Prediction of Coffee Varieties Using Near Infrared Spectroscopy

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Introduction

The Arabica and the Robusta are the most traded coffee varieties in the world. They are varying in green bean chemical composition that affects coffee quality.
This preliminary experiment was conducted to explore the ability of near infrared spectroscopy (NIR) to predict variety and origin of green coffee beans from Indonesia.

Materials and Methods

- Green beans of Arabica (n=5) and Robusta (n=1) of different origins: Aceh, Mandheling, Java, Sulawesi Kalosi and Flores, and Kawista.
- NIR absorbance spectra (1000-2500 nm, Nicolet Antaris NIR Analyzer) of 30 g green coffee beans in petri dish (5 replicate spectra per sample, Fig. 1)
- Data pre-treatment: baseline iterative restricted least squares correction (Fig. 2)
- Principal component analysis (PCA) using R software (package ChemometricsWithR), data set (matrix 29x1557).

Results

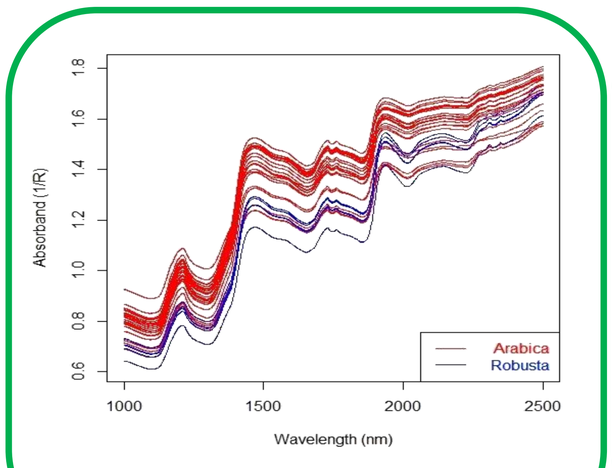


Fig 1. Original Spectra

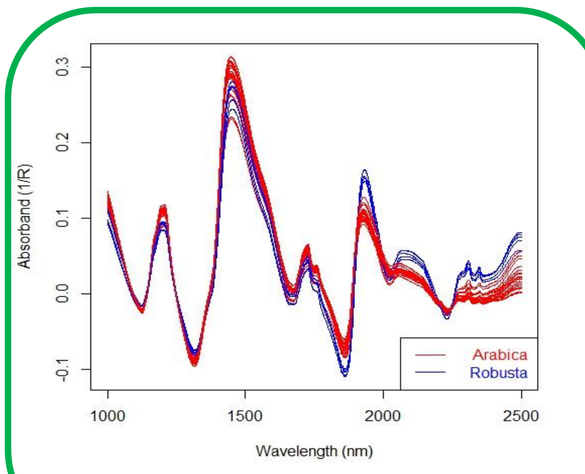
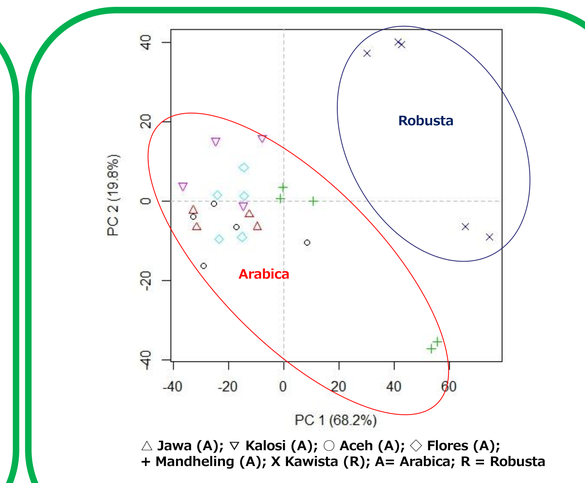


Fig 2. Baseline Correction



△ Jawa (A); ▽ Kalosi (A); ○ Aceh (A); ◇ Flores (A);
+ Mandheling (A); X Kawista (R); A= Arabica; R = Robusta

Fig 3. Score Plot

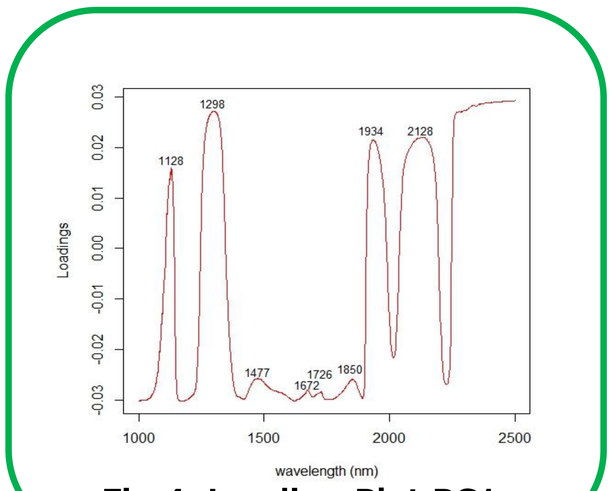


Fig 4. Loading Plot PC1

- PC's 1&2 (Fig. 3) represent 88% of original data variance.
- PCA reveals clustering of coffee varieties based on NIR spectra (Fig.3)
- The loading plot displayed various wavelength peaks that has possibility to be used to determine variety of coffee. (Fig. 4, Table 1).

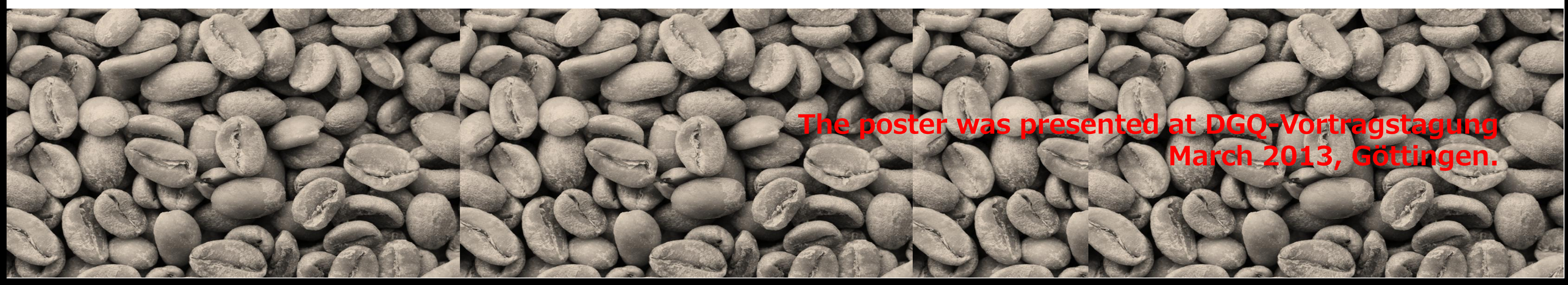
Table 1. Several Wavelength Peak

Wavelength (nm)	Possibility Of Chemical Composition*
1128	Caffeine, Trigoneline
1298	Caffeine
1477	Chlorogenic Acid, Lipid, Carbohydrate
1672	Caffeine
1726	Caffeine, Chlorogenic Acid, Lipid, Sucrose
1850	Sucrose
1934	Caffeine, Cholorogenic Acid, Protein and Amino Acids, Lipid, Water, Carbohydrate
2128	Chlorogenic Acid, Lipid, Carbohydrate

*Ribeiro, J. S., Ferreira, M.M.C., Salva, T.J.G. 2011. Chemometric models for the quantitative descriptive sensory analysis of Arabica coffee beverages using near infrared spectroscopy. Talanta 83: 1352–1358.

Conclusion

NIR spectroscopy can potentially be used to determine green coffee bean varieties of Arabica and Robusta. More samples will be analyzed in the future, and effects of data pre-treatment will be studied.



The poster was presented at DGQ-Vortragstagung March 2013, Göttingen.