

Influence of Agroforestry system on the components of cocoa flavor quality

A. Douady¹, I. Maraval¹, M. Lebrun¹, O. Sounigo², M.C. Lahon¹, N. Forestier-Chiron¹, S. Assemat³, F. Davrieux³, R. Boulanger¹

¹UMR Qualisud. (CIRAD), 34398 Montpellier Cedex 5, France, ²UPR Bioagresseurs. (CIRAD), BP2572 –Yaoundé- Cameroun, ³UMR Qualisud. (CIRAD), Saint Pierre Réunion-France.

The flavour quality of cocoa beans is an important criterion to obtain a "fine chocolate". Some parameters are known to have significant impact on cocoa quality. These factors are environment, genetics and post-harvest treatment. Actually, the importance and interactions of agroforestry system on the biochemistry of beans are not really clear. The aim of the study was to understand the influence of the shade level on the aromatic quality of cocoa beans.

RESEARCH Project EuropeAid • 2012-2015 African Union

AFS4Food
Agroforestry for food security



Material and Methods

Plant Material

One cocoa variety "Trinitario" type coming from Cameroun was used. It is also named "cacao Allemand" in located place. Three types of agroforestry system were characterized: full sun, lightly and strongly shaded.

Post-harvest processing conditions

Fermentation was carried out in wooden cubic boxes for 6 days. Every 24 hours, 1 kg fresh cocoa was sampled and sun dried. The dried beans were transferred to France and stored at -20°C until analysis.

Protocol

About 100 g of unshelled dried cocoa were ground in blender (SEB, France) under liquid nitrogen, sifted to 0.5 mm and stored at -20°C prior to analysis. The volatiles compounds were extracted by SPME fiber (DVB/Carboxen/PDMS) on 2,7 g of cocoa powder. Analysis and identification of cocoa flavour compounds were carried out by CPG-SM (Agilent 6890 and 5973 N).

The biochemical composition of purines, procyanidines, dry matter, fat content and ammonia nitrogen content was determined with NIRS analysis [1,2]. The cocoa beans were also used to make chocolate and realized sensory analysis with a trained panel.



Results and discussion

Aroma compounds

Flavour compounds of all the dried cocoa samples were identified and their contents determined. Compounds were then classified in chemical families. 52 compounds, belonging to 11 chemical families, were identified in the cocoa beans. Esters (16), alcohols (12), aldehydes (7) and ketones (5) were the main families.

A statistical analysis (ACP, figure 1) was carried out to characterize the impact of shade conditions on the volatile compound contents.

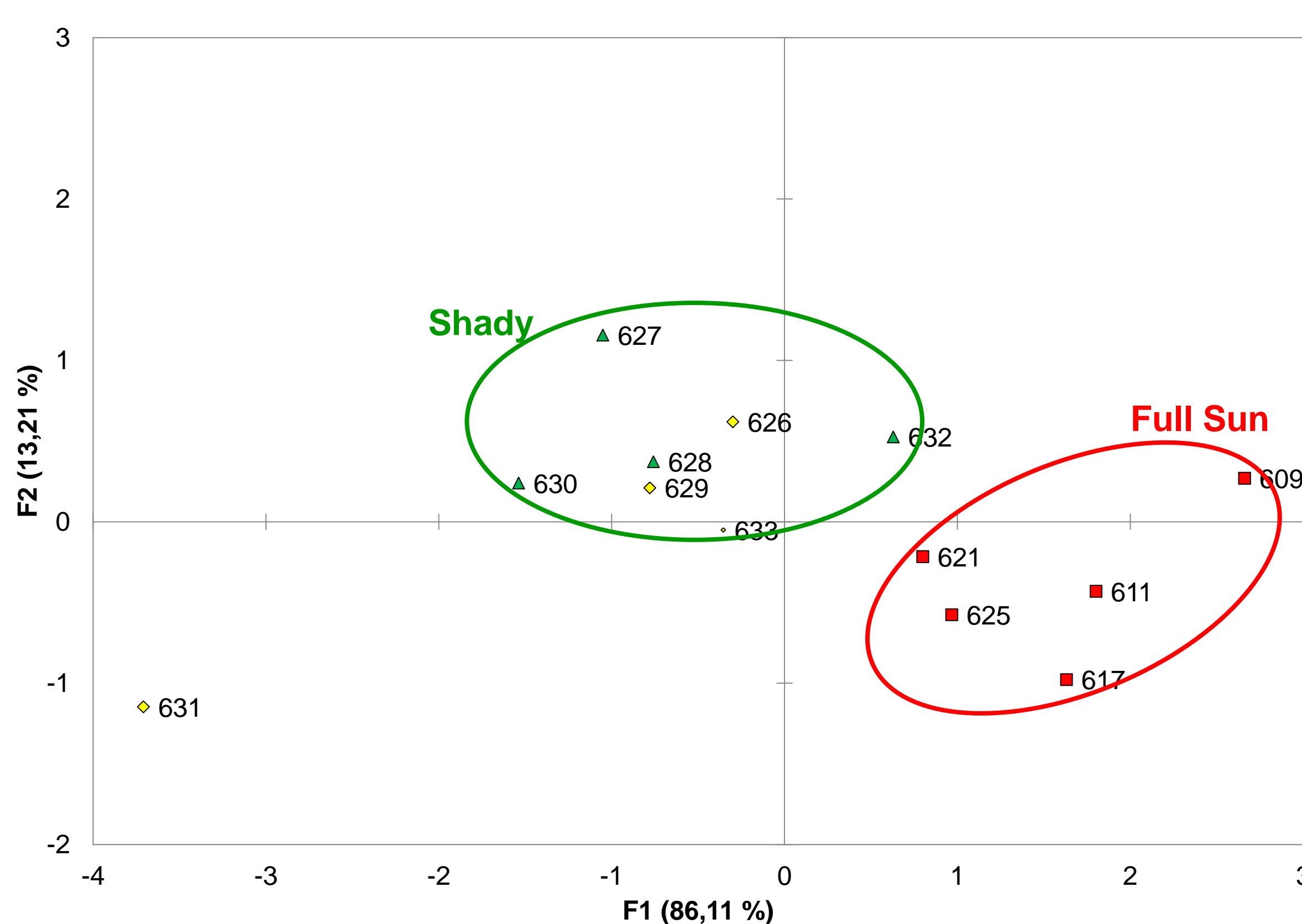


Figure 2 : Score plot of dried cocoa on the biochemical composition according to the level of shade in the agroforestry system on first plan of ACP.

Red, yellow and green dots correspond respectively to sun, lightly and strongly shaded

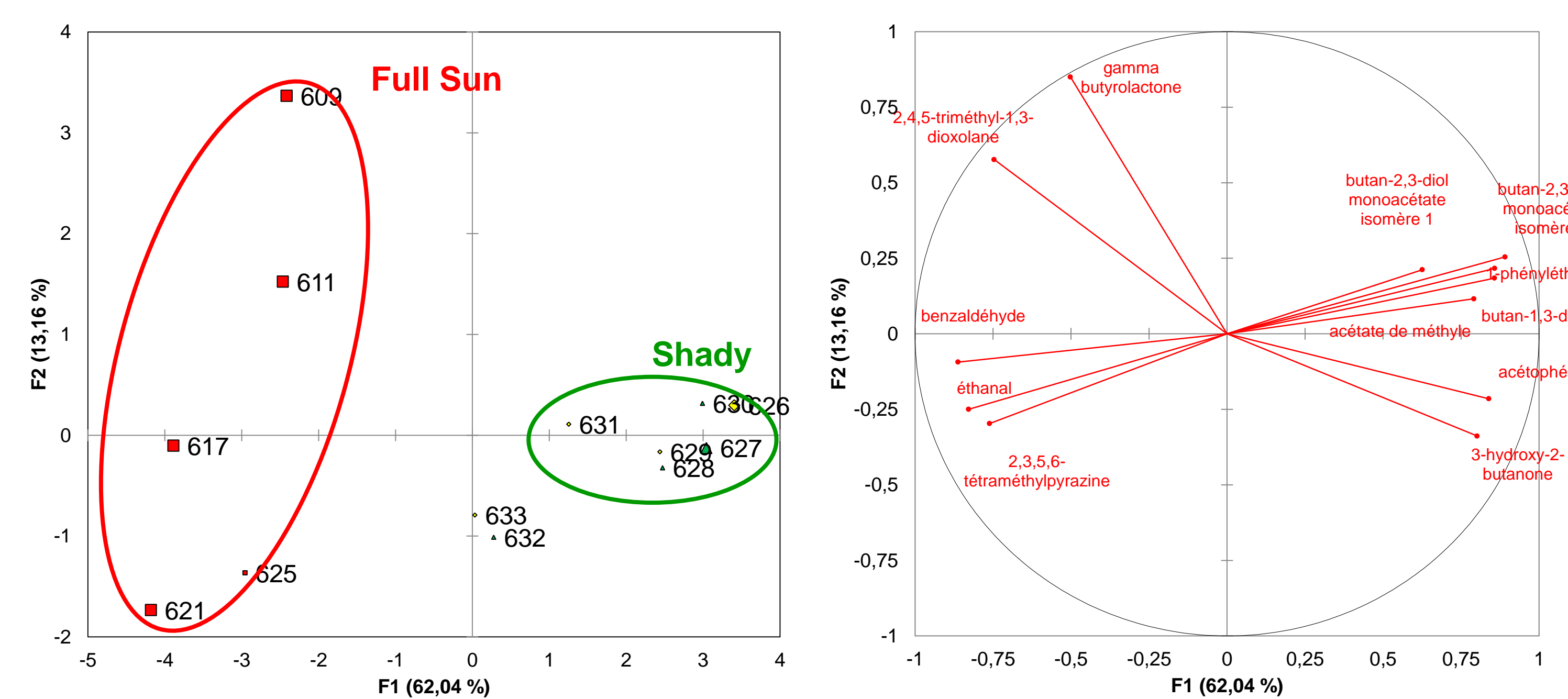


Figure 1 : Score plot of dried cocoa on the aroma compounds according to the level of shade in the agroforestry system on first plan of ACP.

Red, yellow and green dots correspond respectively to sun, lightly and strongly shaded

Biochemical composition

A statistical analysis (Anova) carried out on the biochemical composition showed that only contents of procyanidines B1 and C1 and the ammonia nitrogen content were significantly different in relation with shade level. A PCA on these data (figure 2) showed a good separation between the samples in full sun system and the others. The first axe was correlated positively with the content of procyanidines contents and negatively with the ammonia nitrogen content. The second axe was correlated positively with ammonia nitrogen contents.



Conclusion

- The agroforestry system have an important impact
 - ✓ On aroma composition of cocoa beans and roasted beans (data not shown),
 - ✓ On procyanidines and ammonia nitrogen content of cocoa beans,
 - ✓ On the sensorial perception of chocolate .
- The chocolate obtained with cocoa in full sun agroforestry system were characterized with a sweet taste and a global quality more important than shady system.
- The full sun system are different that all the shady systems.

Sensory analysis

A statistical analysis (PCA, figure 3) was carried out to characterize the impact of shade conditions on sensorial perception of chocolate.

A discrimination between full sun and shady was observed based on the sweet perception and the global quality.

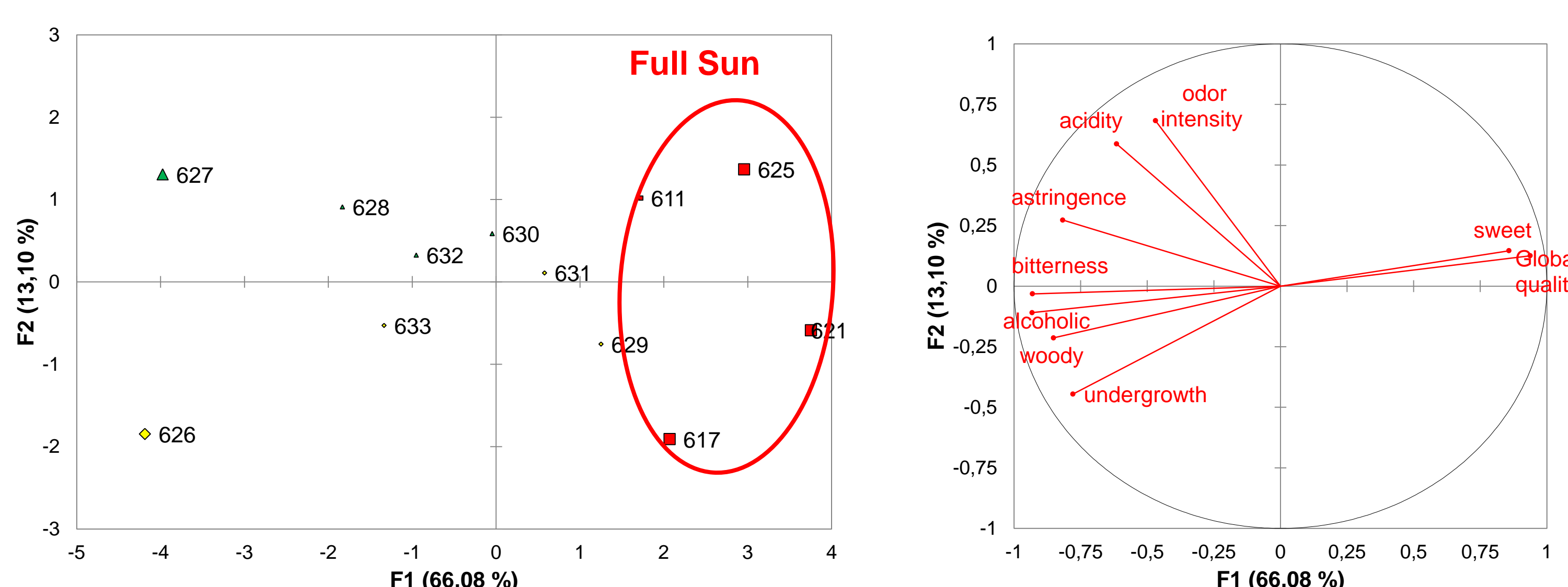


Figure 3 : Score plot of sensorial description of chocolate according to the level of shade in the agroforestry system on first plan of ACP.

Red, yellow and green dots correspond respectively to sun, lightly and strongly shaded

References

1. Alvarez *et al.*, The use of near infrared spectroscopy to determine the fat, caffeine, theobromine and (-)-epicatechin contents in unfermented and sun-dried beans of Criollo cocoa, *Journal of Near Infrared Spectroscopy*, 20(2): 307-315 (2012).
2. Hue *et al.*, Near Infrared Spectroscopy as a new tool to determine cocoa fermentation levels through ammonia nitrogen quantification, *Food Chemistry*, 148, 240-245 (2014).

UMR QualiSud | cirad | Centre de coopération internationale en recherche agronomique pour le développement
www.cirad.fr