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Farmers appraisal, manifestation and scaling up of improved cassava technologies in moisture stressed areas of the Southern Ethiopia

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Abstract

Demonstration and scaling up of two improved and one local variety of cassava was conducted at Goffa and Gssuba districts of Southern Ethiopia for three consecutive years (2008-2011). The purpose of this study was to display, scaling up and increase production of cassava varieties to farmers, create awareness to the farmers and evaluate the yield potential of the varieties by yield and farmers' evaluation criteria. The results of the study indicated that improved variety Kello was out yielded both varieties at both locations and has given total fresh yield of 42.54 (t/ha) at Goffa and 21.06 (t/ha) at Gssuba than the rest of the varieties tested, followed by Quelle which was also gave 33.25 (t/ha) at Goffa and 20.81 (t/ha) at Gssuba. Before harvest the plant, the number of stand count and the roots per plant was nearly similar for all varieties in both tested districts. Based on overall assessment of varieties by farmers, Variety Qulle took the second place after variety (Kello) by its merits. Gender disparity is common in cassava production in south Ethiopia; in this study 90% of major activities were done by men and only 10% of activities are covered by women. Processing of cassava chips, selection and maintenance of planting materials and sharing of incomes are the major activities that are responsible by women in the areas. In tested districts, land shortage, capital, farm inputs, drought and decline soil fertility are the main constraints that limit cassava production.

Keywords: Cassava, Cultivar, Demonstration, Farmers, Scale up

Introduction

Cassava (*Mannihot esculenta* Cranz) is an important staple food in tropical Africa. More than half of the world's production by land area is located in sub Saharan Africa, which accounts for over 40% of global production by volume. It is the second most important staple food being the major source of food energy providing up to 285 calories per person per day (CIAT, 2001; Bensi *et al*., 2004) for over 200 million people in the continent and for 500 million people worldwide (Thresh *et al*., 1994). World production of cassava was estimated to be about 152,473,000 t in 1994, almost half of which comes from the African continent. Cassava is mainly grown for the roots which are consumed in fresh form after boiling or consumed in processed form. Its contribution as an alternative to bread is very pronounced in rural and urban households (Saleh *et al*., 2004). There is also an interest in using high quality cassava flour as a substitute for wheat flour in food and non-food industries (Kappinnga *et al*., 1998).

Cassava was first introduced to Ethiopia by the British. Although reliable statistical information on the distribution and production of cassava in Ethiopia is deficient, the crop has been cultivated, particularly in the South, South West, and Western parts of Ethiopia since its introduction. Its use as a food security crop in Ethiopia has increased during and after the 1984 famine (Tewodros 2012). In spite of the fact that, the production of cassava in South Ethiopia is embarrassed by different biophysical and socio-economic constraints, such land shortage, capital, farm input, drought and decline soil fertility are a few to mention. Consequently, this study was aimed in fact to fill some of these gaps, so as to encourage sustainable and market oriented production of improved cassava varieties in the region, organize the marketing of cassava products through added value development (like flour and dry slices) and to build sustainable linkage with agro-industries in the country.

Materials and Methods

Description of the study area: This study was conducted at Gofa and Gassuba districts of

Gamogofa and Wolaita zones of Southern Ethiopia for three consecutive years 2008-2011. The areas where selected based on their long history for cassava production potentials and farmers who live in these areas have good indigenous knowledge for production of the crop; have greater diversity of cassava among farming communities and ideal to represent major cassava producing areas of South Ethiopia.

Gofa is located at about 520 km South of Addis Ababa and latitude 06°22'335'' N' and longitude 036°58'306'' E' with 1297 m.a.s.l. It receives 1338.95 mm mean annual rainfall with average maximum and minimum temperatures of 29.4^0 C and 17.63^0 C. The soil is Acrisole with pH 5.80 (Agdew, 2006). Gassuba is located about 450 Km South of Addis Ababa with altitude 1060 meters above sea level. The mean annual rainfall is 1272 with bi-modal distribution. The mean annual temperatures and its rain fall patterns are similar to Goffa district.

The dominant soil is *Eutric Nitosols*. The population densities of the districts are 110 and 375 people per km^2 respectively. The farming systems of both districts are characterized by subsistence mixed farming system of crop and livestock production. Intensive agriculture; where farming system combines growing of annual and perennial crops together with livestock is common in the districts; The major crops grown in both districts include maize, teff, sorghum, cassava and sweet potato are a few to mention.

Experimental design and treatments: The demonstration trial consists of a total of three cassava cultivars (two improved varieties which was released from Southern Agriculture Research Institute, namely Qulle and Kello) and one local checks from each district was demonstrated and evaluated together with farmers on a participatory approach. Large un-replicated plot (10m x 10m) for each treatment was used as a design. The land ploughed properly; uniform labeled and planted in rows using stem cuttings as planting material. Cassava stakes from the healthy and disease free stems from each variety of 25 – 30cm length with 2-4cm thickness were used. Spacing of 1m×1m between plants and rows was used in all plots. Each row consisted of ten plants of which two plants were considered as border and the remaining eight plants were used for data collection and analysis. Each plot was separated by a distance of 1 meter. Weeding and other cultural practices were applied uniformly to all plots after 3 months of planting.

Data collection and plant harvesting: Cassava cultivars become ready for harvesting after 18 months of plant, and roots were properly harvested using farmers' labor and traditional equipments. During harvesting care was taken to avoid damage the roots. Both qualitative and quantitative data's were collected, these data's include agronomic (biological) data's like stand count, branching habit, lodging, storage root length, number of roots and weight of roots per plant, shape of storage root, yield per plant and yield per plot. The qualitative data's was only taken at harvest from ten representative farmers field and all of the trial farmers and others interested farmers from neighbors were told to participate by site DA's to be assembled in the near by appropriate site so as to participate in the evaluation and preference ranking activity. In general, a total of 20 farmers were attended the evaluation processes from each sites and farmers were told curiously to differentiate, observe and compare the local varieties existing at their hand against the improved ones. Based on their observation farmers evaluate the two improved varieties and the respective local checks against a number of criteria; such as emergency, disease and pest resistance, early maturity, yield, etc. The qualitative and quantitative data's collected from host farmers were analyzed using descriptive analysis methods. Matrix ranking was applied to rank their preferences.

Result and Discussion

The result of this study showed that there is significant difference exhibited in fresh marketable, un-marketable and total fresh root yield among the cassava cultivars utilized across all locations demonstrated (Table 1). For instance, both of the improved varieties of cassava were superior in total fresh yield at both locations. The improved variety Kello was out yielded both varieties at both locations and has given total fresh yield of 42.54 (t/ha) at Goffa and 21.06 (t/ha) at Gssuba than the rest of the varieties tested, followed by Quelle which was also gave 33.25 (t/ha) at Goffa and 20.81 (t/ha) at Gssuba. Farming families dependent on cassava as their staple food and for famine relief, have increased the productivity from present levels up to 30-45 tons per hectare through improved crop production technologies and hence achieve sustainable household food availability.

Table (1): Fresh root yield (t/ha) and yield components (Marketable, Un marketable and Total root yield) of cassava varieties (two improved and one-respective local checks)

Cassava varieties	On- farm					
	Gofa			Gassuba		
	Marketable	Un marketable	Total fresh yield	Marketable	Un marketable	Total fresh yield
Quelle	28.78	4.50	33.25	18.31	2.50	20.81
Kello	32.59	9.95	42.54	17.53	3.63	21.06
Local checks	16.48	4.60	21.08	14.59	4.19	18.78

Figure (1): The best adapted variety Kello at Gofa on farm

Figure (2): Cassava field and peeling of tuber

Table (2): Average performances of cassava varieties across all locations tested for pre-harvest and at harvest yield components

Cassava varieties	Stand count 1 month after planting	Plant height at 6MAP(cm	Plant height at 12 MAP(cm)	Plant height at harvest(cm)	Root length (cm)	Root girth (cm)	No. of root/plant	Weight of root/plant (Kg)	Percentage of dry matter content of roots
Quelle	10	206.7	250.0	292.0	41.6	7.34	11.0	8.84	218.0
Kello	10	200.0	214.0	283.0	39.8	6.42	10.0	7.64	226.0
Local checks	10	233.0	253.0	293.0	45.8	6.38	10.0	6.88	196.0

Per-harvest result indicated that stand count at planting and at harvest remained the same for all varieties under demonstration showing that farmers were carefully managed the trials by fencing their farm fields and the number of roots per plant was also nearly similar for all varieties at both districts (Table 3), despite the fact that, the respective local checks from each district attained the maximum height and branching habit than the improved ones, which made it unsuitable for intercropping with other crops.

Figure (3): Cassava tuber before harvest ay Gassuba

For evaluation and ranking of cassava varieties the following the most common attributes utilized by majority of the farmers and these attributes include, yield, drought tolerance, maturity (earliness), suitability for processing, palatability (taste) and storability of the roots and the relative importance of each attributes and rank of each cultivars with respect to each attribute is shown in Table (3).

The improved varieties were evaluated against the respective local checks by using 11 criteria. There is no much difference establishment between the local and improved varieties at both locations. In both districts farmers indicated that neither disease nor pest was occurred and they have the same disease and pest reaction. 66.67% at Goffa and 75% farmers at Gassuba district gave first rank for the improved varieties for their early maturity. In line with this, the same results was observed on Tewodros and Getachew (2013) works on adaptability and acceptability of improved cassava genotypes at Jimma, Agaro and Gera districts of Southwest Ethiopia. The same number of farmers at Gofa said that number of tuber per plant is higher for the improved varieties than the local. At Gassuba district 62.5% of the host farmers ranked the improved varieties first for number of tuber per plant.

Table (3): Farmer's evaluation and ranking of cassava varieties

No.	Attributes	Rank of cassava varieties with respect to each attributes		
		Quelle	Kello	Local checks
1	Yield	2	1	3
2	Tuber (root) size	2	1	3
3	Drought tolerance	2	3	1
4	Maturity	2	1	3
5	Canopy coverage	3	2	1
6	Suitability for processing/ Powder ness when cooked	1	1	2
7	Palatability (taste)	2	1	3
8	Storability of roots/longevity of root storage without spoilage	2	1	3
9	Susceptible to wind break	3	2	1
10	Resistance to disease & pests	1	1	1
11	Ease of establishment	1	1	1
Total		21	15	22
Over all rank		2	1	3

Note:- 1=Good 2= Fair 3= Not good

For organoleptic taste, the farmers says different across location, i.e. half of the farmers at Goffa said there is no difference in taste among the improved varieties, but at Gassuba 87.5% of the farmers found the new varieties superior than the local. In regarding to yield, the new varieties were also found superior than the local cultivars. In both districts, based on suitability for intercropping, flesh color, storage life and level of woodiness, there is no difference between improved and local variety. The overall rank of assessment showed that the new varieties had first preference by farmers over location.

Figure (4): Cassava field at Gassuba

Figure (5): Cassava in Goffa open market

Gender role in cassava cultivation: Men are responsible for the major work (90%) in cassava production/cultivation while women are responsible for some work (10%) like processing, selection and maintenance of planting materials and sharing of incomes obtained from sell of cassava tubers (Table 4). In most developing countries, women manage components of the farming system that contain high level of biodiversity that can be used for daily culinary use (Admasu, 2002). Women and development study in Southern Ethiopia verified that women participated in crop and livestock production as they share 33-37 % of the crop production (FAO, 1990).

Table (4): Gender role in cassava production at both study sites (*n=30*)

Activities	Responsibility					
	Men		Women		Both	
	F	P	F	P	F	P
Land preparation	30	100	0	0	0	0
Planting	28	93.3	0	0	2	6.67
Weeding	24	80	0	0	6	20
Harvesting	23	76.7	0	0	7	23.3
Processing	1	3.3	28	93.3	1	3.3
Decision on income obtained from sell of tubers	19	63.3	5	16.67	6	20
Selection and maintenance of cultivars	0	0	27	90	3	10

F= Frequency, P= Percentage

Figure (6): Cassava chip at Goffa open market

Identification of production constraints of cassava: Group of farmers and selected key informants were identified and prioritized the major constraints that limiting cassava production. Based on farmers' evaluation, land shortage became the main factor that affect cassava production in the areas, followed by shortage of capital (money) to buy farm inputs, lack of oxen and improved farm implements that limits adequate land traction power, erratic rainfall and its associated dry spells, shortage of labor, decline in soil fertility, in adequate supply of planting materials and low yielding potential of local cultivars are the main factors that reduce cassava production in the areas.

Farmers' feedback:

- The new varieties mature earlier than the local variety, this help to get enough food during drought and fill seasonal food gaps.
- When compared with the local cultivars, the new varieties are more suitable for fattening of animals.
- Generally most of the farmers who host the demonstration liked the varieties for early maturity
- Some farmers said they will not plant local variety, they decided to produce only the new varieties
- Farmers like to produce the new varieties but porcupine attack is becoming a major threat for cassava production (the situation is sever at Gassuba)

Conclusion

In sub-Saharan Africa, it is the second most important staple food crop being the major source of food energy providing up to 285 calories per person per day for over 200 million people in Africa and for 500 million people worldwide. Its contribution as an alternative source of carbohydrate and highly pronounced in rural and urban households. Since the yield per area is reasonably high, identifying alternative uses might be interesting as there are types with characters like medicinal value. The farm-based cassava diversity was influenced by the combination of household resources and agro ecology, indicating the potentials for the presence of types suiting different levels of soil fertility and agro ecology. Further studies on morpho-agronomical and molecular characters in association with farmers' indigenous knowledge have tremendous impact for genetic improvement and to reduce further genetic erosion of the crop in order to develop a strategy to assess and utilize the existing genetic diversity.

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