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Research Article

Cluster Based Large Scale Demonstration of Cassava (*Manihot esculenta* Crantz) Technology at Low land Areas of Gofa Zone, Southern Ethiopia

Lakamo Liben^{1*}, Melese Ejamo², Abebaw Bergena³ and Kanko Chuntale⁴

¹⁻³South Ethiopia Agricultural Research Institute, Arba Minch Agricultural Research Center, Agricultural Technology Transfer and Communication Research Directorate Researcher, P.O.BOX : 228, Arba Minch, Ethiopia

⁴South Ethiopia Agricultural Research Institute, Arba Minch Agricultural Research Center, Crop Research Directorate, root and tuber crop breeder P.O.BOX : 228, Arba Minch, Ethiopia

***Corresponding Author:** Lakamo Liben, South Ethiopia Agricultural Research Institute, Arba Minch Agricultural Research Center, Agricultural Technology Transfer and Communication Research Directorate Researcher, P.O.BOX : 228, Arba Minch, Ethiopia

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Abstract

Zala district is one of the major food insecure districts found in low land areas of Gofa Zone which was influenced by shortage and unevenly distribution of rainfall pattern. Introducing and popularizing drought tolerant crops like cassava are an option to reduce this food insecurity problem. To solve this, Arba Minch Agricultural Research Center conducted adaptation as well as pre-extension demonstration trial of the 2 improved cassava varieties (Chichu and Hawassa-04) and local check and got the promising result. However, the better preformed cassava varieties with full package for Chichu variety was not popularized in the area. Therefore, this study was aimed to demonstrate the productivity of cassava through demonstrating medium maturing and high yielding cassava varieties with full packages at farmers field in 2024 Belg cropping season at Zala district, Southern Ethiopia. 1 Kebele was selected purposively based on potential of the crop. A total of 11 farmers were selected based on clustering approach for 10 hectares. Since this technology was not well known by the community, target farmers, Development Agents and expert of district are well trained before start to the demonstration. Arba Minch Agricultural Research Center provided the cuttings. It was planted in 100 cm b/n rows and 100 cm b/n plant. Weeding and other management practices were done as required. Data were collected through measurements, Focus Group Discussion and photographs. Root yield and farmer's perceptions were analyzed using mean, percentage, and the feedback data's were analyzed qualitatively. The crop performed well on all farmers' field. Field day was organized at maturity stage of the crop. The mean fresh root yield in ton ha⁻¹ of has shown 36.42 toneha⁻¹ at the study area which is greater than District level productivity (27.25 toneha⁻¹). Based on perception score result, the variety is good in root yield, no occurrence of disease (Cassava Mosaic Virus) and sweet taste. Therefore, the extension system of the respective districts and similar agro-ecologies should provide cuttings of this variety from Research centers and source technology multiplying cooperatives with full package through facilitating the technology by participating the concerned bodies..

Keywords: Cassava Mosaic Virus, Chichu, Cluster Approach, Drought Prone, Farmers perception, Storage root yield performance, Gofa, Lowland, Medium Maturing Cassava.

Background and Justification

Although cassava (*Manihot esculenta* Crantz) is commercial crop in many countries with hundreds of varieties in existence, little is generally known of the nomenclature and identification of varieties. It is a perennial woody shrub with an edible root, which grows in tropical and subtropical areas of the world. It grows well latitudes of 30° and from sea level to 1800 m above sea level. It is the fourth most important crop for farmers in tropics after rice, wheat and sugar, consumed by up to a billion people globally [1]. According to FAO estimates, 276,721,584 tons of cassava was produced worldwide in 2013. Africa accounted for 57%, Asia for 32%, and others 11% of the total world production

In sub-Saharan Africa, cassava is mainly a subsistence crop grown for food by small-scale farmers who sell the surplus. It grows well in poor soils with limited labor requirements. It provides food security during conflicts when the invader cannot easily remove the crop since it conveniently grows underground. It is originated in the tropical Latin America and was first introduced to Ethiopia by the British (Amsalu, 2003). In Ethiopia, cassava grows in vast areas mainly in Southern Region. Cassava is one of the most important food crops that constitute a considerable portion of the daily diet of the people and also serves as a major source of carbohydrates in Southern Ethiopia [2]. It is mainly cultivated by small resource poor farmers on smallholding plots of land. It is both a food security crop and a source of household income. It is increasingly becoming a source of industrial raw material for production of starch, ethanol, waxy starch, bio-plastics, glucose, bakery and confectionery products, glue among others. It is also used as bio-fuel.

Due to its water stress resistance, cassava is used for various purposes in different areas, which includes; the underground part as food for home consumption and source of income through an exchange in the local market, the above ground part used as planting material, as a fence. The bitter variety of cassava must be processed to improve palatability, prevent acute toxicity in humans and reduce the level of cassava cyanide contents [3]. In addition to the economic value of the products and byproducts obtained from cassava, it offers

other recognized advantages: tolerance of drought, capacity to produce considerable yield in degraded soil, resistant to insect pests and diseases, tolerance of acid soils (which are predominant in most of the world's tropical plains), and flexibility in planting and harvesting time [4].

Despite its various importance's, the crop is not well known in the farming communities and there is no research activity conducted concerning the adaptability of improved varieties of cassava in the Gofa Zone, Southern Ethiopia. Chichu and Hawassa-04 varieties were released in 2018. Arba Minch Agricultural Research Center has conducted an adaptation to evaluate the yield and other economic importance of cassava varieties at Gofa Zone Southern Ethiopia during 2021. Depending on yielding potential, chichu and Hawassa-04 were selected during the pre-extension demonstration. Therefore, this research was conducted with the objective of demonstrating the cassava technology under the farmer's condition in large scale.

Objectives

- To create awareness on cassava technology and practices
- To increase yield performance of improved cassava under farmers' conditions
- To investigate farmers perception towards cassava technology

Materials and Methods

Descriptions of the Study Area

Zala district geographically extends from 60°4' 00" North to 60°30' 00" N latitude and 36° 58' 20" E to 37° 13' 30" E longitude (Fig.1 and Table:1). It has a low to mid altitude of 1000-1700 m.a.s.l. with annual mean temperature of 19- 34°C as indicated in Table:1 [5]. The district has 2 cropping seasons known as Meher (July to August) which receives the highest rain and Belg (March to May) (Kiflu, 2015). [6] Agriculture, both farming and livestock, is the main livelihood of the people. The major crops grown in the district include Maize, Teff, Sorghum, Cassava and Sweet potato is a few to mention.

No	Character	Location Zala District
1	Latitude	60°40' N to 6° 30' 00" N
2	Longitude	36°58'20"E to 37°00'00"E
3	Agro-ecology	94.1% Lowland and 5.9% Midland
4	Altitude (Elevation) in m.a.s.l	501-1700
5	Mean Annual Rainfall in mm	525-1200
6	Mean Annual Temperature in °C	18-33
7	Total Population	88,725

8	Major human Activity	Mixed Farming
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Table 1: Mean annual Rainfall, Temperature Altitude of Zala District, 2024

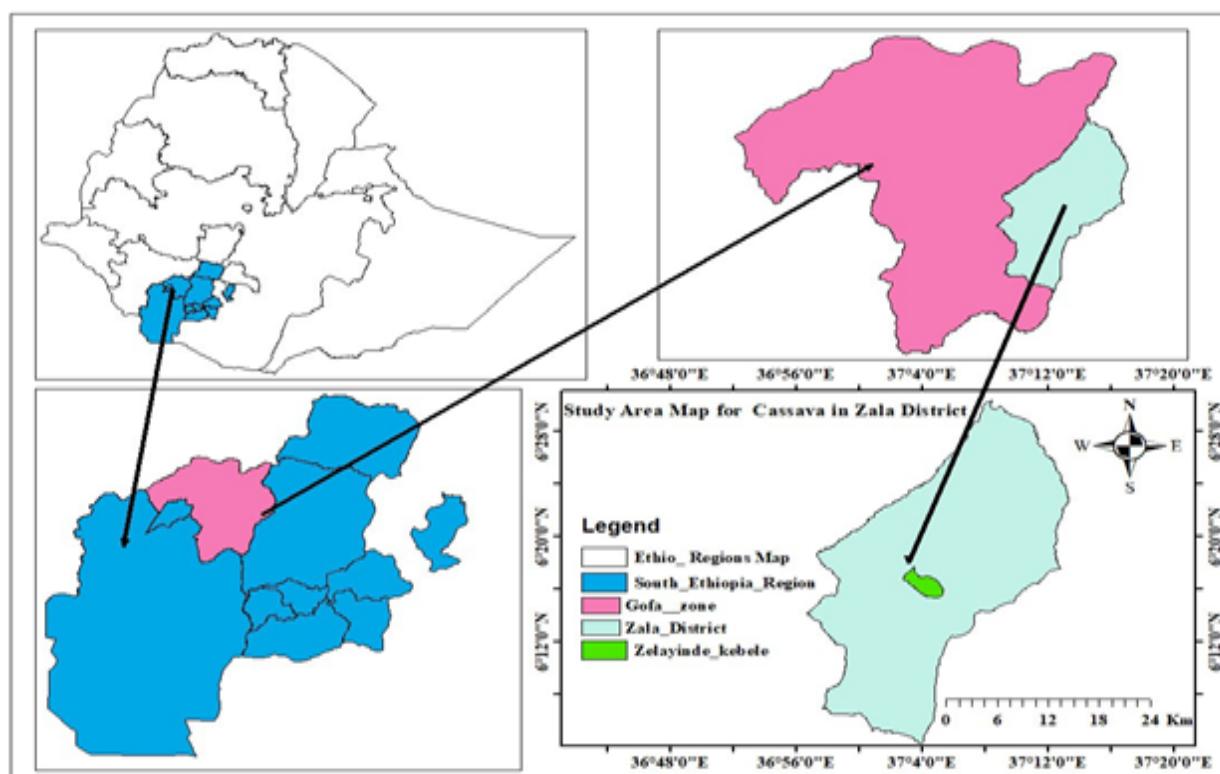


Figure.1 Map of the study area

Site and Farmers Selection

Zala district from Gofa Zone was selected purposively based on Potential to cassava production and appropriateness of the land for the technology . 1 Kebele, namely Zelayinde, was selected purposively based on potential of the crop. Total of 11 farmers were selected by the researchers in collaboration with Kebele and district level Office of Agriculture experts based on cluster approach. Interest on technology, willingness to cost sharing like land provision and experience sharing for members as well as non-members and activeness/innovativeness was also considered in participant farmers selection.

Capacity Building Training

Since this technology was not well known by the community, field level practical and theoretical training interms of input utilization and application method, weed, disease and pest control methods, storage experience, processing, post-harvest handling to reduce physiological deterioration, and modes of consumption method for food purpose are some of the points in training for farmers, Development Agents,

Administrative bodies and Subject Matter Specialists (Fig.2). During training different professionals researchers were participated and share their knowledge and skills through power point presentation and using extension materials like banners and leaflets (Table:2). After training, improved cassava variety was distributed to selected farmers.

Participants	Male	Female	Total
Farmer	13	1	14
Development Agent	4	1	5
Administrates	6	0	6
Subject Matter Specialist	4	1	5
	27	3	30

Table 2: Number of training participants



Figure.2: Training and field level performance of cassava

Agronomic Recommendations used

The variety used for the demonstration was Chichu and source of seed was Arba Minch Agricultural Research Center. A total land size of 10ha-1(minimum of 0.375 from each farmer) was used. Planting was done with spacing of 1 meter between rows and 1m between plant in row planting from 12 months aged cassava mother plants were used as a planting material on a ridge during onset of rainy season

(early April. Cutting length of 25-30cm with 2-4cm with stem cuttings of 10,000 cuttings ha-1(Table:3). One month after planting, after the crop was well established, the plants were earthed up. Cultivation and weeding were carried out when necessary. The crop was harvested at 18 months after planting [7] cited in Tewodros etal 2013, genetic diversity of Cassava genotype in Ethiopia

No	Practices	Recommendations
1	Land preparation	2-3 times ploughing properly with Maresha and labeled
2	Planting time	April to 1st week of May but can be planted any time by irrigation
3	Seed rate/ no of cuttings	10,000 cuttings ha-1,
4	Planting depth	25 – 30cm with 2- 4cm thickness
7	Spacing	100 cm b/n rows and 100 cm b/n plant
8	Weed Management	Hand weeding applied uniformly to all plots after 2 months of planting.

Table 3 : Agronomic Recommendations and Designs used

Source: Ethiopia Agriculture Authority, Plant Variety Release, Protection and Seed Quality Control Directorate [8].

Data Collection and Analysis Methods

Fresh root yield data was collected by measurements (2mx2m) from the highest, medium and lowest yield using data collection checklist. After measuring the yield, the amounts are converted in to kg per plot. Farmer’s perception on the technology was collected using Focus Group Discussion participants during mini field day

Mean, frequency and percentage were used to analyze root yield performance. Likert scale was used to analyze farmers perception toward cassava technology. Finally, data from different sources were triangulated to get reliable information. Monitoring, Evaluation, Field Visit and Field day The demonstration was visited by different stakeholders

(farmers, Development Agent's, Zone and district Agriculture experts and administrative bodies) at different stages. At the maturity stage, a mini field day was held at the farmers' field in coordination with Zone and district level Agricultural offices, as well as participant farmersto raise awareness about improved cassava technologies. A total of 51 farmers,4 Development Agents and, 2 Subject Matter Specialists and 4 administrative bodies were participated on the field day and shared experiences(Table:4). The experiences were disseminated through Facebook and local FM Radio for the mass who do not directly participated in the mini field day.

No	Participants	Zala District		
		Male	Female	Total
1	Farmers	40	11	41
2	Development Agents	2	2	4
3	Administrative Bodies	3	1	4
4	Subject Matter Specialists	2	0	2
Total	47	14	61	

Table 4: Field day participants from the District



Figure.2: Mini Field day participants

Results and Discussion

Tuber Yield Performance of Chichu variety

The result of the cassava storage root yield on farmer's field at Zala district ranged from 33.61 to 39.20 with mean yield of was 36.42 toneha-1 (Table:5). The result is consistent with the result of the study in South Ethiopia [9] at Demba Gofa and Zala districts of Southern Ethiopia and [10] at South West Ethiopia.

Variety	Tuber yield (tha-1)		
	Minimum	Maximum	Mean
Chichu	33.61	39.20	36.42

Table 5: Mean storage root yield performance of cassava at Zala district in 2024 (toneha-1)



Figure. Field level performance of Chichu variety at the study area

Farmers' perceptions on Cassava Technology

Farmers were asked to give their opinion from 1-5 on each attribute of the variety where 1= Very poor , 2=Poor, 3 =good 4= Very good 5=Excellent based on 7 criteria's. The perception score result of the demonstration is very good (Table:6). The Focus Group Discussion participants also reported the good taste(sweetness), good product quality(flour), no disease occurrence like Cassava Mosaic Virus (transmitted

by white fly vector) and Cassava brown streak disease, big stems and petioles leaves, number of storage root per plant and very good fresh tuber yield. In addition, farmers positively perceive Chichu variety in terms of good root size, ready market for the storage stems(cuttings) and shape and early maturity.

Variety					Farmers Criteria				
Chichu	EM	TDP	TS	CT	FT	TM	TY	TS	MS
	3.24	4.15	4.47	4	3.2	3.86	3.5	26.47	3.7

Table:6 Farmers perception on cassava technology

Note: EM =Early maturity, TD=tolerance to disease and pests, CT=cooking time, FT=food taste, TS=tuber size, TN=tuber number), TC=tuber color, TY=tuber yield. TS =Total Score and MS= Mean Score

Awareness Creation

Almost all participant farmers in the demonstration do not know planting space, how to control disease (Cassava Mo-

saic Virus) production, planting hole depth, compost application and post-harvest handling (Table:7).

No	Recommendations	Number of farmers who donot know before			percentage
		M	F	T	
1	Spacing	11	--	11	100
2	Disease Controlling(Management) Mechanism	10	-	10	90.09
3	Planting hole depth	5	-	5	45.45
4	Compost application	7	-	7	63.63
5	Post Harvest handling	8	-	8	72.72

Table: 7: Farmers awareness on the recommended practices of cassava technology (n=11)

Challenges Faced

- Development Agent turn over to continuously follow-up and communication with Kebele
- High rainfall to earthen up cassava during the first weeding
- Lack of organized market and market linkage at the study area

Lessons Learned

- It was confirmed that the neighboring farmers did also exchanged Chichu by their fields taking cuttings from the initial beneficiaries
- The performances of improved cassava variety on farmers' fields with farmers' own management were excellent
- Feedback assessment from Monitoring and Evaluation frequent field visit and field days showed that demand was created on the improved cassava technology
- Access to the cassava cutting was partially solved
- The farmers will be used as learning place cutting source source for other potential cassava growing areas
- Experience of growing that particular variety opened the door for additional income for participant farmers in terms of ready market for the cuttings in addition to storage root yield

Conclusion and Recommendations

Food security issue in the study area is mainly dependent on crop production. Crops are cultivated for many years. Different agricultural extension systems, technologies and practices were disseminated for the last many decades. But, farmers in the study area are still food insecure. Among this, cassava, root crop demonstration and evaluation was conducted both on-farm and Farmers Training Centers in the area in 2021. Therefore, to alleviate this problem, Chichu variety was recommended for the study area and similar agro-ecologies based on pre-extension demonstration trial by the center. Cluster Based Large Scale Demonstration of cassava technology was conducted at Zala districts of Gofa Zone on 11 farmers' field. Arba Minch Agricultural Research Center conducted the demonstration from Pre-extension to Cluster Based Large Scale Demonstration and farmers responded as a best intervention for the year 2023 of severe drought occurrence in the area. The mean fresh root yield performance of the Chichu variety in the area was 36.42 tone/ha. The perception score of the technology is near to very good. Therefore, the Agricultural Extension System of the area (Zone and district) is advised to strengthen the seed supply of the chichu variety from different sources and Arba Minch Agricultural Research Center should increase the seed multiplication.

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Authors Contribution LL: Conceptualization, material preparation, writing the original draft and editing analyzed data and wrote the whole manuscript, KCHU, ME and AB: giving training, field investigation, data curation, reviewed the whole manuscript. All authors approved the complied and submitted version manuscript.

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Data Availability Statement: All data generated from this study is included in the manuscript. Further data sets are available from the corresponding author upon reasonable request.

Ethics of Approval and Consent to Participate: All the participants have been informed and trained about the objective of the study in general and the purpose of collecting the data in particular. Participant farmers were also informed about the data obtained from the demonstration will be kept confidential and all farmers who participated in the study were fully acknowledged.

Consent for Publication: The authors are agree to publish this study

Competing of Interest: The authors declare no competing interests

References

1. FAOSTAT. FAO Statistical Database, 2010. <http://faostat.fao.org>. Food and Agricultural Organization .2010. Statistical Data Base of the Food and Agricultural Organization of the United Nations available at <http://faostat>.
2. Tesfaye T, Daniel M, Fikre H, Molalish P, Legesse H and M G .2012. Cassava production and utilization Manual, Tom publisher, Hawassa, Ethiopia.
3. Cardoso, A. Paula, Estevao Mirione, Mario Ernesto, Fernando Massaza, Julie Cliff, M. Rezaul Haque, and J. Howard Bradbury. "Processing of cassava roots to remove cyanogens." *Journal of Food Composition and Analysis* 18, no. 5 (2005): 451-460.

4. Ospina, Bernardo, and Hernan Ceballos. Cassava in the third millennium: Modern production, processing, use, and marketing systems. 2012.
5. GZFEDO (Gofa Zone Finance and Economic Development Office). 2024. Socio-Economics Report of the year 2022 (Unpublished). Gofa Zone, Sawula, Ethiopia
6. Kiflu, A. Characterization of Agricultural Soils in Cascape Intervention Districts in Southern Nations, Nationalities, and People in Regional States (April). 2015.
7. Johnson, Herbert W., H. F. Robinson, and R. E. Comstock. "Estimates of genetic and environmental variability in soybeans." (1955): 314-18.
8. Ethiopia Agriculture Authority, Plant Variety Release, Protection and Seed Quality Control Directorate Issue no.24.pp 210-211. June 2021, Addis Abeba Ethiopia
9. Andualem. 2023. Evaluation of the adaptability and performance of improved cassava Varieties on Yield and other economic traits at South Western Ethiopia. 2023; 11(3): 14–18p, <http://science Journals.stm journals. In /index.php/RRJOAST/index>
10. Liben, Lakamo, Melese Ejamo, and Abebaw Bergena. "Pre-extension Demonstration of Improved Cassava Technologies with Chopping Device at Gofa Zone, Southern Ethiopia." *International Journal of Plant Biotechnology* 9, no. 2 (2023): 34-41p.
11. CIMMYT (International Maize and Wheat Improvement Center). 2004. Second Semi Annual Progress Report for the QPM Development Project for the Horn and East Africa. July 1- December 31, 2004

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