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Study on Adaptability and Acceptability of Released Cassava (*Manihot esculenta* Crantz) Varieties at Teppi, South Western Ethiopia

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Abstract: Two released cassava varieties and one local check were tested in randomized complete block design with two replication in 2015/2016 cropping season. The experiment was carried out to test the adaptability of improved cassava varieties and identify and select the best high yielding variety/ies for the target area. ANOVA revealed significant differences ($p<0.05$) between varieties for tuber yield and other characters studied. The significance of varieties difference indicates the presence of variability for each of the characters among the tested entries. The mean tuber yield ranged from 209.444 qt/ha to 462.222 qt/ha for Kello and Qulle respectively. Based on mean yield, Qulle and Local gave the highest yields. The mean tuber length ranged from minimum 46.3 to maximum 52.9 for Qulle and Kello respectively. The mean tuber diameter ranged 4.95 for Kello to 8.45 for Qulle. Root per plot, number of marketable tuber per plot, marketable yield per plot, unmarketable root per plot and total yield per plot was low but number of root per hill was high for kello. Un marketable yield per plot was the highest for the local variety. Qulle was the highest yielder as compared to the other varieties. Even when Kello was low yielder than local, due to their low Hydrogen Cyanide (HCN) content, Qulle and Kello will be the best adaptable varieties at Teppi and similar agro-ecologies in different parts of Ethiopia.

Key words: Acceptability · Adaptability · Improved Cassava Varieties · Teppi

INTRODUCTION

Agriculture is the means of livelihood for almost all of the rural population as the main source of domestic food production and major supplier of raw materials for industries. It is a dominant sector in Ethiopia and contributes about 43% of the gross domestic product (GDP), this employs nearly 85% of the total labour forces and contributes about 90% of exports [1, 2]. The socio-economic progress of Ethiopia rests on the performance of the agricultural sector, which is dominated by smallholder farmers. As it is well known, in peasant agriculture the goal of development is undoubtedly changing the scope and efficiency of food crops production [3]. Root crops covered more than 1.62% of the area under all crops in the country. Potatoes, sweet potatoes and taro added cover 25.2%, 38.11% and 19.72% of the total root crop area, respectively. These crops contributed 23.35%, 38.44% and 17.74% of the total root crop production in the same order. However, cassava production is not significantly used in many areas of the country except Amaro Woreda, Gamo Gofa and in some areas of Wolayta zone. In Amaro Woreda it is an introduced crop than indigenous and has been accepted widely by the farmers of the Woreda as in other African countries [4, 5]. Cassava (Manihot esculenta Crantz) is the fourth most important crop for farmers in tropics after rice, wheat and sugar, consumed by up to a billion people globally [6]. Cassava is a perennial woody shrub with an edible root, which grows in tropical and subtropical areas of the world. Cassava originated from tropical America and was first introduced into Africa in the Congo basin by the Portuguese around 1558. Today, it is a dietary staple in much of tropical Africa. It is rich in carbohydrates, calcium, vitamins B and C and essential minerals. However, nutrient composition differs according to variety and age of the harvested crop, soil conditions, climate and other environmental factors during cultivation. In sub-Saharan Africa (SSA) 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

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during conflicts when the invader cannot easily destroy or remove the crop, since it conveniently grows underground. Cassava is usually intercropped with vegetables, plantation crops (such as coconut, oil palm and coffee), yam, sweet potato, melon, maize, rice, groundnut, or other legumes. The application of fertilizer remains limited among small-scale farmers due to the high cost and lack of availability. Roots can be harvested between 6 months and 3 years after planting. Apart from food, cassava is very versatile and its derivatives and starch are applicable in many types of products such as foods, confectionery, sweeteners, glues, plywood, textiles, paper, biodegradable products, monosodium glutamate and drugs. Cassava chips and pellets are used in animal feed and alcohol production [7]. In Ethiopia, cassava grows in vast areas mainly in Southern Region. According to [8], cassava was introduced by some Non Governmental Organizations (NGOs) to drought prone areas of southern part of the country such as Amaro, Gamogoffa, Sidama, Wolayta, Gedeo primarily to fill the gap for subsistence farmers due to failure of other crops as a result of drought. In these areas, farmers usually grow cassava in small irregular scattered plots either sole or intercropped mainly with taro, enset, maize, haricot bean and sweet potato. The average total coverage and production of cassava per annum in Southern region of Ethiopia is 4942 hectare with the yield of 53036.2 tons [9]. Cassava was first introduced to Ethiopia by the British. Although reliable statistical information on the distribution and production of cassava in Ethiopia is lacking, 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 [10].

Its use as a potential food crop in Ethiopia has been appreciated since 1984 famine [11]. 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 carbohydrate in Southern Ethiopia. Cassava crop secure food and 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 and glue among others). Despite the importance of this crop, the production and productivity is constrained by different biophysical and socio-economic constraints, such as lack of adapted and improved technologies, land shortage, lack of knowledge and proper utilization of the crop are few to mention. Therefore, this study was designed to test the adaptability and acceptability of improved cassava technologies and evaluate the yield potential of the varieties by their evaluation criteria at Teppi.

MATERIALS AND METHODS

Experimental Site: The experiment was conducted at Teppi National Spices Research Center 1.5 km away from main Teppi town, during 2015/2016 cropping seasons. Teppi located in south western Ethiopia in SNNP Regional State, 1200 meter above sea level and it is situated at Latitude of 7°10' 54.5' and with a Longitude of 35° 25' 04.3-28.2" E of Ethiopia. The research station receives an annual average rainfall of 1559 mm with maximum and minimum temperatures of 29.7°C and 15.5°C, respectively. The soil of experimental site is reddish brown sandy clay loam classified as nitosol with PH range of 5.60 to 6.0.

Experimental Materials and Design: The experiment based on two released varieties of cassava which were obtained from Hawassa Agricultural Research center. Randomized complete block design with three replications was used to conduct the experiment. Cuttings were planted meter*meter spacing between plants and between rows respectively giving population density of 10,000 plants per hectare.

Description of the experimental materials with their yield potential is shown in Table I.

Data Collected: Data were collected on fourteen traits of cassava varieties. Data collected were, stand count at harvest, tuber length, tuber diameter, number of verticals per hill, number of primary branch per hill, stem girth, number of root per hill, number of root per plot, number of marketable tuber per plot, marketable yield per plot, number of unmarketable root per plot, unmarketable yield per plot, total yield kg/ha, total yield Qt/ha. Some important metrological data including mean monthly rain fall (mm), mean maximum and minimum monthly temperature, mean % relative humidity and soil type were recorded.

Statistical Analysis: All necessary data were recorded and being subjected to analysis. Analysis of variance was performed using the ANOVA procedure of SAS Statistical Software. Effects were considered significant in all statistical if the P-values were < 0.05. Means were separated using least significant difference test.

Table I: Description of two cassava Varieties with their agro-ecological adaptations

Variety	Rainfall(mm)	Maturity days	Yield qt/ha		Year of release	Altitude
			RM	FM		
Qulle	980- 1398	12-18 months	272	241	2005	1200-1800
Kello	980-1398	12-18 months	281	271	2005	1200

RM=Research management, FM=Farmer's management
Source: Tesfaye *et al*. 2012

Table II. Mean Performance of three Varieties at Teppi

TRT	SCH	TL	TD	NVPH	NPBPH	SG	PHFB	NRPH	NRPP	NMTPP	MYPP	NUMRPP	UMYPP	TY KG/HA	TY QT/HA
QULLE	84.5^{a}	46.3^{a}	8.45^{a}	3.2^{a}	9.3^{a}	6.65^{a}	2.17^{a}	11.9^{a}	646.5^{a}	646.5^{a}	409.5^{b}	47^{a}	14.050^{a}	46222.2^{a}	462.222^{a}
LOCAL	84.5^{a}	49.5^{a}	6.72^{a}	2.4^{a}	6.6^{a}	4.05^{a}	1.42^{a}	11.3^{a}	597.5^{a}	597.5^{a}	578.25^{a}	56^{a}	5.600^{a}	45677.8^{a}	456.778^{a}
KELLO	79.5^{a}	52.9^{a}	4.95^{b}	2.9^{a}	11.3^{a}	4.8^{a}	1.15^{a}	16^{a}	273^{b}	273^{b}	188.5^{c}	38^{a}	5.665^{a}	20944.4^{b}	209.444^{b}
LSD	16.09	31.05	2.98	2.19	6.7	5.18	1.65	5.19	241.53	241.53	75.14	18.59	25.04	1900	19
CV	4.51	14.55	10.03	17.99	17.25	23.31	24.28	10.91	11.1	11.1	4.45	9.19	68.97	1.17	1.17

Note: SCH=stand count at harvest, TL=tuber length(cm),TD= tuber diameter(cm), LL=leaf length(cm), LW =leaf width (cm), NVPH=no. of verticals per hill, NPBPH=no. of primary branch per hill, SG=stem girth(cm),NRPH=no. of root per hill, PHFB =Plant height at first branch(m),NRPP=no. of root per plot, NMTPP= no. of marketable tuber per plot, MYPP=marketable yield per plot, NUMRPP=no. of unmarketable root per plot, UMYPP=unmarketable yield per plot, TY KG/ha=total yield kg/ha, TY Qt/ha=total yield Qt/ha

RESULT AND DISCUSSION

The analysis of variance for the 14 characters studied is presented in Table 2. All the characters showed significant ($p<0.05$ and 0.01) difference among the tested varieties. The significance of varieties difference indicated the presence of variability for each of the characters among the tested entries.

Statistical analysis showed significant differences for yield among the varieties. Mean tuber yield ranged from 209.444 for Kello to 462.222 for Qulle. Based on mean yield, Qulle and Local gave the highest yield. Mean stand count at harvest ranged 79.5 for Kello to 84.5 for Qulle and Local. Mean tuber length ranged from 46.3 for Qulle to 52.9 for Kello. Mean tuber diameter was ranged 4.95 for Kello to 8.45 for Qulle. Mean leaf length ranged 15.19 for Kello to 20.1 for Local. Mean leaf width ranged from 3.75 for Kello to 4.08 for Local. Mean number of verticals per hill ranged from 2.4 for Local to 3.2 for Qulle. Mean number of primary branch per hill ranged from 6.6 for Local to 11.3 for Kello. Mean stem girth ranged from 4.05 for Local to 6.65 for Qulle. Mean number of root per hill ranged from 11.3 for Local to 16 for Kello. Mean number of root per plot ranged from 273 for Kello to 646.5 for Qulle. Mean number of marketable tuber per plot ranged from 273 for Kello to 646.5 for Qulle. Mean marketable yield per plot ranged from 188.5 for Kello to 578.25 for Local. Mean number of unmarketable root per plot ranged from 38 for Kello to 56 for Local. Mean unmarketable yield per plot ranged from 5.6 for Local to 14.05 for Qulle. Mean total yield kg/ha ranged from 20944.4 for Kello to 46222.2 for Qulle. Mean total yield Qt/ha ranged from 209.444 for Kello to 462.222 for Qulle. This result is in contrary to result reported by [12] which stated Kello variety is high yielder than Qulle variety.

SUMMERY AND CONCLUSION

Cassava (Manihot esculenta Crantz) is the fourth most important crop for farmers in tropics after rice, wheat and sugar, consumed by up to billion people globally (FAOSTAT, 2010). Cassava is a perennial woody shrub with an edible root, which grows in tropical and subtropical areas of the world. Cassava originated from tropical America and was first introduced into Africa in the Congo basin by the Portuguese around 1558.It grows from tropical to sub-tropical agro-ecology. To advance improvement of crop productivity in different localities, continual identification of the best and suitable crop technologies appeared to be essential. This can be achieved, through adaptability tests and generation of new technologies. Two released cassava varieties were tested in randomized complete block design with two replicats during 2011cropping season. The experiment was carried out to test the adaptability of improved cassava varieties and identify and select the best high yielding variety/ies for the target area.

Significant differences between varieties were observed for tuber yield and six characters studied (tuber diameter, leaf length, number of root per plot, number of marketable tuber per plot, marketable yield per plot and total yield quintal/hectare).

Mean yield ranged from 209.444 for Kello to 462.222 for Qulle. Based on mean yield, Qulle and Local gave the highest yield. Mean stand count at harvest ranged from 79.5 for Kello to 84.5 for Qulle and Local. Mean tuber length ranged from 46.3 for Qulle to 52.9 for Kello. Mean tuber diameter ranged from 4.95 for Kello to 8.45 for Qulle. Mean leaf length ranged from 15.19 for Kello to 20.1 for Local. Mean leaf width ranged from 3.75 for Kello to 4.08 for Local. Mean number of verticals per hill ranged from

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In general, all varieties Qulle and Local had high mean tuber yield and had good mean performance for yield related traits than Kello variety. Due to their high yield and low Hydrogen Cyanide (HCN) content Qulle and Kello are more recommended for the target/study area. Further study should be carried out with improved varieties to improve cassava production.

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