IMPROVED CASSAVA FOR THE DEVELOPING WORLD

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Introduction

One of the major constraints upon cassava production as a commercial crop is its perishability. The short post-harvest storage life of cassava is a characteristic that limits the marketability of the root, and necessitates either consumption or processing shortly after harvesting. Post-harvest physiological deterioration (PPD) of cassava roots begins within 24 hours after harvest (Figure 1). PPD is a blue-black discoloration of the vascular parenchyma and results in crop and product quality losses, high marketing margins and risks, and restricted management flexibility for farmers, traders and processors. The reduction of PPD has been identified as a priority target for strategic research. In many aspects, PPD resembles wound responses found in other better studied plant systems, but cassava appears to lack the wound healing capacity which is normally associated with the inhibition of wound responses. Normally, such defensive wound responses are inhibited by wound repair. However, this repair process does not occur in the harvested cassava storage root, leading to the hypothesis that unrestrained cascades of wound responses ultimately result in deterioration. An important component of these wound responses is the oxidative process. Ascorbic acid and carotene are known to have antioxidant properties. Therefore, PPD was measured in a sample of genotypes to evaluate the potential correlation between these two vitamins and PPD.

The results of this study are relevant to activities carried out through a collaborative research study with the University of Bath. The study aims to better understand the biochemical basis and pathways that result in the onset of PPD.

Objectives

- To improve the nutritional status of people living in marginal environments of the tropics, by selecting and promoting cassava genotypes with low PPD.
- To correlate ascorbic acid and carotenes contents with PPD.

Methodology

About 400 genotypes of cassava were selected to represent the wide variability in PPD susceptibility from the CIAT germplasm collection (6000 genotypes). Three plants per cultivar were harvested, all at 9-12 months maturity.

Five commercially sized roots (minimum length 18 cm) were chosen randomly. Roots were analyzed using the method of Wheatley et.al (1985) with one modification: prepared roots were stored under ambient conditions for 7 days instead of 3 days. The proximal and distal root ends were cut off and the distal end was covered with clingfilm. After 7 days, seven transversal slices of 2 cm thickness were cut along the root, starting from the proximal end. A score of 1-10 was assigned to each slice, corresponding to the percentage of the cut surface showing discoloration (1=10%, 2=20%, etc). The mean score of PPD for each root was calculated.

Figure 1. A cassava root slice (cv. MDOM 5) observed under visible light after a storage time of five days.

Results

The 400 accessions of cassava were evaluated for ascorbic acid, carotene contents and PPD. The screening included 100 CIAT elite clones accessions, which have excellent performance in different agro-ecological zones.

The quantification of carotenes was done using the extraction procedure outlined by Safo-Katanga et al. (1984).The determination of ascorbic acid followed the protocol by Fung and Luk (1985) modified. The relationship between PPD and carotene content was (ρ = -0.16) and it is almost identical to the one reported previously by Bedoya (1999) for the core collection (ρ = -0.17). The graph plotting the relationship between carotene in the roots and PPD (Figure 2) suggests that above 0.50 mg carotene/100g FW, PPD does not exceeds 30%.

The correlation coefficient between PPD and vitamin C in roots (ρ = +0.465) suggests a positive association between vitamin C content and PPD, contrasting with previous results (Bedoya, 1999) that suggested otherwise.

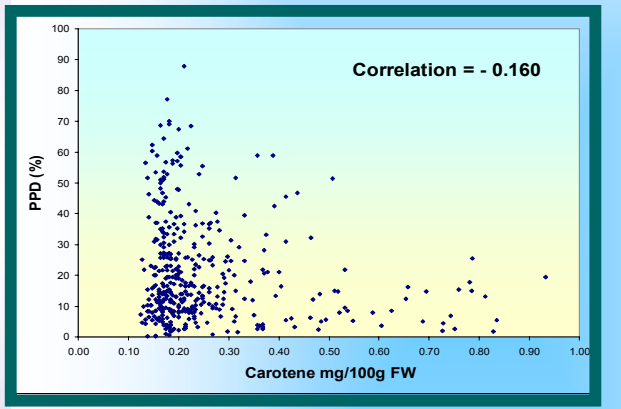

Figure 2. Relationship between PPD and carotene content in 400 genotypes of cassava roots

Conclusions

- 400 accessions from the cassava world germplasm bank collection held at CIAT were evaluated for carotene,ascorbic acid content and PPD. The correlation coefficient (ρ = - 0.16) between carotene content and PPD suggests an interesting relationship.
- The hypothesis that carotene content can help to reduce PPD (through their antioxidant capacity) is supported again by these results.
- The identification of genotypes with low PPD susceptibility, high carotene content and also good performance in different agro-ecological zones is relevant for breeding programs.

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