Enhancing the Nutritional Quality of Cassava Roots to Improve the Livelihoods of Farmers in Marginal Agriculture Land - Case: Vitamin A

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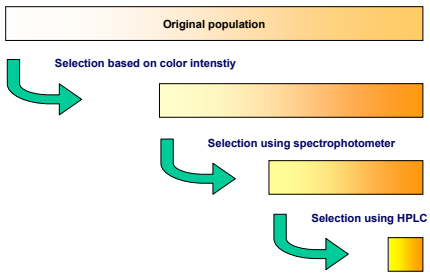
INTRODUCTION

Vitamin A deficiency is still a prevalent problem in many regions of the world. It is preventable problem originating in the unbalanced diets of those populations where malnourishment remains a problem. Vitamin A deficiency has been successfully overcome by supplementation and fortification of different foods. However, these approaches are expensive and solve the problem only temporarily. CIAT has conducted research to evaluate the potential of cassava (*Manihot esculenta* Crantz) as a vehicle for delivering pro-vitamin A carotenoids to those populations chronically deficient in this vitamin. The overall objective of this is to improve the nutritional status of people living in marginal environments of the tropics, by selecting and promoting cassava genotypes with high and good bio-availability of micronutrients and vitamins. This research is supported by the *HarvestPlus Challenge Program* and financed with resources from DANIDA, USAID and the Bill and Melinda Gates Foundation.

MATERIALS AND METHODS

Fig.1 Methodology for selection of elite genotypes with high β-carotene content.



New recombinant seed produced

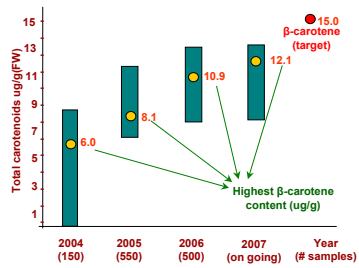
During last four years, thousands of crosses took place in breeding nurseries. As a result thousands of botanical seed containing new recombinant genotypes were produced and harvested. Selection is based on a step-wise process (Figure 1) based on color intensity of the roots, total carotenoids (spectrophotometry) and β-carotene contents (HPLC). The process is a continuum that is not interrupted until the crossing blocks are finally harvested to renew the field. The description of genotypes produced in search of improved nutritional quality is provided in Table 1. The amount of new germplasm produced in 2007 (the figure also includes estimations of seed that is expected to be harvested by the end of 2008) doubles the amount produced in 2005. For the first time sources of high carotenoid content and resistance to CMD (an important viral disease endemic in many countries in Africa and in India) have been combined in 2007 (112 genotypes). In addition, high carotenoid content is also combined with elite germplasm adapted to acid soils, sub-humid environments and mid-altitude valleys. Figures 2 and 3 summarize relevant results.

RESULTS

Table 1. Seed obtained from crosses targeting increased carotenoids content in cassava roots produced in CIAT

	2005	2006	2007*	TOTAL
High Carotenoids				
Between yellow -rooted clones	1096	1291	775	**3162**
S1 (one self -pollination)	505	688	139	**1332**
S2 (two consecutive self -pollinations)	132	140	1010	**1282**
Crosses to clones adapted to subhumid environment			422	**422**
Crosses to clones adapted to acids soils			80	**80**
Crosses to clones adapted to mid altitude valleys			494	**494**
Combining resistance to ACMD			112	**112**
Polycrosses	13815	15687	18659	**48161**
High protein				
Between high -protein cassava	112	78	1148	**1338**
S1(one self -pollination)	111	93	1196	**1400**
Polycrosses			7642	**7642**
High carotene x high protein	201	12	442	**655**
TOTAL	**15972**	**17989**	**32119**	**66080**

Fig. 2. Increases in total carotenoids and β-carotene contents (µg/g FW) in the cassava project at CIAT.



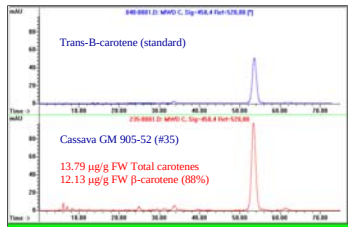


Fig. 3. HPLC chromatogram of elite cassava with highest β-carotene content

PERSPECTIVES

- To identify materials with values close to the nutritional target of 15 µg/g of β-carotene (fresh weight basis)
- To improve the use of NIRS as fast methodology for carotenoids analysis.

Cassava self pollination

Cassava seeds

Cassava roots

Cassava root colors

Carotenes extraction