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Research Article

Adaptation Trials of Cassava Varieties at Semi-arid of Borana Zone, Southern Ethiopia

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Abstract

The study took place at onstation of Yabello Pastoral and Dryland Agriculture Research Center at long rainy-season Onset.. Its goal was to see how different cassava varieties adapt and to measure their above- and below-ground biomass yields. Four cassava varieties stem cut at 25-30 cm were collected as evaluated adaptation trials. These varieties are Chichu, Hawassa 4, Qulle and Kello varieties were taken from Sidama region of southern Ethiopia. The stems were planted at 1 m spacing, between plants and rows by using a RCBD. Each row had five plants and totaly twenty stems were planted per plot. Collected data were analyzed by SAS software, and used LSD to compare means at a significance level of $p \leq 0.05$. Of evaluated cassava trials chichu variety had the lagest leaves and tuber drymatter yields by 39 kg/ha and 0.323 t/ha respectively and and followed by Qulle and Hawassa 4 varieties. In terms of foilage canopy diameters, tubers lengths and vertical growth (height) measurements, chichu variety had the largest values than evaluated cassava varieties while Hawassa 4 was the lowest.. Therefore, chichu variety was selected in pramarly and followed by Qulle and Hawassa varieties as options for demonestion at pastoral and agropastoral of Borana rangeland areas for both human consumtion and animal forage purposes.

Keywords

Yields, Biomass, Tubers, Variety, Feed and Food Resources

1. Introduction

Cassava is a tropical root crop that used as source of food for millions of people around the worldwide [1, 2] specially where other crops might struggle. The leaves of cassava also containing higher crud protein about 25.5-29.8% that used as animal feed resources. This crop is paramount for both food and feed security in tropical areas at unfavorable environmental conditions [3]. Cassava varieties are adapt well across different agro-ecologies with better yields in average 46 tons per hectare [4]. In Ethiopia the production of cassava was started during and after 1984 famine periods. Known for its drought tolerance, cassava can thrive on less-than-ideal soils, delivering reasonable harvests where many other crops fail [5, 15]. It's propagated simply by planting cuttings.

Beyond human consumption, cassava is also used as livestock feed, especially in small-scale farms across Africa, where animals like sheep and goats are fed it regularly [6, 13]. One of the main challenges for expanding livestock production in developing countries is the availability of affordable animal feed, and cassava can help fill that gap. It's appreciated for its ability to grow in poor soils, resist drought, and tolerate pests. Mostly cassava varities was produced for its root production used as human consumsion but recent research suggests that

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its foliage has strong potential as well. Feeding cassava leaves to ruminants, especially in the form of hay made from the whole plant including leaves, stems, and petioles. Harvesting the green top parts early within three to four months then consequently cut within two to three months to make hay has been established as an effective method [7, 14].

Usualy, people process roots of cassava varieties into many products to suit local tastes, but there's limited information on its use as feed purpose, particularly pastoral and adgro pastoral areas of Borana, southern Ethiopia. However. These varieties have a great potential in both biomass yield and nutritional values, especially when balanced with other nutrients. Therefore, the study was designed to evaluate the adaptation and yield performances of different cassava varieties and explore how this crop are crutial as sources pastoral and adgro pastoral areas of Borana, southern Ethiopia.

2. Methods and Materials

2.1. Study Area

The activity was tookplaced at onstation Yabello pastoral and dryland agriculture research center that located in southern parts of Ethiopia at 565 km form Addis Ababa (Yabello town). Its located at 4-6 ℕ and 36-42 ℇ within 1600 m.a.s.l Rainfall is bimodal that has long and short rainy season that occurred in the Martch to May, and September to Nevemebr respectively. The study areas obtained 60% rain fall in the long rainy season while 27% in the short rainy season. In annual, the rain fall amount was varying from 353 mm to 900 mm [8]. Also it has two dry season namely cood dry (June to Augost) and Warm dry (December to February) with 13.1 ^{o}c to 25.2 ^{o}c mean annual temperature.

2.2. Study Site Identification and Tillage

An appropriate site was identified from onstation of Yabello Pastoral and Dry Agriculture Research Center. The identified site was firmly fenced to protected any animal enterances. In addition the guard was assigned to protect interfere from any wild and domestic animals.

After cleaned weeds/shrubs from selected study site, the land was properly tillaged and planting plots or seedbeds were conducted prepared based on expermetal design.

2.3. Research Design and Materials and Planting

The promeced cassava varieties used for adaptation trials were Chichu, kello, Qulle, and Hawassa4 which collected from sidama region. The collected cassava varieties stems were pepeared for planting by cut at 25 to 30 cm length. The research design was liad in randomized complete block design (RCBD) by 4 (four) replications spacing 2 m between repilications. The cut stems were planted in row; 1 m space was used between both plants and row spacing.

The cut stems were planted on prepared seedbed at on set of long rainy season of study areas (mid march). Primarly, the planted cassava varieties were weed at month during reached 20 cm to 25 cm tall and included weeding and other agronomic managements were continouned till harvested.

2.4. Collected Data

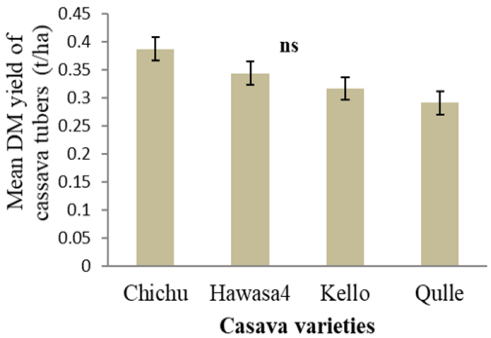
Different agronomic data were collected during study periods. Data of vertical growth of plant, branch count, plant foilage canopies, stem thickness, root count per plant, root length and thickness, dry matter of leaves, stems and roots were recorded at 18 months of planted [9]. These data were collected by divided cassava varieties in to three level (large, medium and small) and onven dried at 105 ^{o}c for 24 hours then that amount were convert into tons per hactors.

2.5. Statistical Analysis

All collected data were analyzed by ANOVA (Analysis of variance) through CRBD. using One way Analysis of Variance (ANOVA) in a Completely Randomized Block Design. Statistical analysis was preformed using SAS software version 9.0 [10] computer softeware pakage. General lidear model procedure was used to performed a one-way ANOVA to test for differences for all parameters. LSD (least significance difference at $P < 0.05$ was used to compered mean.

Statistical model used: $Yij=\mu+\beta i+\gamma j+eij$,

NB: Yij (onservations), μ (overall mean), βi (block effects), γj (variety effects), eij (error effects).



[1]ns =not significant differences ($P > 0.05$)

Figure 1. *Means values of cassava-varieities tuber dry mater in ton/ha.*

3. Result and Discussions

3.1. Dry Mater Yield of Tubar Cassava Varieties

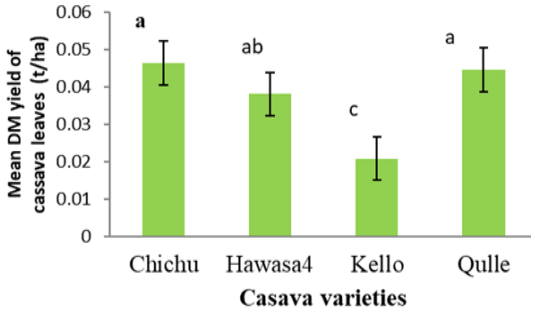
As presented in figure 1, there weren't significant differ-

ences in amount of dry matter yield of tubers of cassava varieties. Of varieties of cassava; Chichu had largest dry matter yield of tubers at 0.323 tones/hetors, followed by Hawassa-4 (0.287 tones/ha) and Kello (0.264 tons/ha) respectively while Qulle had the least tuber dry matter (DM) yield at 0.243 tons/ha (Figure 1). The scores of tubers dry matter yields of cassava varieties differed due to tubers varieties were varied in their thickness and lengths. Similarly, [12] reported that the tuber yield was positively correlated with some yield components of cassava varieties. Of cassava varieties Chichu variety had larger size and lengeth of tubers.

3.2. Drymatter Yield Leaves Cassava Varieties

In figure 2, Kello variety shawed a significant differences ($p<0.05$) by amount yield of leave as comber to evaluted cassava variety. However, not significantly different ($p>0.05$) among Chichu, Hawassa-4 and Qulle cassava varieites. As the figure shows, Kello varieties had the least leaves dry matter yield at 0.017 tons/ha. Incontrast, the leaves dry matter yield was highest for chichu (0.039 t/ha), followed by Qulle (0.037 t/ha) and Hawassa4 (0.032 t/ha).

These mean values of leaves DM yield depend on branch numbers of cassava varieties. That is Kello variety had fewer branches than other cassava varieties while Chuch and Qulle varieties had more. The result is similar with [11] finding, there was high variation of cassava leaf measured that varies in canopy and leaf size.



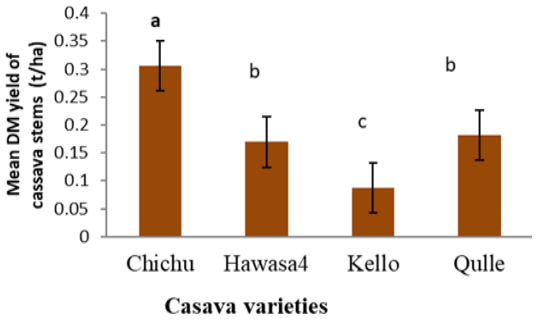
[1] Bars of with different letters are significant different ($p<0.05$)

Figure 2. *Means values of leaves drymatter of cassava varieties (t/ha).*

3.3. Stem Drymatter Yield of Cassava Varieties

In figure 3, a significantly different ($P<0.05$) by stem drymatter yield among cassava varieties.

Of evaluated varieties, chichu had the largest stem drymatter yield (0.25 tons/hectors), followed by Qulle varieties (0.15 tons/ha) and Hawassa4 (0.14 t/ha) but Kello had the lowest by 0.073 tons/ha (Figure 3). The differed values happened because of variations of cassava varieties stem by their thickness, lengths and counts of branchs. Chichu had highest in stem dry matter due to its had highest stems thickness, lengths and counts of branchs than evaluated varieties.



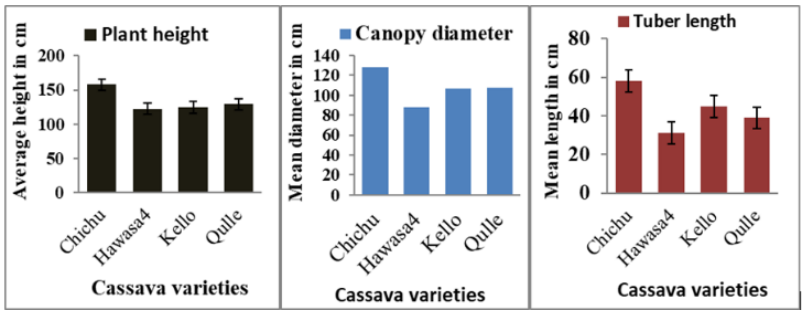
[1] Letters of different bar are indicate significantly difference ($P<0.05$)

Figure 3. *Means values of drymatter yield of stem (t/ha).*

3.4. Canopies Diameters, Tubers Lengths and Hieghts of Cassava Varieties

As indicated in figure 4, the range of vertical growth (hieghts) of cassava varieities were 158 to 122.4 cm. Chichu varieties scored highest in vertical growths of plant (58.2) and Kello, Qulle and Hawassa4 varieties were followed by 45cm, 38.19 cm and 311.19 cm repectively.

Also the range of tubers lengths of cassava virieties were 58.17 cm to 31.19 cm. Again, Chichu varieties had highest tubre lengths (58.19 cm) and Qulle, Kello and Hawassa4 varieties were followed by 129 cm, 125.4 cm and 122.4 cm repectively (Figure 4).



[1]Bar with different letters are significant difference ($P<0.05$).

Figure 4. *Means values of cassava varieties foilage canopies diameters, heights and tubers lengths.*

The foliage cassava canopy diameters were ranged about 128.83 cm to 88.1 cm. Among the Cassava varieties, and Qulle, Kello and Hawassa4 varieties were followed by 107.4 cm, 106.4 cm and 88.1 cm repectively (Figure 4).

In a general, chichu variety recored largest values in terms of foilage canopy diameters, tubers lengths and vertical growth (height) measurements than evaluated cassava varieties while Hawassa 4 was the lowest.

3.5. Percentage of Cassava Varieties Vigorness and Leafness

Of part of cassava plant, its' leaf is an edible that used as sources of animal feed. Leaf part of forage varieties are used to determine potantial yield-biomass in terms of both qualities and quantities. As showed results of leaf data, most cassava varieties were scored excellent in 80%, and followed by good in 10%, and fair in 10% while zero score for poor (Figure 5). This indicated, casaava varities are better options of animal feed resources.

In forage production, the persistence of vigorousness is other main criteria that used to determine forage adaption. Since it indicated potential of varieties that able withstand with moisture stress of study areas. During study periods vigorness data of cassava varieties were collected and scored 89% excellent, 11% good, while zero for fair and poor (Figure 5). Both Chichu, Qulle, and Hawassa cassava varieties showed an excellent vigoroness conditions that able to grewn in the water stress of study eclological areas.

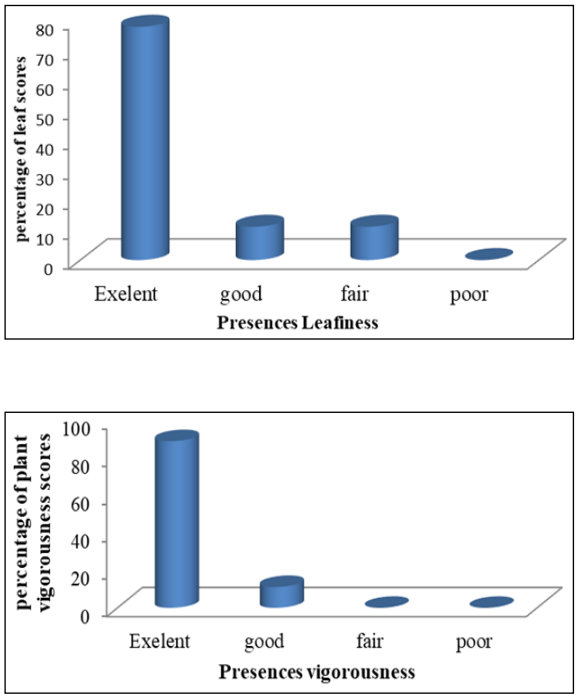


Figure 5. *Percentage of cassava varieties vigorness and leafness.*

3.6. Proportions of Cassava Verieties Withsand with Pests and Diseases

Most of cassava varieties were soldom attacked by pests and diseases. As data shows in figure 6, the the percentage of infestation were zero that is no infestation (67%), very low (22%,), and low (11%). During study only very few warm infestation were observed that not lose the greenness or dried of cassava varieties. Therefore, evaluated cassava varieties have better resistance to pests and diseases under normal environmental conditions of study areas.

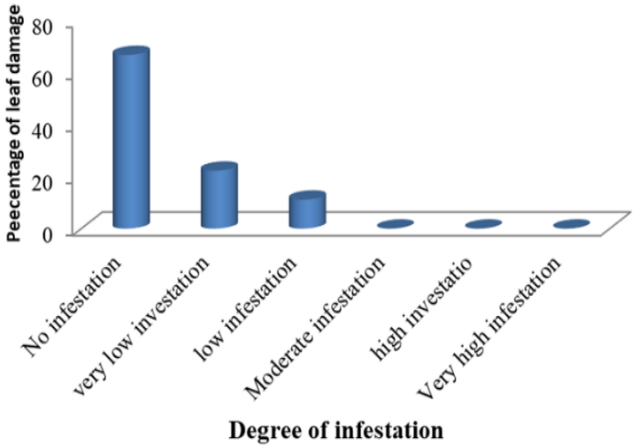


Figure 6. *Proprtion of cassava varieties affected by pests and diseases.*

4. Conclusions and Recommendations

Cassava varieties were evaluated for both human consumbtion and animal forage purposes in pastoral and agropastoral areas of Borana, southern Ethiopia. Most of evaluated cassava vatieties could be survived mosture stress of the study area but they were showed different performances. That is chichu variety had the best performance than evaluated verieties. Since chichu variety had lagest dry matter yield of tubers and leaves and also Qulle variety scored next to chichu variety while Hawassa4 and Kello varietis showed lower yield dry matter.

Therefore, both chichu and Qulle varieties will be recommended respectively for demonstration, scalling-up and promotion in semi-arid of pastoral and agro-pastoral areas as livestock feed and human consumtions to ensure feed/food security happened during the dry season/drought periods.

Abbreviations

ANOVA	Analysis Of Variance
RCBD	Randomized Complete Block Design
SAS	Statistical Analysis System Software

LSD	Least Significant Difference
DM	Dry Matter
Cm	Centimeter
M	Meter
T	Tone
Ha	Hector

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Author Contributions

Asfaw Ejo is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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