant Cavendish and William I varieties were disease resistant as compared to Robusta and local check varieties that accounted 40 % and 36.2% as well as 22.9% and 0% for robust and local, respectively . William I variety was accepted in the market because of good fruit size and not easily perishable as compared to Giant Cavendish. Therefore based on farmer's preference Giant Cavendish and William I were ranked as 1st and 2nd, respectively (Table 6).

5. Conclusion and Recommendation

Demonstration of dessert type banana was conducted in Daro Lebu district of West Hararghe mainly intended to evaluate improved varieties of banana and then create linkage & awareness on the crop production. The result of the study revealed that Giant Cavendish and William I varieties have showed advantage over others varieties in terms of their number of hands per bunch, number of fruits per bunch and weight of fruits per bunch as compared to local check. In addition, feedback from trial farmers during field day point out that Giant Cavendish and William I were selected in terms of their fruit size, early maturity, plant height, disease resistant, preferable at market & sweetness of fruit. Therefore, Giant Cavendish and William I varieties were recommend for further scale up /out for Daro Lebu district and other similar agro-ecologies. Therefore, agricultural development office, research organization, NGOs, private sector and other organization will have promote and disseminate to end user there to boost production and productivity of banana through contribute to food security of farming households.

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