

Preliminary evaluation of yellow-fleshed cassava genotypes in Uganda

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1. Introduction

In Uganda, cassava is the second most important staple after banana. To date, twenty-one varieties have been officially released, all of which are white-fleshed and resistant to cassava mosaic disease (CMD). Only a handful are tolerant to cassava brown streak disease (CBSD). White-fleshed varieties are very low in beta-carotene content, the precursor of a key micronutrient - vitamin A. This renders diets that heavily depend on the crop vulnerable to vitamin A deficiency (VAD). Biofortified cassava, provides a low-cost sustainable strategy for reducing VAD.

2. Methods

• Field establishment

The trial was established at Sendusu (Wakiso district), Uganda during the 2021/2022 second rain season. Twenty-five genotypes that were in preliminary stage of evaluation were used along with one improved (NARO-CASS 1) and one CBSD susceptible check (TME 14). A RCBD was used with two replications. Plot size was 5m x 5m with 1m x 1m spacing.

• Performance evaluation for CMD and CBSD severities and incidences

Foliar disease and root necrosis assessment was done using a scale of 1-5 where 1 = asymptomatic, and 5 = very severe symptoms.

• Harvesting

Harvesting was done 12 months after planting. The roots were detached from the stem stalks and weighed to get the total fresh root weight (TFRY). Thereafter, each root was cut into five pieces and each piece was scored for root necrosis. The highest score was assigned to that root. The roots with necrosis of class 3 and above were separated, counted, and weighed to get the unmarketable root weight. The difference between the unmarketable fresh root weight and the total fresh root weight was the marketable fresh root weight that was used to calculate the marketable fresh root yield (MFRY t/ha). The root necrosis incidence (RNI) was calculated as the ratio of the number of unmarketable roots to the total number of roots in the net plot expressed as a percentage.

• Evaluation of dry matter content (DMC) and total carotenoid content (TCC)

DMC was measured using the specific gravity method and TCC was measured using the iCheck procedure.

3. Results

Table 1: ANOVA

SOV	DF	CBSDI	CMDI	TFRY	MFRY	DMC	TDRY	MDRY	TCC	RNI
Rep	1	7.4	3.06	0.27	0.01	6.3	0.05	0.88	10.97	225.7
Gen	26	1074.1***	40.6***	97.35	58.19	9.34**	14.76	8.13	8.15*	1327.2***
Res	26	173.2	5.06	63.82	30.57	2.41	11.67	5.39	3.63	270.00
H2		0.92	0.94	0.67	0.74	0.87	0.60	0.67	0.78	0.90

Rep = replication, Gen = genotype, Res = residual, H2 = broad-sense heritability, CBSDI = cassava brown streak disease incidence, CMDI = cassava mosaic disease incidence, TFRY = total fresh root yield, MFRY = marketable fresh root yield, DMC = dry matter content, TDRY = total dry root yield, MDRY = marketable dry root yield, TCC = total carotenoid content, RNI = root necrosis incidence.

- All the genotypes were resistant to CMD (with no symptoms) except three (MM19/0164, MM19/0212 and MM19/0328).
- DMC ranged from 33.5% (MM19/0094) to 41.5% (MM19/0328) with a mean of 37.9%. The commercial check had a DMC of 38.5% , which was statistically lower than that of MM19/0328.
- MDRY ranged from 1.8 t/ha (MM19/0208) to 9.1 t/ha (MM19/0133) with a mean of 4.8 t/ha. The commercial check gave a MDRY of 6.4 t/ha. However, as mentioned above, the differences were not significant.
- RNI ranged from 0.0% (no necrosis) among five genotypes (MM19/0023, MM19/0101, MM19/0163, MM19/0229, and MM19/0273) to 100.0% (TME 14) with a mean of 16.4%. The commercial check had a RNI of 9.8% which was not significantly higher than that of the five genotypes mentioned above.
- TCC among the yellow-fleshed genotypes ranged from 4.6 (MM19/02530 to 10.6 (MM19/0155) with a mean of 6.7 µg/g fresh root weight.
- Broad-sense heritability estimates ranged from 0.60 (TDRY) to 0.94 (CMDI)(Table 1).

4. Discussion and Conclusion

We observed significant phenotypic variation for most of the traits among the clones to enable the identification of superior genotypes for advanced evaluation. All the genotypes had high dry matter content. Our results differ to those of other breeders who linked yellow-flesh color with low DMC (Esuma *et al.*, 2021). Twelve genotypes were selected for further advanced evaluation, among them **M19/0155**, that had the highest TCC. It was also sweet and mealy suitable for boiling (Plate 1)



Plate 1: Boiled roots of MM19/0155

Acknowledgement:

Funding from RTB-CRP and the NextGen Cassava Project is highly appreciated. We are grateful to the technicians involved in data collection.

Reference

Esuma ,W., Ozimati ,A., Kulakow ,P. Gore ,M., Wolfe ,M., Nuwamanya, E., Egesi, C., and Kawuki R. 2021. Effectiveness of genomic selection for improving provitamin A carotenoid content and associated traits in cassava. G3, 2021, jkab160. DOI: 10.1093/g3journal/jkab160.