Changes in extended shelf life of cassava roots during storage in ambient conditions.

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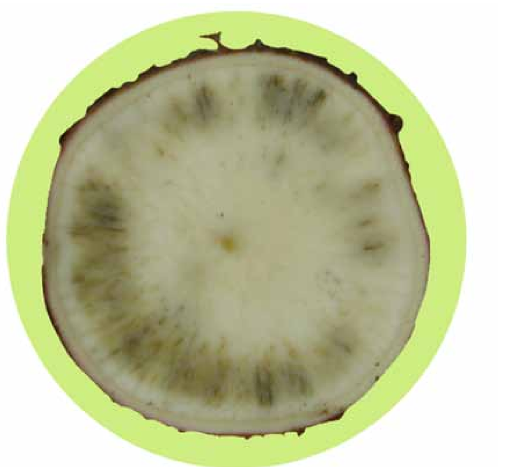
AM 206-5

Cassava roots have a short shelf life due to a process known as post-harvest physiological deterioration (PPD). Within 2-3 days undesirable vascular streaking in the root develops. Tolerance to PPD was recently reported in different cassava genotypes, opening up new opportunities to analyze biochemical changes in stored roots and in the functional properties of their starches.



HMC-1

Materials and methods

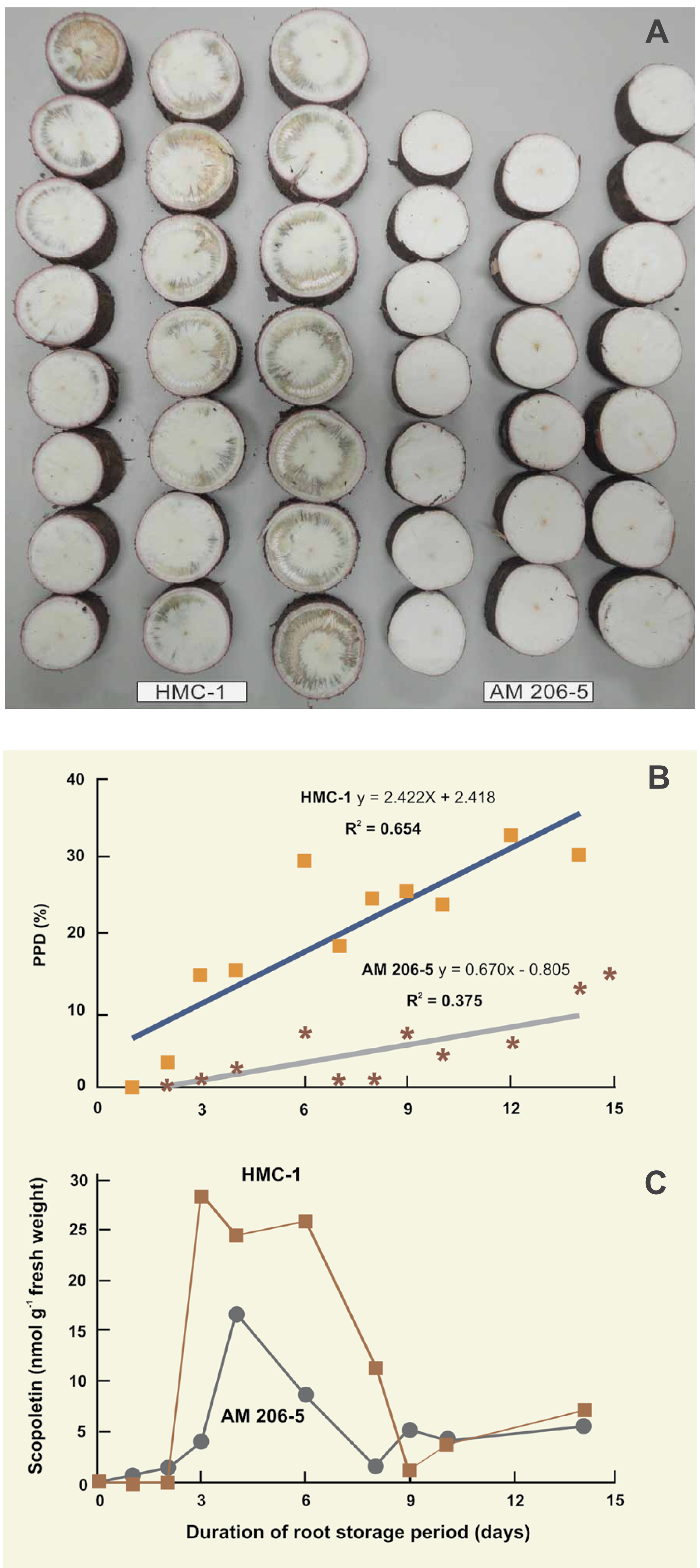
Roots from PPD-susceptible (HMC-1) and PPD-tolerant (AM 206-5) clones were harvested, weighed and stored for up to 14 days in ambient tropical conditions. AM 206-5 is also characterized by amylose-free starch. Different roots and starch were analyzed each day. For the analysis roots were weighed again and then cut in seven transversal slices for PPD scoring. After that step, the peel was discarded and parenchyma homogenized using a food processor for different measurements that included dry matter quantification (DMC), starch extraction and analysis of pasting properties and quantification of scopoletin (a compound involved with PPD).

Results

PPD levels differed significantly between the two clones (HMC-1: 35% and AM 206-5: 8% at day 14) and showed a relation to scopoletin synthesis (Figure 1), which reached maximum levels around the third or fourth day of storage (Table 1). Roots lost weight consistently during storage (≈10% in two weeks). Important changes in starch properties were observed. Gel clarity decreased gradually during storage, with more pronounced changes occurring in starches from HMC-1. Swelling power decreased only in the case of AM 206-5. Gel viscosity increased in both genotypes. A critical result is the starch loss per day of root storage which was estimated to be around 1% per day. This could be the result of consistent increases in total sugars and respiration of root tissue.

Improved tolerance to PPD could significantly reduce the economic impact of the short shelf life of ordinary cassava root processing but roots need to be processed 1-2 weeks after harvest, otherwise starch losses become too high. It remains to be seen, however, whether changes in stored roots positively or negatively affect the quality of the final product.

Problems in the transportation of roots often result in losses that tolerance to PPD would avoid.



Storage
14 days

Figure 1. Illustration of differences in PPD between roots from the two contrasting genotypes (A). Average scores of PPD through time (B) and accumulation of scopoletin (C)

Table 1. Results of linear regression analyses made for different starch or root quality traits on duration of storage periods for two cassava genotypes. When the regressions in the two clones were similar, results from a combined analysis is presented and standard error values are presented within parenthesis.

Variable	AM 206-5		HMC-1	
	Coefficient	**St. Error**	**Coefficient**	**St. Error**
ROOTS				
Weight loss (%)	0.525	0.054**	0.684	0.049**
Starch loss (%)	0.712	0.083	1.010	0.052
PPD	0.700	0.124**	2.422	0.246**
FLOUR				
Saccharose (g 100 g-1 dw)	0.108	0.065	0.216	0.050**
Glucose (g 100 g-1 dw)	0.210 (0.020**)			
Fructose (g 100 g-1 dw)	0.209 (0.029**)			
Total sugars (g 100 g-1 dw)	0.485	0.065**	0.683	0.033**
Citric acid (g 100 g-1 dw)	-0.025	0.006**	-0.036	0.007**
Malic acid (g 100 g-1 dw)	0.027	0.013*	0.058	0.007**
Succinic acid (g 100 g-1 dw)	0.004	0.005	0.021	0.006**
Fumaric acid (g 100 g-1 dw)	0.000	0.000	0.002	0.001**
STARCH				
Gel Clarity	-0.442	0.066**	-1.070	0.100**
Solubility (%)	0.310	0.066**	-0.140	0.031**
Swelling power (g 100 g-1 dw)	-1.109	0.112**	-0.059	0.099
Fraction volume (Φ)	-0.008	0.002**	0.001	0.001
Pasting temperature (°C)	-0.012 (0.037)			
Maximum viscosity (cP)	10.676	3.499**	-3.958	2.530
Final viscosity (cP)	3.829	1.503*	8.478	1.859**
Hot paste viscosity (cP)	8.871 (1.497**)			
Cool paste viscosity (cP)	5.139 (4.424)			
Breakdown (cP)	2.803	2.675	-13.827	2.215**
Setback (cP)	-6.543	2.822*	10.102	1.711**
Consistency (cP)	-3.732 (3.446)			
Onset temperature (°C)	-0.008 (0.060)			
Gelatinization enthalpy (j g-1)	0.011	0.033	-0.051	0.050

* Significant at 5%; ** Significant at 1% .

References

Sánchez T., Dufour D., Moreno J.L., Pizarro M., Aragón I., Domínguez M., Ceballos H. (2013). Changes in extended shelf life cassava roots during storage at ambient conditions. *Postharvest Biology and Technology*. (Accepted. Manuscript Number: POSTEC-D-12-00563)

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