

**Topic 2 Integrated approaches for quality
Optimization, maintenance and transfer of models between near infrared
spectrometer and micro-spectrometer
Application to the assessment of the Ente plum maturity**

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CONTEXT

The B.I.P. for many years has been carrying out measurements on Ente plums, in order to better characterize the maturity of the fruits at harvest and adapt the drying process for transformation into prunes. The quality parameters to be measured are the sugar level and the total acidity, in addition to the average weight. These parameters are currently measured in the laboratory using long and destructive reference methods.

The objective of this study was to replace these reference methods by a rapid and non-destructive method such as near infrared spectroscopy, and possibly by a portable tool in the orchard.

The experiments were carried out by the B.I.P. and data analysis by Ondalys.

MATERIALS, METHODS AND RESULTS

Spectra were collected between 2013 and 2016 (about 1500 fruits / year) on a near infrared laboratory spectrometer: the ASD LabSpec4® (range between 350 - 2500nm).

The acidity and sugar prediction models, developed on the ASD LabSpec4® spectra (2013 - 2016) gave satisfactory performances, capable of estimating the quality of new vintages with the following performances:

- Sugar (° Brix): RMSEP = 1.7 and R² = 0.87
- Acidity (Meq): RMSEP = 15.6 and R² = 0.74

In order to perform a calibration transfer on a handled micro-spectrometer, spectra were also measured in 2016 on the MicroNIR™ OnSite® (908 - 1676 nm) from VIAVI.

The historical database (2013-2016) on the ASD was then transferred to the MicroNIR™ to rebuild a "MicroNIR type" model, along with true MicroNIR™ spectra from 2016.

Various methods of inter-instrument transfer have been tested. Local centering, that is to say an offset correction for each wavelength, gave the best results. Results were satisfactory for sugar but were lacking of accuracy for acidity:

- Sugar (° Brix): RMSEP = 1.9 and R² = 0.83
- Acidity (Meq): RMSEP = 22.8 and R² = 0.48

CONCLUSIONS AND FUTURE PROSPECTS

As the model established on the LabSpec4® ASD is already robust against vintages, the annual maintenance will be very light in terms of number of samples.

As for updating the models established on the MicroNIR™ OnSite®, the sugar prediction database will have to be enriched with new vintages, in order to increase the performance of the model.

Concerning the acidity, a complete re-development of a model based only on MicroNIR™ OnSite® spectra will be necessary, this parameter being more complex to estimate.

In the future, the B.I.P. plans to equip technicians and drying facilities with handheld micro-spectrometers as well as to work on the issues of online sorting of fruits before drying.

Keywords: Near infrared spectroscopy, micro-spectrometer, maintenance, transfer, robustness.

References:

LALLEMAND J., RASHIDI S., *et al.* - *Evaluation of Ente plum maturity by infrared spectroscopy - 2015 - 7th International Conference on Near Infrared Spectroscopy, Foz do Iguassu – Brazil.*