Identification and characterization of three different sources of sugary cassava genotypes

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Introduction

In a pioneering work L.J.C.B Carvalho and co-workers from EMBRAPA (Brazil), reported in 2004 the first phenotypic description of a trait affecting starch biosynthesis in cassava roots[1]. This mutation resulted in the production of "sugary" roots where normal starch synthesis is hampered and, higher amounts of free sugars (mostly glucose) and a glycogen-like molecule are instead accumulated.

Materials and methods

CIAT initiated several years ago a systematic screening of cassava germplasm (either hybrid or S_1 genotypes) in search of high-value traits. Different tests/criteria are used for the identification of unusual phenotypes (iodine test, pasting properties using the rapid viscoanalyzer RVA, light microscopy to inspect starch granule morphology, biochemical analyses, etc.).

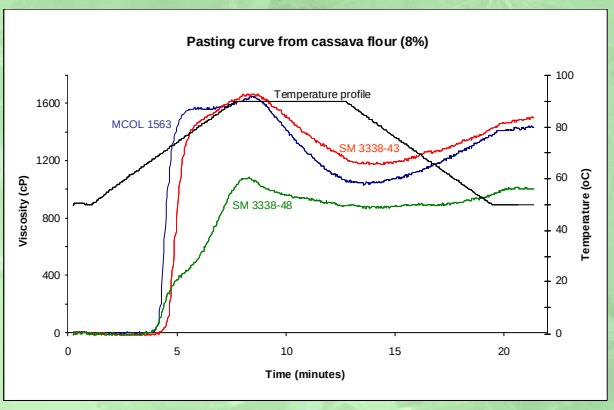

Figure 1. Amylograms based on 8% flour analyzed using a Rapid Viscoanalyzer (RVA) of normal cassava flour (MCOL 1563) and three samples suspected to have a "sugary" phenotype.

Results

Different mutations have been identified or induced in search of high-value traits [2,3]. This work reports what may be another special root trait. Three genotypes from an open pollinated family (SM 3338) derived from MCOL638 showed unusual root characteristics. Two of the three genotypes (SM 3338-43 and SM 3338-48) allowed further analyses, which confirmed that they have indeed unusual biochemical characteristics. Table 1 presents dry matter, total sugars and total reducing sugars contents for these two genotypes as well as for a typical cassava genotype (MCOL 1563). Dry matter content was low in the SM 3338 genotypes compared with the normal check. Total and reducing sugars, on the other hand, were much higher than in normal cassava (Table 1). It is suspected that SM 3338-43 and SM 3338-48 are indeed self-pollinations of MCOL638. Self-pollinations can often occur in polycross nurseries left for open pollinations. Controlled self-pollinations of MCOL638 are currently underway. Pasting properties of flour (8%) the two SM 3338 genotypes and MCOL 1563 were analyzed with a rapid viscoanalyzer (RVA). The amylogram of SM 3338-48 was very distinctive.

In March 2010 the cloned SM 3338 genotypes will be harvested and more roots will be available for analyses, which may help to understand if they are or not the same type of mutation already reported by Carvalho et al.[1] (the amount of starch present in the two SM 3338 genotypes, however, would suggest that they are not the same mutation). In addition to its value for basic knowledge, this type of cassava may prove to be commercially valuable by reducing the costs of conversion of roots into ethanol.

Table 1. Main characteristics of the two clones suspected to have "sugary" roots. Data is the average of two independent quantifications.

Clone	Dry matter content (%)	Total sugars (%)	Total reducing sugars (%)	Starch (%)
SM 3338-43	25.10	9.48	5.00	83
	24.25	8.20	4.27	81
SM 3338-48	15.97	12.68	6.26	77
	16.25	11.82	5.24	78
MCOL 1563	34.52	2.27	0.58	87
		1.86	0.36	88

References

[1] Carvalho LJCB, De Souza CRB, Cascardo JCM, Junior CB, Campos L. 2004. Identification and characterization of a novel cassava (*Manihot esculenta* Crantz) clone with high free sugar content and novel starch. Plant Molecular Biology, *56*, 643-659.

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[3] Ceballos H, Sánchez T, Denyer K, Tofiño AP, Rosero EA, Dufour D, Smith AM, Morante N, Pérez JC, Fahy B. 2008. Induction and identification of a small-granule, high-amylose mutant in cassava (*Manihot esculenta* Crantz). Journal of Agricultural and Food Chemistry 56: 7215-7222.