EXPLORING THE GENETIC POTENTIAL TO IMPROVE MICRONUTRIENT CONTENT OF CASSAVA

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Introduction

Improving the efficiency with which cassava acquires micro-nutrients and accumulates them in the roots and leaves has an enormous potential, not only in terms of human nutrition, but also regarding crop production. Results obtained at CIAT on nutrient use efficiency for P, K, and Ca in cassava, combined with data from research programs in other crops, suggest that there is a potential for a broad spectrum in micro-nutrients in this crop as well. In the case of cassava, woody stem cuttings are used for propagation and their quality influence early crop establishment and final root yield. We have greater expectation that new cultivars with higher contents of micro-nutrients will also have an agronomic advantage, which will ensure they are competitive in the market place. Evaluation of a representative genetic base within the cassava global germplasm collection, as well as, in early breeding work, has been conducted within the genetic improvement project of micro-nutrient concentration for different crops. This project is being financed by DANIDA, with the overall coordination of IFPRI.

Objective

- To improve the nutritional status of people living in marginal environments of the tropics, by selecting cassava genotypes with high bio-availability of micronutrients, particularly vitamins.
- To continue the characterization of the genetic diversity within CIAT cassava collection for their micro-nutrients content.

Methodolgy

Carotenes

The extraction procedure (Safo-Katanga et al., 1984) was adjusted by extracting root parenchyma with petroleum ether. The protocol for leaves had to be modified due to the presence of tannins and chlorophylls. Several extractions with petroleum ether 35-65 ºC and washing steps with methanol were carried out to minimize the interference from the others pigments . A random 5 g sample was taken out of the root or leaves at 10 to 11 months after planting. The quantification was done by ultraviolet spectrophotometry using a Shimadzu UV-VIS 160A recording spectrophotometer. UV detection was done at λ = 455nm for root extracts and λ = 490 nm for leave extracts.

Variability with respect to color intensity in roots from CIAT's cassava collection

Ascorbic acid

Determination of ascorbic acid (Fung and Luk, 1985), adjusted for fresh leaves and roots, involved the homogenization of 1 g of leaves or 6 g of roots in a turrax with 20 ml of extraction buffer (3% phosphoric acid and 8% glacial acetic acid). The supernatant was mixed with 2 ml of 10% hydrochloric acid and the reading was taken immediately with an UV-VIS spectro-photometer. UV detection was done at λ =245 nm. A previously decomposed extract with 1M sodium hydroxide solution as blank, was used for quantification. During the whole process, samples were protected from air in order to avoid oxidation.

Results

A total of 500 genotypes were evaluated, including 100 elite clones which have excellent agronomic performance.

Analysis of carotene content

Carotene concentration on leaves and roots showed a broad distribution (Fig 1). Carotene concentrated about 100 times more on leaves than in roots. The correlation between carotene concentrations on leaves and roots (ρ = - 0.12) was weak. Results are similar to those reported by Bedoya (1999).

Analysis of ascorbic acid content

Fig. 2 summarizes the ascorbic acid results. Ascorbic acid concentrated in the leaves rather in the roots (mean concentration on leaves 10 times larger than the in the roots). There was no correlation between the ascorbic acid concentration on leaves and roots (ρ = - 0.081)

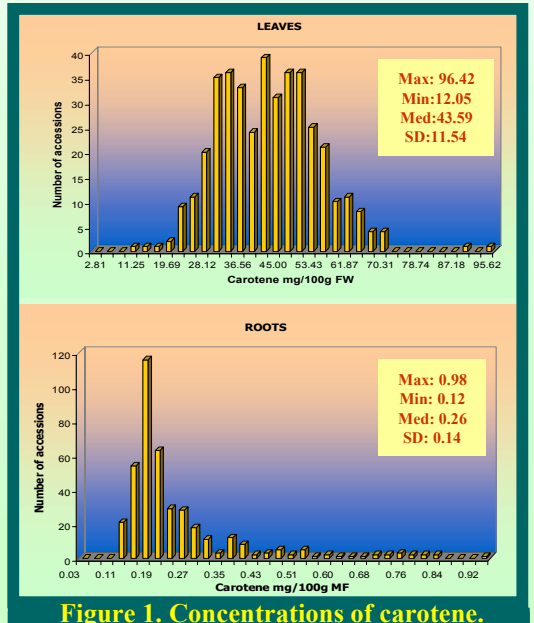

Figure 1. Concentrations of carotene.

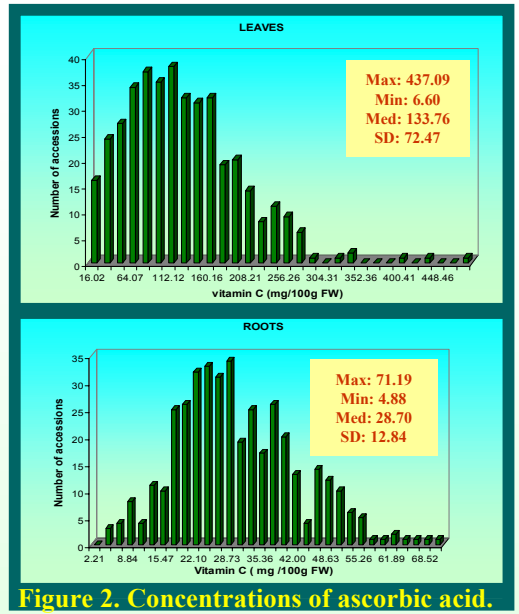

Figure 2. Concentrations of ascorbic acid.

Conclusions

- Wide genetic variability was observed for the four measurements, indicating that there is good potential for exploiting and improving nutritive values of cassava.
- Carotenes and ascorbic acid concentrate significantly more on leaves than in roots.
- Correlations between concentrations in leaves and roots were not significant for either vitamin.
- Cassava leaves have the potential to become a valuable source of micronutrients in marginal regions of the tropics.

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