DEVELOPMENT OF A RAPID METHOD FOR THE ASSESSMENT OF PHENOLIC MATURITY IN BURGUNDY PINOT NOIR

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Objectives

Currently, the assessment of phenolic maturity involves manual, lengthy and tedious methods.
In order to allow oenologists or viticulturists to follow the phenolic evolution of the grape in real time (on plot or regional level), it was necessary to convert the reference method into a routine analysis. The FT-IR method developed by FOSS (WINESCAN FT120), and combined with a rapid grape sample preparation technique, is an advantageous and viable analytical technique.

The quantitative, and possibly, qualitative data for polyphenols in Pinot Noir should contribute to the proper determination of harvest dates, and to guide the vinification.

Materials and Methods

1- Grape sampling
BIVB has a network of reference plots, which are distributed all over the 3 departments of Burgundy, and comprise 20 Pinot Noir plots.
Samples are taken twice per week, on Monday and Thursday, following a rigorous protocol.
In each plot, samples were taken from 10 rows (the same rows since the creation of the plot network), selecting 20 vines per row, and excluding the edges. Samples consisted of 3-4 berries taken from one cluster and were selected at random on all sides of the cluster. The different clusters chosen also varied in their position on the vine. Both sides of every row were sampled.
In the laboratory, the entire sample was destemmed. Then, a 400 berry-sample was selected and weighed.

2- Sample preparation.

2.1 – Reference method:

The berry sample was pressed with a bag press (Parapress) allowing to control juice extraction. The skins were then recovered from the pomace.
Two skin batches of approximately 25 g were then subjected to extraction: one with solvents in order to assess the skin polyphenolic potential, the other with a hydroalcoholic solution in order to assess the extractability of these compounds.

2.2 – “FOSS” method:

Extraction of grape berries occurred by centrifugation, followed by juice clarification. Must analysis was carried out in calibration mode on a WINESCAN FT120.

3 – Analytical reference methods

The extracts obtained previously were analysed by spectrophotometry.
Measurement of anthocyanins: SO_2 decolourisation method
Measurement of tannins: Acid butanolysis method
Total polyphenolic index: O.D.280 index (measurement of optical density at 280 nm after hundredfold sample dilution in 1cm light path cuvettes)

The results are expressed in g/kg berries.

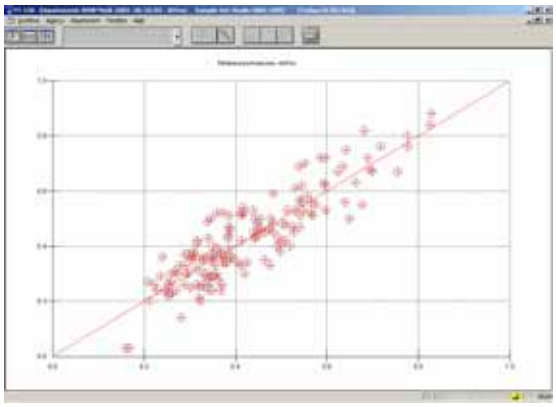
Results

Statistical evaluation of the results was carried out by FOSS Electric.

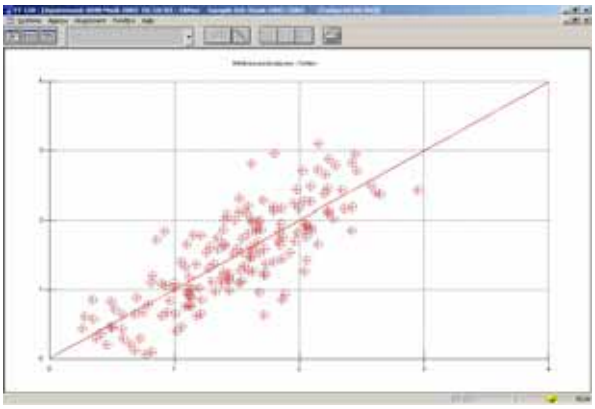
1 – Calibrations

The figures below show the calibration curves obtained from results in 2002/03 (i.e. 177 samples).

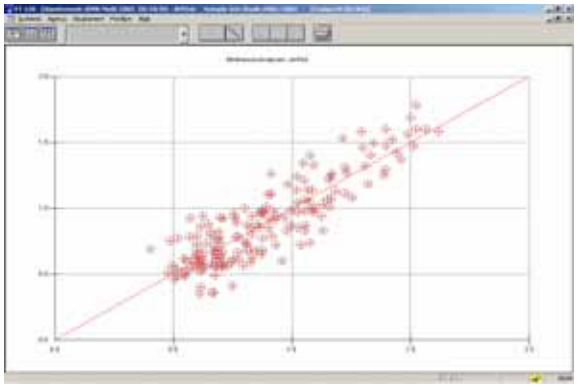
Extractable anthocyanins



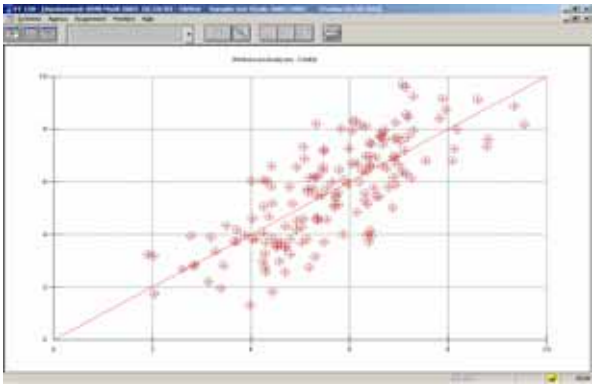
Extractable tannins



Total anthocyanins



Total tannins



Overall, the calibration curves obtained are satisfactory considering the uncertainty of the reference methods.
Linearity and bias are better for the anthocyanins than for the tannins. Against all expectations, the measurement of the total tannin content of skins was possible.

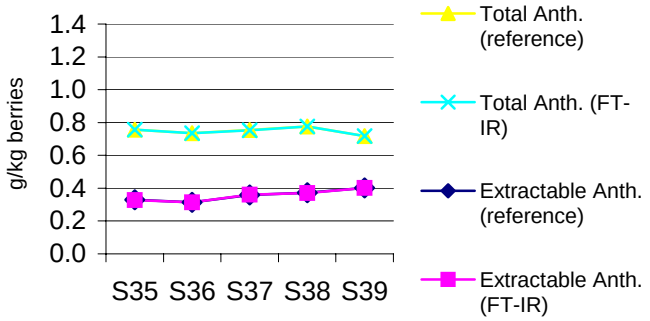
2 – Study of plots

All Pinot Noir plots were assessed with both methods during the two-year study.

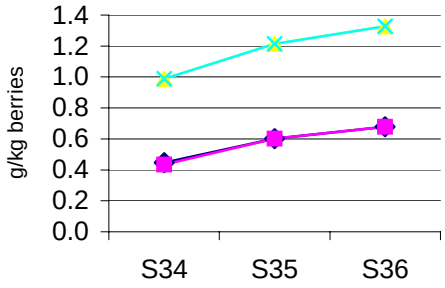
2.1 – Study of skin anthocyanin content

2.1.1 – Development of average contents in 2002 and 2003 vintages

2002 Vintage

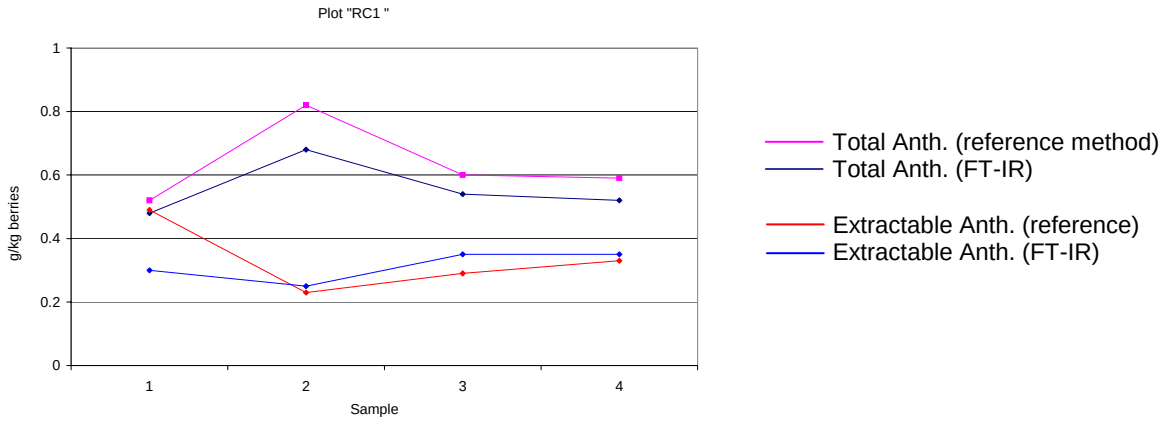


2003 Vintage



Overall, the evolution as assessed by the two methods, was strictly identical.

2.1.2 - Evolution within one plot

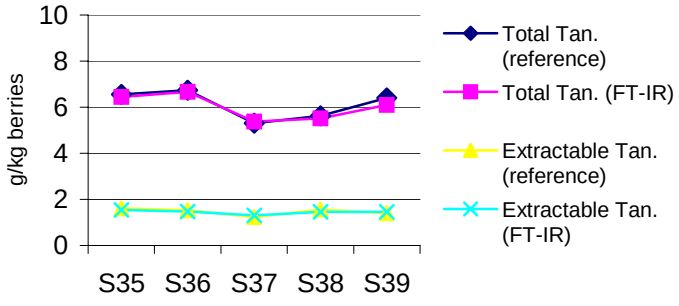


The comparison between both methods shows a similar evolution. For certain samples, notable differences could be seen. Nevertheless, regarding the precision of the reference method, the differences were not truly significant.

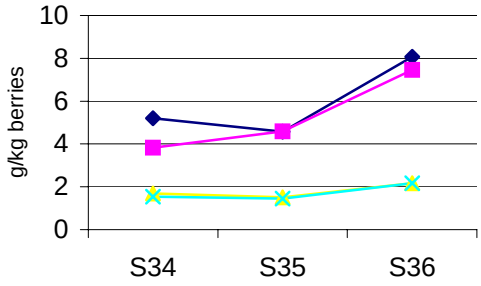
2.2 – Study of skin tannin content

2.2.1 – Development of average contents in 2002 and 2003 vintages

2002 Vintage



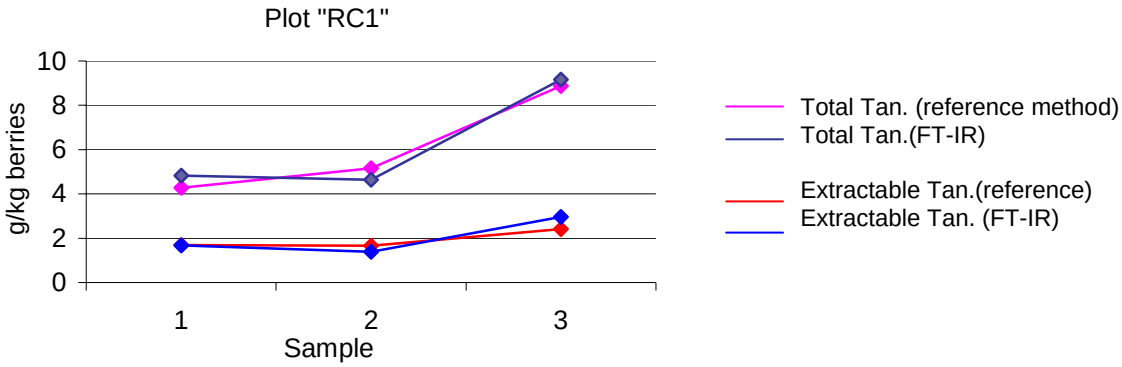
2003 Vintage



Such as for total and extractable anthocyanins, the evolution of average tannin contents during the study was similar

2.2.2 - Evolution within one plot

Here again, both methods were in agreement regarding the evolution of skin tannin contents.



The 2003 results substantiate the method robustness as well as the dynamic range of the method. The results from 2004 will further contribute to this calibration.
The years to come will allow to evaluate the vintage effect.

Method comparison:

	"FOSS" Method	Reference Method
Berry sample size	> 200 berries	> 200 berries
Sample preparation duration	1 minute 30 sec.	3 hours
Duration of Analysis	30 seconds	1 hour
Number of samples processed per worker and day	> 150	6
Qualification of personnel	Technician	Technician

The advantage of using FT-IR spectroscopy has been sufficiently demonstrated. This analytical method, besides its robustness and reproducibility, allows to analyse a bigger number of samples.
In addition, the FOSS method allows to obtain the so-called physiological maturity parameters (sugar, acidity,…) of the grape sample at the same time.

Discussion

The results obtained from two vintages show that both methods yield very similar results.
The method accuracy, considering that of the reference method, is already satisfactory. The evolution of phenolic compounds during the maturation is similar for both methods.
The final validation of this method will be carried out with the 2004 vintage.
The good results obtained with skins allow us to attempt developing a calibration for grape seed tannins in order to follow their evolution.

Conclusion

FT-IR analysis allows to obtain results about the content and the evolution of phenolic compounds rapidly and reproducibly.
This technique allows to consider a short-term study where the evolution on a specific plot could be followed tightly. The interest in a regional maturity study, or a study on vineyard level through the services of an analytical laboratory is considerable.
Obviously, the interpretation of results remains the most critical point and requires further results from years to come.
Even if the analysis of anthocyanin and tannin quantity does not seem to pose a particular problem, the actual determination of the best harvest date is more difficult.

The relation between the maximum contents, the extractability and wine quality has to be known. Grape seed maturity may become an additional decision factor.

The development of this type of analytical control and maturity assessment should also lead to orient winemakers toward the technique or techniques, which would be best adapted to the quality of grapes available.