PhD Research

Evaluation of Yellow Flesh Cassava Genotypes for Total Carotenoids, Dry Matter, Yield and Cyanogenic potential at Coastal Savanna Zone

E. O. Adu [1], G. Amernope [2], E. Parkes [3], K.J. Taah [1], and P. Agu-Asare [1]

[1] Department of Crop Science, School of Agriculture, University of Cape Coast, Cape Coast

[2] Nuclear Agriculture Research CENTRE, BNARI, Ghana Atomic Energy Commission, Kwabenya, Accra

[3] IITA, Cassava Breeding Unit, Ibadan, Nigeria

Autor's email: emmanuel.adu@ucc,edu,gh

Background

Vitamin A deficiency has been identified as a widespread public health problem in 37 countries worldwide, affecting a considerable percentage of the population in North-East Brazil, sub-Saharan Africa, and South-East Asia, where cassava is a staple (Shrimpton 1993). The availability of yellow flesh cassava (Sanchez *et al*., 2006) provides great opportunity to sustainably address vitamin A malnutrition through deployment of provitamin A cassava varieties where the crop is a major staple (Nassar and Ortiz, 2010). A valid strategy to reduce vitamin A deficiency is to enhance levels of the vitamin A in cassava through plant breeding and genetic transformation (transgenics). Mutagenesis was used to develop high yellow flesh cassava varieties to combat these challenges.

Research Objective

This research was to evaluate new yellow flesh cassava genotypes for yield, dry matter, hydrogen cyanide content and Total carotenoids' stability as means to improve nutrition, especially among the poor in the population.

Methodology

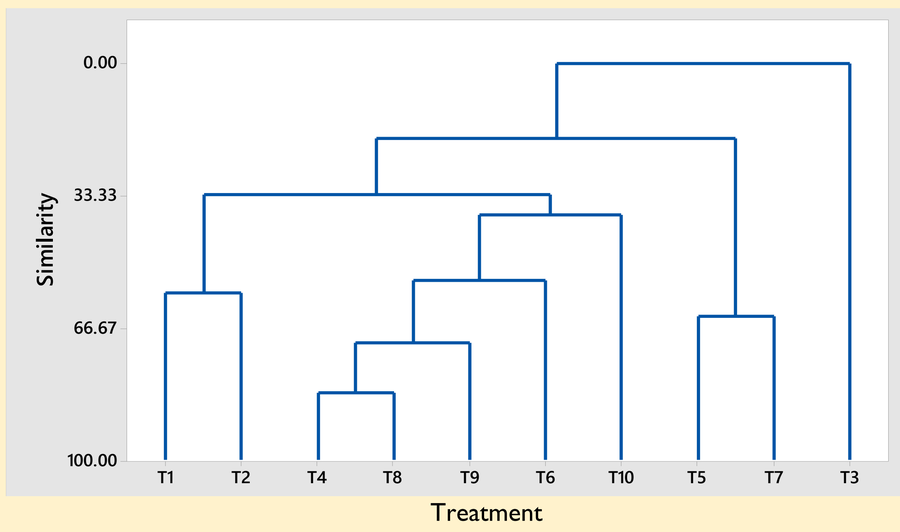
Cassava seeds were brought from IITA, mutagenized in GAEC, evaluated at seedlings, clonal and preliminary yield trials. The genotypes were moved to UCC for advanced yield trails. The experiment was established to evaluate the eight yellow flesh cassava genotypes with one yellow flesh used as a check, in addition to a white flesh check. The genotypes were laid out in a randomized complete block design (RCBD) with four replications at the Teaching and Research Farm of the School of Agriculture at the University of Cape Coast (Coastal savannah zone). Total carotenoids (TC), dry matter (DM) total root yield (FRY) and cyanogenic potential (CP) of ten cassava genotypes were accessed with I-check, oven dried and alkaline titration methods, respectively. In addition, plant stand count, CMD at 1, 3, 6, and 9 MAP, and Whitefly count at 3, 6 and 9 MAP and morphological characterisation (Fukuda *et al,* 2010) were collected. Data was analysed using GenStat Version 12.1.

Fig. 1. A: YFC plants in the field; and (B): Gari made from YFC tubers

Fig 2: Dr. Parkes, Dr. Amernope, Mr. Peter Illuebey and Dr. Emmanuel Ogyiri Adu during Total Carotenoids analysis at A.G Carson Technology Laboratory – U.C.C.

Results and Discussions

There are four clusters observed in this dendrogram at 34% similarity index. The effect of treatment on T3 is more dis-similar (outlier) from all the varieties in terms of the parameters used for this analysis. T1 and T2 are very similar in terms of their number of lobes, leaf lobes etc (used for this study). T4 and T8 are closely related in terms of the effect of the treatments on the varieties as well as T9, T6 and T10. T5 and T7 are closely related and both are closer to T3 with respect to the parameters studied than any of the varieties (Fig. 3)



KEY:

T1=9A (151036)
T2=6A (150579)
T3=8A (151082)
T4=1A (70593)
T5=12B (150306)
T6=1011A (150029)
T7=14B (151110)
T8= 5B (151006)
T9= 11B (150538)
T10=6F (106F)

Fig. 3: Dendrogram showing relationship between the genotypes

Table 1: Total Carotenoids, Cyanogenic Potential (CP), Dry matter and Yield

Genotypes	Total Carotenoids (ug/g)	Cyanogenic Potential	Dry matter (%)	Yield (t ha^{-1})
9A (151036)	6.07^{c}	37.11^{c}	31.67^{ab}	29.90^{abc}
6A (150579)	10.39^{a}	29.15^{f}	30.00^{bc}	25.00^{bc}
8A (151082)	6.64^{c}	37.70^{c}	27.50^{cd}	23.44^{bc}
1A (70593)	7.98^{abc}	31.36^{b}	31.35^{bc}	29.35^{abc}
12B (150306)	10.01^{a}	38.54^{b}	31.25^{ed}	40.46^{a}
1011A (150029)	9.57^{ab}	30.87^{d}	26.67^{cd}	36.15^{ab}
14B (151110)	9.84^{a}	34.41^{e}	21.67^{d}	20.46^{c}
5B (151006)	5.42^{c}	40.13^{a}	30.42^{bc}	34.16^{abc}
11B (150538)	6.89^{bc}	39.28^{b}	32.67^{ab}	33.34^{abc}
6F (106F)	1.78^{d}	31.15^{e}	43.33^{a}	42.29^{a}
Mean	7.46	34.97	30.50	31.45
%C.V	9.0	1.30	9	15.4

Figures with different letters indicate significant differences between the means

Conclusion and Implication

i. The Total Carotenoids in four genotypes: 6A (150579), 12B (150306), 1011A (150029) and 14B (151110) were higher than IITA reference genotype 1A (70593) with 7.98mg/g.. Five YFC had higher dry matter content and yield and were selected for multilocational trials and possible release to Ghanaian farmer as varieties.

ii. The Cyanogenic potential (CP) ranged from 28.52 - 39.68 mgHN/kg for all genotypes is safe because it is lower than the innocuous value of 50mgHCN/kg.

References

Sanchez, T., Chavez, A. L., Ceballos, H., Rodriguez-Amaya, D. B., Nestel, P. and Ishitani, M. (2006). Reduction or delay of post-harvest physiological deterioration in cassava roots with higher carotenoid content. *Journal of the Science of Food and Agric*ulture. *86*(4):634-639.

Nassar, N.M.A. and Ortiz, R. (2007). Cassava improvement: Challenges and impacts. *Journal Agricultural Science. 145*,163-171.

ACKNOWLEDGMENT: The author appreciates the support of International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, and School of Graduate School/ Samuel and Emelia Brew-Butler, University of Cape Coast, Ghana for the support in the research.