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Phenotypic characterization of reducing and non-reducing sugars content in *Solanum tuberosum* group Phureja

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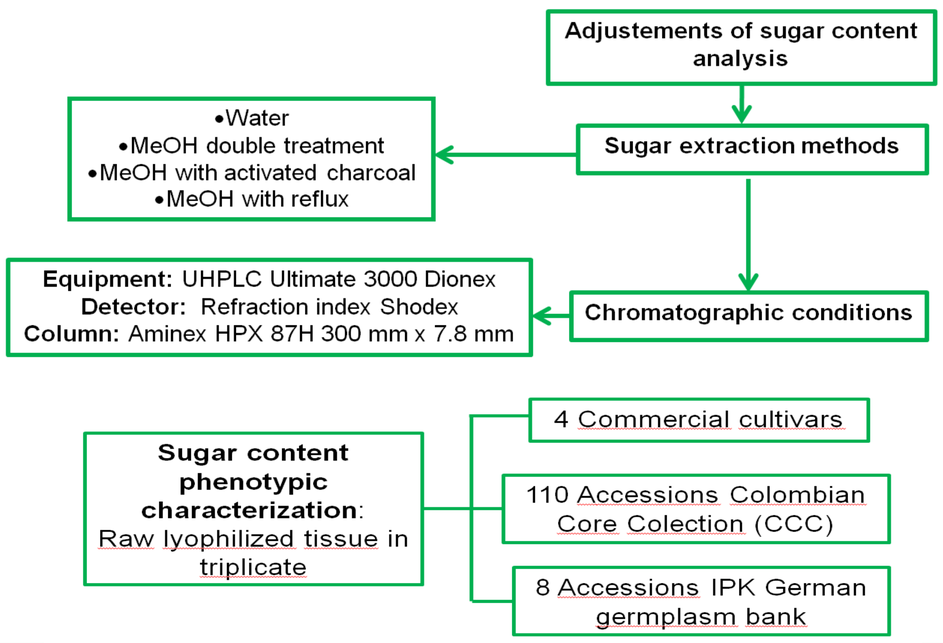
Introduction

Ready-to-eat products present an increasing demand which is reflected in the fast growing of potato processing market. Colombia is an important producer of diploid genotypes, which belong to the cultivated group Phureja and present outstanding organoleptic properties. Currently, there are not Phureja cultivars suitable for frying processes because of high levels of reducing sugars in the tubers. Association mapping is a strategy to study the molecular basis of complex traits such as reducing (glucose and fructose) and non-reducing sugars (sucrose, main source of reducing sugars) content, as a first step in the development of diagnostic molecular markers that can be used by breeders in processes of marker assisted selection. The main purpose of this research is to perform the phenotypic characterization of reducing and non-reducing sugar content in a natural population of *Solanum tuberosum* group Phureja using the HPLC technique, to obtain the phenotypic information to implement an association mapping approach to identify genomic regions related to frying quality.

Materials and methods



Results

Adjustment of sugar content analysis

Four sugar extraction methods were tested in tuber lyophilized tissue, it was determined that the method using MeOH double treatment allows higher extraction levels and its average concentration presented a significant difference with the other methods (Table 1). Chromatographic conditions have been adjusted and validated as shown in Tables 2 and 3. Additional analytes were found in extracts and were identified as malic and citric acid by comparison of retention times with standards

Sugar content phenotypic characterization

The fructose, glucose and sucrose content of 22 accessions have been established (Figure 1). Figure 2 shows two contrasting accessions: CCC 102 contains the highest amounts of reducing and total sugars while IPK-170031 contains the lowest amount of reducing sugars with non-detectable fructose content.

Table 1. Average concentration of sucrose for each extraction method. Averages with different letters indicate significant differences according to Tukey test (p<0,05).

Method	Average sucrose concentration (ppm)
Water	2566,22 a
MeOH double treatment	**4925,64 c**
MeOH with activated charcoal	3479,68 ab
MeOH with reflux	4322,76 b

Table 2. Validation of the chromatographic method. **a.** Detection and quantification limits, and % of recovery of the selected extraction method. **b.** Reproducibility and repeatability tests. **CV:** Coefficient of variation; **SD:** Standard deviation.

a.

	Detection limit (ppm)	Quantification limit (ppm)	% of recovery
Glucose	4	5	111,47
Fructose	2	3	103,10
Sucrose	2	2	96,13

b.

	Reproducibility		Repeatability		Linearity	
	Average (ppm)	CV (%)	Average (ppm)	CV (%)	Average R^2	SD
Sucrose	40,08	1,21	52,06	4,61	0,9998	0,00015
Glucose	40,42	0,83	41,33	3,67	0,9997	0,00021
Fructose	40,41	0,72	40,49	4,44	0,9997	0,00016

Table 3. Chromatographic conditions established for sugar content analysis

Chromatographic conditions	
Column temperature	18°C
Detector temperature	35°C
Flux	0,3 ml/min
Injection volume	20 µl
Time per sample	35 min

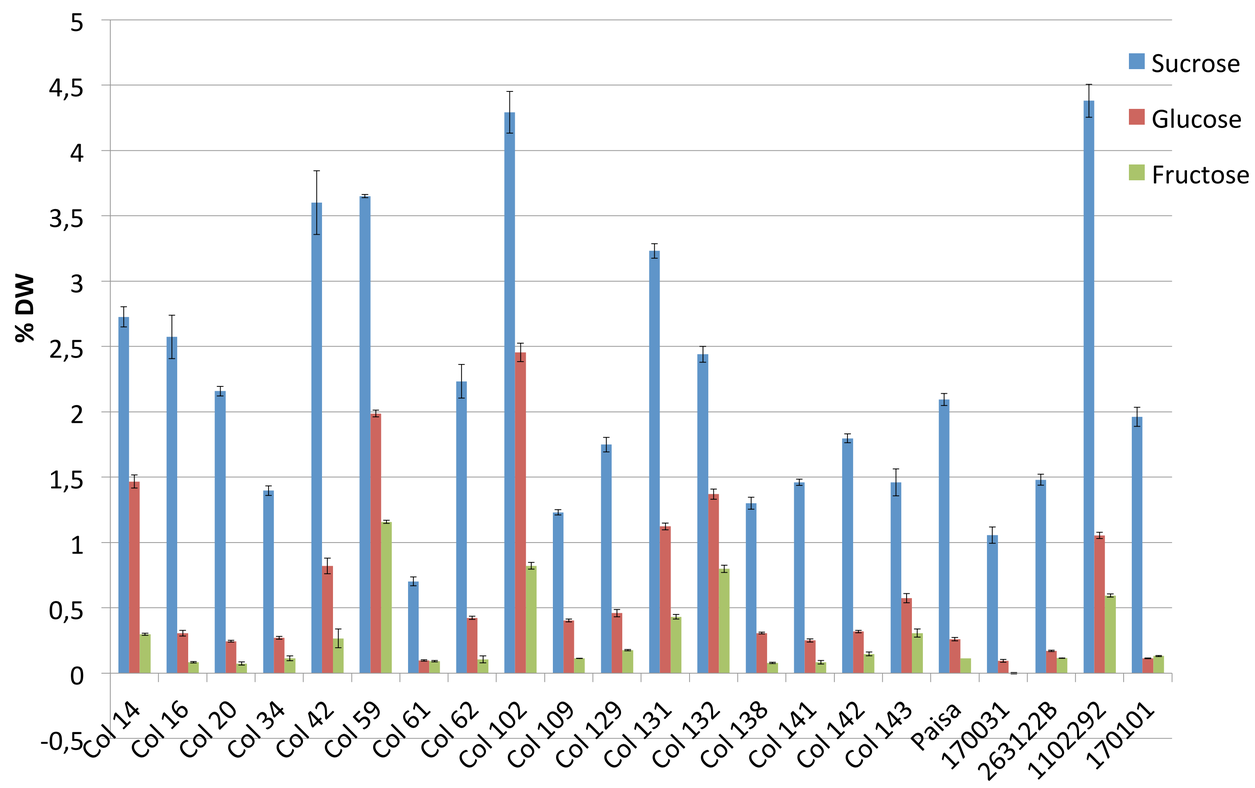


Figure 1. Average sugars content of 22 accessions with standard deviations

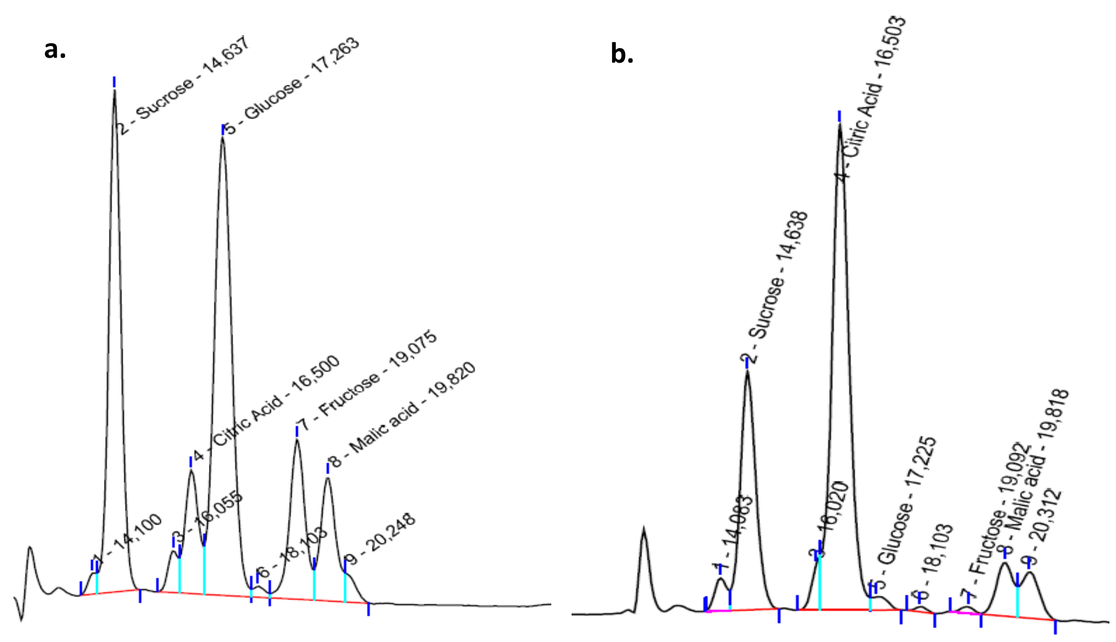


Figure 2. Contrasting genotypes for their sugar content. **a.** CCC 102 **b.** IPK-170031

Conclusions and perspectives

The results obtained until now reveal a high variability in the sugar content of Phureja genotypes. Once the entire phenotypic data is completed, association analysis will be carried out using SNPs from candidate genes and from GBS to identify genomic regions with influence in frying quality in this important cultivated group of potatoes for Colombia.

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