

Impact Of Technological Post-Harvest Processing On The Production Of Chocolate Aroma Compounds In Raw Cocoa Beans Originated From Côte d'Ivoire



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Ivorian raw cocoa material is currently characterized by a standard aroma quality. Fermentation is one of the major post-harvest treatments leading to the production of chocolate aroma compounds. This research aims to study the effect of each post-harvest processing stage on the development of flavor compounds in raw cocoa beans.

Material and Methods

Cocoa beans were extracted from mixed Ivorian 1st generation of hybrids (Amelonadao x West African Trinitario) cocoa pods. They were prepared at South East of Côte d'Ivoire according to controlled pod opening delay, methods and time of fermentation, turnings of fermenting beans and sun-drying (Figure 1).

A total of twelve fermentation processes were realized. In each fermentation process, three samples were prepared and analysed in triplicate.

Volatile aroma compounds were analyzed by SPME-GC-MS method and statistical analysis of data were done by ACP.

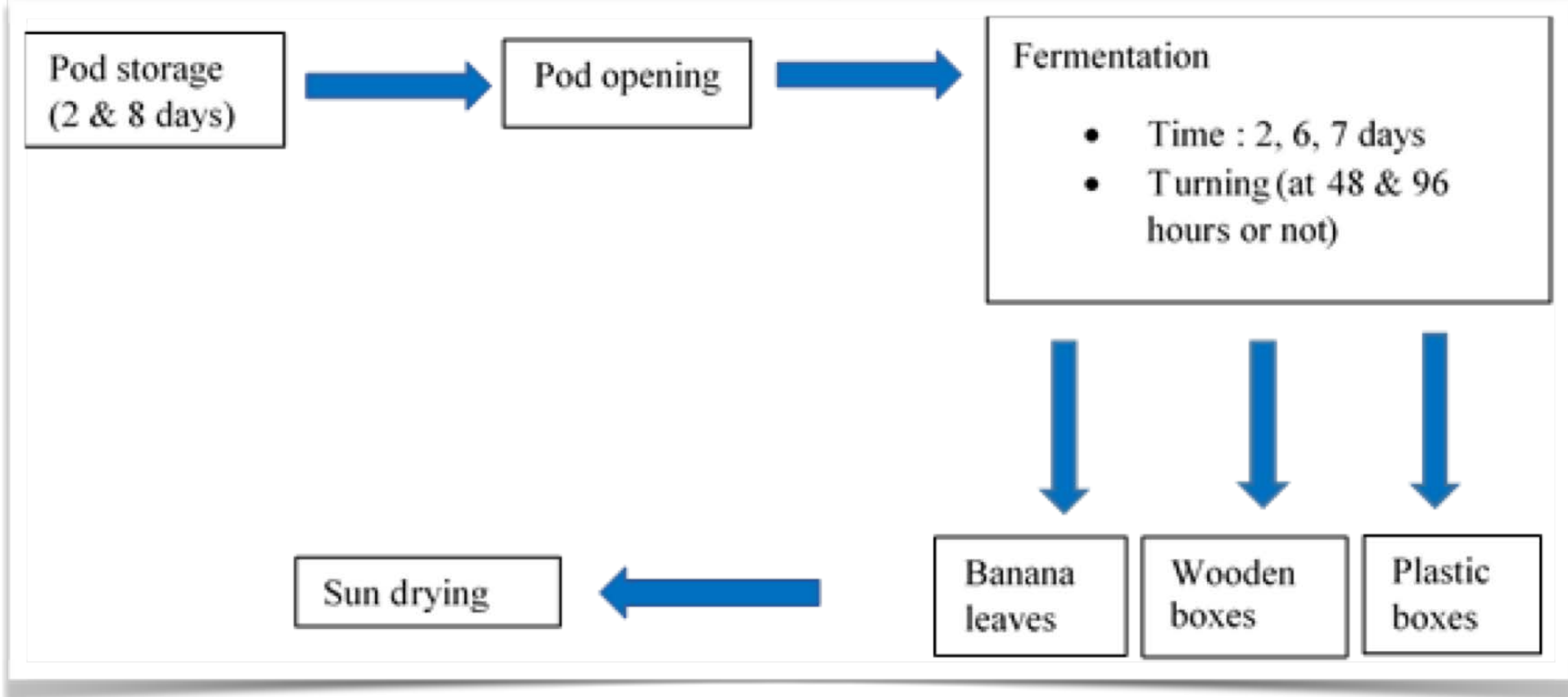


Figure 1. Sampling during post-harvest processing of cocoa



Results

- A total of 30 aroma compounds grouped into six chemical compounds families were detected (Table 1).
- Fermented cocoa beans from 2 days opening delay pods contained more aroma compounds than cocoa from 8 days opening delay pods (Figure 2).
- Like turning of fermenting beans, fermentation technique (Figure 3) did not influence the formation of aroma compounds in raw cocoa beans.
- The analyse of importance of fermentation's day was realized on each pod delay. For the first delay, the fermented cocoa after 2 days were characterized largely by alcohol aroma compounds while 6 and 7 fermented cocoa contained aroma compound belonging to several chemical families (Figure 4).
- We observed the same conclusion for the second delay pods, but after two days, in addition of alcohols; some esters (ethyl acetate, isobutyl acetate 2 and 3 methylbutyl acetate) were also most abundant.

Table 1. Aroma compounds identified in cocoa beans samples

	Families					
	Aldehydes	Esters	Alcohols	Ketones	Acids	Pyrazines
30 Compounds	- Isobutanol	- Methyl acetate	- Ethanol	- 2-Pentanone	- Acetic acid	- Trimethyl 2,3,5 pyrazine
	- Butanal, 2-methyl	- Ethyl acetate	- Isobutanol	- 2-Heptanone	- Isobutyric acid	- Tetramethyl 2,3,5,6 pyrazine
	- Butanal, 3-methyl	- Isobutyl acetate	- 2-Pentanol	- 3-hydroxy-2-Butanone	- 3-methyl butanoic acid	
	- Benzaldéhyde	- Butyl acetate	- Isopentanol	- 2-Nonanone		
		- Methyl butyl acetate	- 2-Heptanol	- Acetophenone		
		- Isoamyl acetate	- 2-Nonanol			
		- Phenylethyl acetate	- 2,3-Butanediol			
			- Phenylethyl Alcohol			

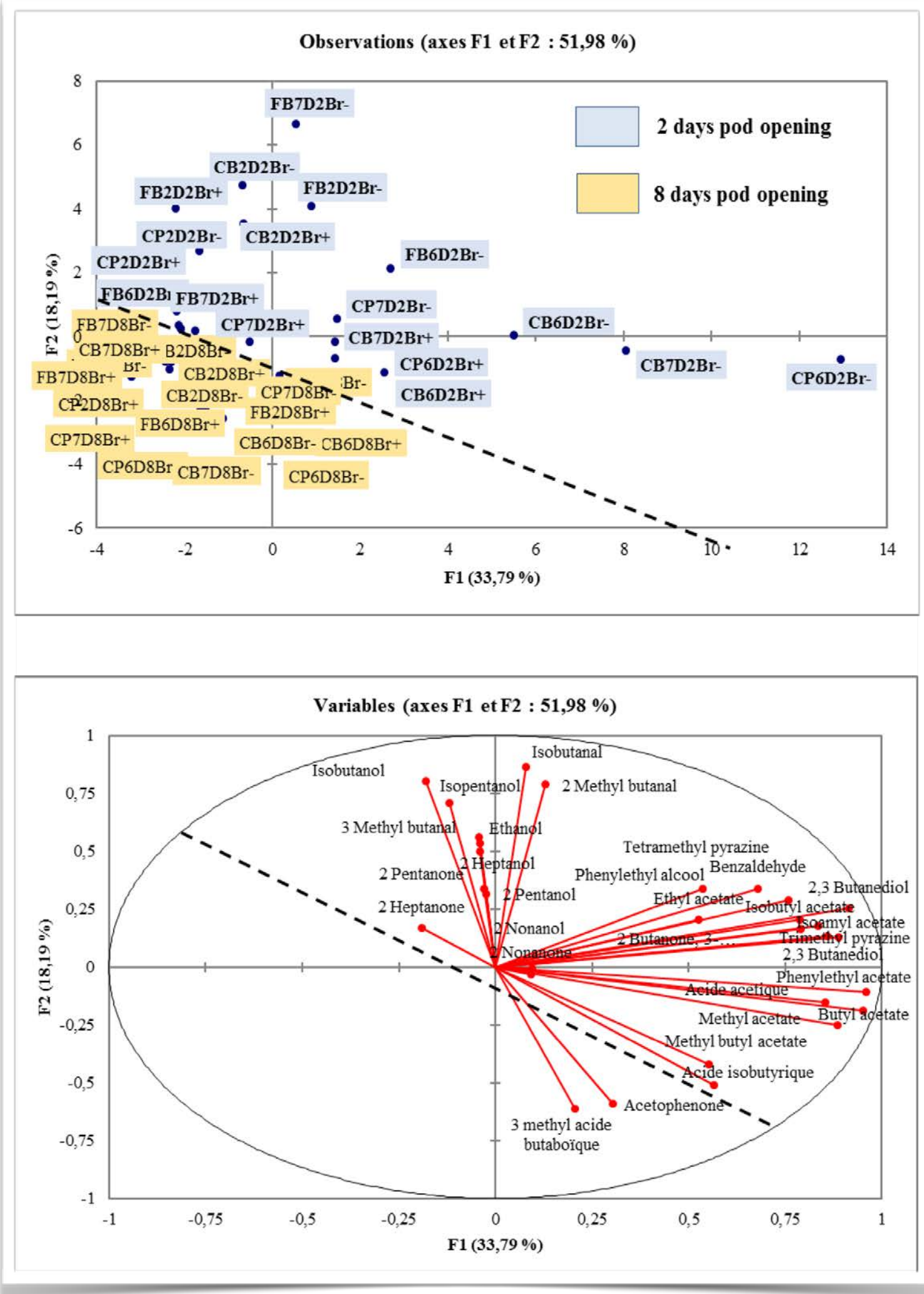


Figure 2. Graphical representation of Principal component analysis (PCA) of the volatile flavor compounds content in cocoa beans of 2 and 8 day pod storage

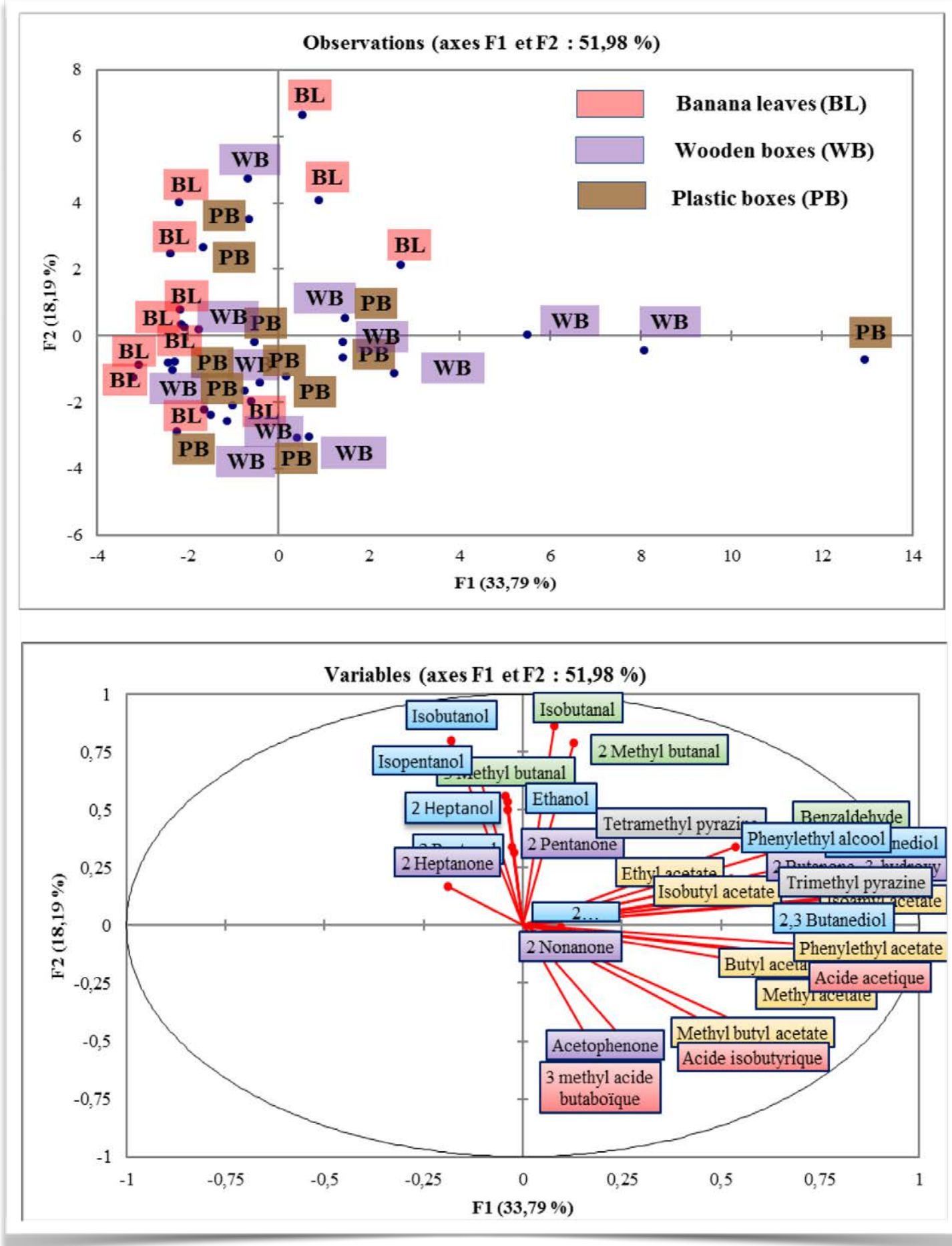
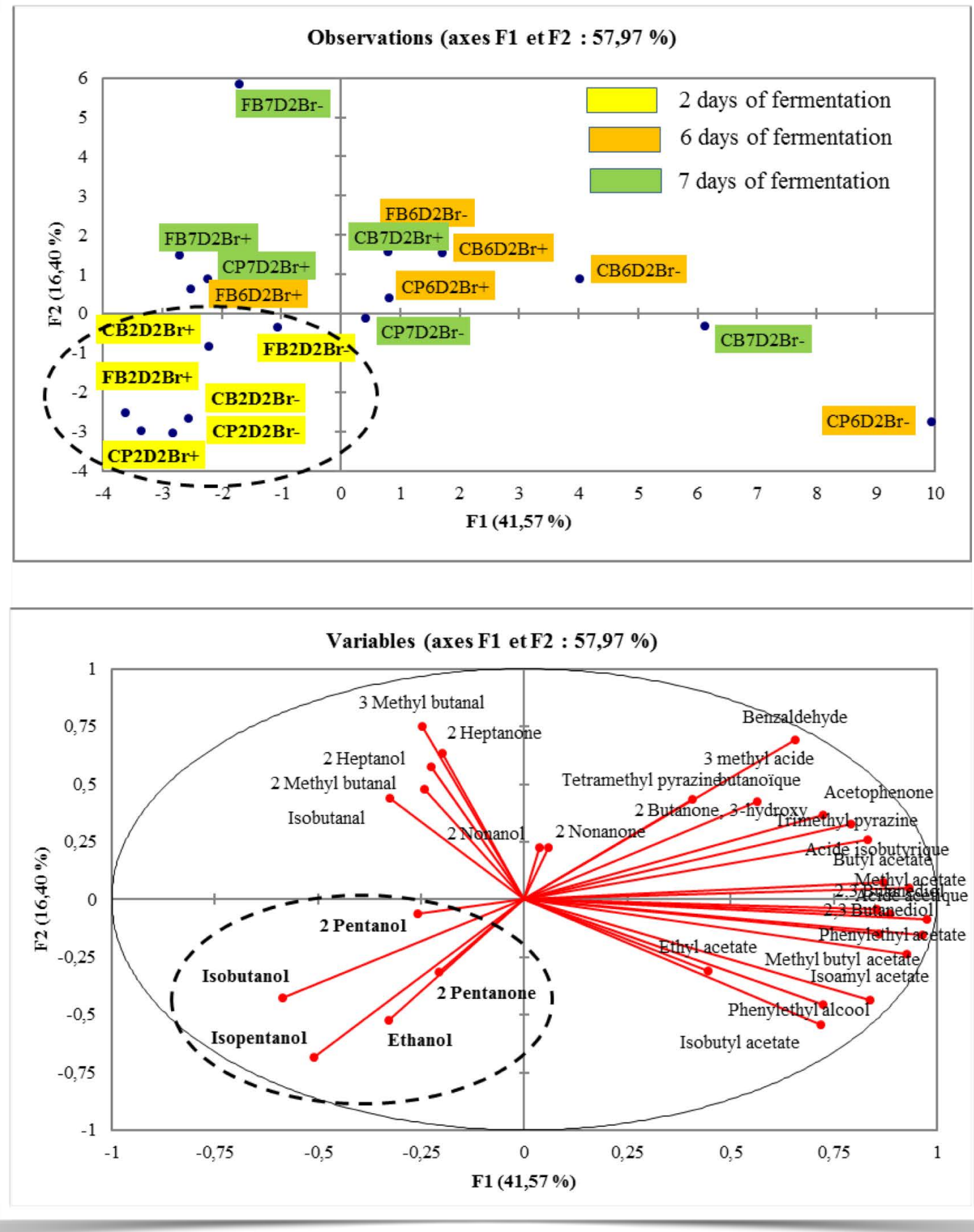


Figure 3. Graphical representation of Principal component analysis (PCA) of the volatile flavor compounds content in cocoa beans fermented according to different methods

Figure 4. Graphical representation of Principal component analysis (PCA) of the volatile flavor compounds content in cocoa beans of 2 day pod storage according to the duration of fermentation



Conclusion

Formation of aroma compounds in raw cocoa beans is depending both on the pods opening delay and the fermentation time but not on the fermentation method neither turning of beans.

Recommendation

In order to improve raw cocoa aroma quality, pods must be opened for 2 post-harvest days and beans fermented for at least 4 days.

References

Alakolwa, E. O., Paterson, A., Fowler, M., & Ryan, A. (2008). Flavor formation and character in cocoa and chocolate: a critical review. *Critical Reviews in Food Science and Nutrition*, 48(8), 840-857.

Rodriguez-Campos, J., Escalona-Buendia, H. B., Contreras-Ramos, S. M., Orozco-Avila, L., Jaramillo-Flores, E., & Lugo-Cervantes, E. (2012). Effect of fermentation time and drying temperature on volatile compounds in cocoa. *Food chemistry*, 132(1), 277-288.

Rodriguez-Campos, J., Escalona-Buendia, H. B., Orozco-Avila, L., Lugo-Cervantes, E., & Jaramillo-Flores, M. E. (2011). Dynamics of volatile and non-volatile compounds in cocoa (Theobroma cacao L.) during fermentation and drying processes using principal components analysis. *Food Research International*, 44(1), 250-258.