Development of Cassava Cultivars with High Zinc Content in Roots

Antonia Fonseca Jesus Magalhães[1], Wania Maria Gonçalves Fukuda[1], Márcio Eduardo Canto Pereira[1], José Luiz Viana Carvalho[2] and Marília Regina Nutti[2]

[1] Embrapa Cassava and Tropical Fruits, Caixa Postal 7, Cruz das Almas – BA, 44380-000, BRAZIL (antonia@cnpmf.embrapa.br)
[2] Embrapa Food Technology, Rio de Janeiro, RJ, BRAZIL

INTRODUCTION

The lack of micronutrients is responsible for major nutrition deficiencies in the world, mainly in developing countries and poor communities. Zinc is essential for survival, and Zn deficiency has serious consequences for health. Zinc supplementation can reduce the severity of morbidity from a number of common childhood infections, including diarrhea, pneumonia, and possibly malaria, by one-third (Bhuta et al. 2000, HarvestPlus 2006a). Because of inadequate intakes, billions of people are at risk of Zn deficiency (HarvestPlus 2006b). Current efforts to combat micronutrient deficiencies focus on providing mineral supplements continuously, which generates a considerable yearly expenditure. As an alternative to supplementation, an international program (HarvestPlus – Biofortification Challenge Program) that seeks to reduce micronutrient malnutrition through breeding nutrient dense staple crops was started. There is also evidence that cassava roots have adequate variability of Zn contents, but the germplasm must be explored to select top accessions for breeding purposes. This work aimed to quantify the Zn content of cassava varieties and hybrids.

METHODS

The Zn content of 72 yellow landrace roots, previously selected for carotenoid content from the Cassava Germplasm Bank of Embrapa Cassava & Tropical Fruits (Cruz das Almas, BA, Brazil) were evaluated. The Zn content of 179 yellow cassava hybrids (2003 harvest) and 136 hybrids (2004 harvest) and their progenitors was also evaluated.

The roots were collected early in the morning and taken to the laboratory, where they were washed with tap water to remove residual soil, and peeled. The pulp was cut longitudinally into quarters and two opposite slices were taken for analysis. The longitudinal slices were dipped in distilled water and in Milli-Q type water, air dried and chopped into small pieces, which were then homogenized in a domestic food processor. All these steps were carried out with stainless steel knives and blades. The homogenate was placed on a Petri dish and oven dried (60-65ºC) for 24 hours. A small sample (5-8g) of the dried material was grounded in a Retsch mixer mill MM 200 equipped with zirconia-made jars and balls. Adequately grounded samples were digested in acid and analyzed for Zn by Atomic Absorption (AA). Results were expressed in mg Kg^{-1}.

RESULTS AND DISCUSSION

The distribution of Zn content in the analyzed samples is presented in Table 1, and Fig. 1 and 2. The Zn content of the landrace varieties ranged from 0 to 26.23 mg Kg^{-1}, and 26 landraces (36.1%) had a higher Zn content than the average (4.14 mg Kg^{-1}).

For the first group of 179 cassava hybrids, the average content of Zn was 4.27 mg Kg^{-1} for the progenitors and 5.2 mg Kg^{-1} for the hybrid population, and 62 hybrids (34,6%) had a Zn content that was above the average. In the second group of 136 cassava hybrids, the average Zn content was 3.37 and 125 mg Kg^{-1} for progenitors and hybrids, respectively, and 56 hybrids (41%) had a Zn content that was above the average. These superior accessions have been used as parents in the crossings for segregant populations to select elite and adapted cassava genotypes with roots that have high Zn levels.

Table 1. Zinc content (mg Kg^{-1}) of roots from Landrace varieties of cassava.

	Varieties / Hybrids	Number of genotypes	Mean mg Kg^{-1}	Min mg Kg^{-1}	Max mg Kg^{-1}
Zn	Landraces	72	4.14	0.0	26.23
	2003	179	5.2	0.0	34.1
	2004	136	12.5	0.5	87.1

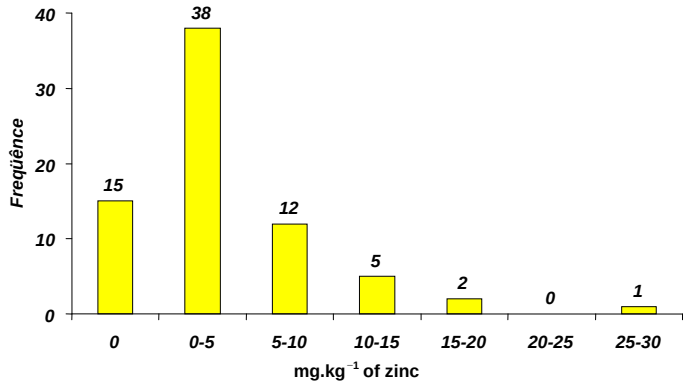

Fig. 1. Zinc content (mg Kg^{-1}) of roots from 72 landrace varieties of cassava.

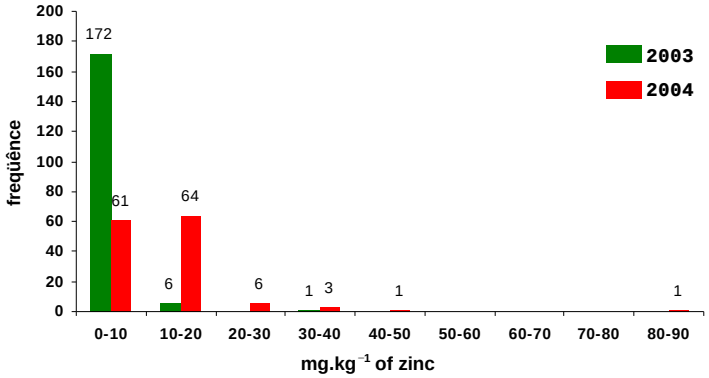

Fig. 2. Zinc content (mg Kg^{-1}) of roots from hybrids of the generation 2003 e 2004.

CONCLUSIONS

A high variability in Zn content was observed in cassava roots. It is possible to establish specific crossings in order to obtain cassava hybrids with high Zn contents.

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