

# Effect of age of the plant in total carotenoids content in cassava roots

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## Introduction

The HarvestPlus initiative is supporting several breeding projects to increase carotenoids content in cassava roots. The correct and reliable quantification of carotenoids content is critical for an efficient breeding process. This includes a proper sampling procedure (described in a different study in this meeting) and a clear understanding of the effect of age of the plant on carotenoids content. Our working hypothesis was that carotenoids content increases with the age of the plant. The implication of this hypothesis is relevant. Only a limited number of samples can be analyzed each day during the harvest season and evaluations must be spread over a 2-3 months period.

## Materials and methods

A total of 80 genotypes, ranging widely in carotenoids content, were used for this study. Plants from each genotype were harvested 8, 10 and 12 months after planting. Total carotenoids content (TCC) and total  $\beta$ -carotene (TBC) were measured through the colorimetric method and HPLC, respectively<sup>1,2</sup>. At each harvest time, roots from two different plants of each genotype were harvested and independently analyzed.

## Results

There was a clear increase in TCC and TBC from the 8<sup>th</sup> to the 10<sup>th</sup> month (Table 1), but then there was a slight decrease from the 10<sup>th</sup> to the 12<sup>th</sup> month. This was surprising because it did not follow previous observations. A more careful analysis also indicated that dry matter content followed an unusual pattern with the highest values in the 8<sup>th</sup> month and declining sharply in the 10<sup>th</sup> and 12<sup>th</sup> months. Cassava harvests are set so that dry matter contents (DMC) are at a maximum at harvest time. However, in this case DMC was not at a maximum during the typical age for cassava harvests (10-12 months after planting). If TCC and TBC are expressed on a dry weight basis, the expected pattern of increased contents over time can be observed (Table 1).

The unexpected DMC results can be explained by the atypical climate conditions at the time this experiment was conducted. Rainfall and evaporation data at harvest times (March through August, 2009) was very atypical (Figure 1). It can be concluded that TCC and TBC increase with the age of the plant but figures based on a fresh weight basis can be affected by DMC. This variable should be monitored for an assessment of the reliability of results in breeding work for increased carotenoids content in cassava.

Table 1. Summary of the results from the analyses made on 80 cassava genotypes harvested and analyzed 8, 10 and 12 months after planting. Within parenthesis the range of variation for individual genotypes averages.

Variable	Harvest time (months after planting)			Average (across dates)
	8	10	12	
Dry matter (%)	34.3 (25.2-41.5)	28.2 (15.7-34.8)	25.5 (14.7-35.7)	29.34 (20.86-35.16)
TCC ( $\mu\text{g/g}$ FW)	8.84 (3.1-14.3)	9.58 (2.7-14.4)	9.35 (2.7-14.8)	9.26 (2.82-13.06)
TCC ( $\mu\text{g/g}$ DW)	25.74 (8.6-41.4)	34.15 (9.8-55.4)	36.96 (9.5-61.8)	32.28 (0.62-14.38)
TBC ( $\mu\text{g/g}$ FW)	6.37 (1.6-12.1)	6.81 (1.5-13.0)	6.4 (1.3-12.0)	6.52 (1.47-11.21)
TBC ( $\mu\text{g/g}$ DW)	18.9 (4.6-35.5)	24.59 (9.6-45.6)	25.39 (5.2-49.8)	22.96 (5.17-41.76)

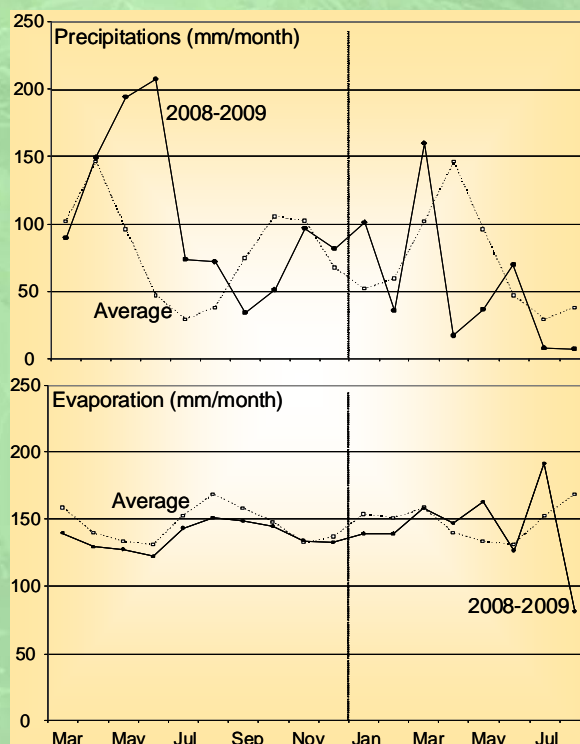


Figure 1. Data for the period March 2008 - August 2009 compared with historic averages at CIAT experimental station in Palmira, Colombia. Unusual data was collected at the time this experiment was harvested and affected harvests in May and August, 2009.

## References

- Rodríguez-Amaya DB, Kimura M. 2004. HarvestPlus Handbook for carotenoid analysis. HarvestPlus Technical Monograph 2. Washington, DC and Cali. International Food Policy Research Institute (IFPRI) and International Center for Tropical Agriculture (CIAT)
- Chávez AL, Ceballos H, Rodríguez-Amaya DB, Pérez JC, Sánchez T, Calle F, Morante N. 2008. Sampling variation for carotenoids and dry matter contents in cassava roots. Journal of Root Crops 34(1). 43-49