PHAZIR™

Rapid, non-destructive determination of °Brix on whole grapes on-cluster.

By F. G. Haibach

Abstract

Rapid assessment of °Brix in the vineyard is critical in determining harvest timing. °Brix is highly correlated with grape maturity and flavor development. In green grape varieties there are only subtle external indicators of maturity. Handheld near-infrared spectroscopy enables 3-5 second determination of maturity parameters. This analysis can be performed through the skin of the grape without removing it from the cluster. In addition, the results of the analysis are archived for later analysis.

Introduction

Fruit, and in particular grape harvesting, is dependent on picking the fruit at an optimal state of maturity. Both table and wine grapes need to be harvested when sugar and other flavor compounds are reaching their optimal levels.

In table grapes, importers set a minimum °Brix during inspection. Individual tested grapes that fail to meet the minimum °Brix can cause the entire batch to be rejected. Analyzing a greater portion of the vineyard reduces waste. A more detailed profiling of the vineyard allows selective harvesting of vineyard rows at optimal maturity. There are strong market drivers to analyze a greater portion of the harvest for table grapes.

Grapes destined for winemaking are harvested at a later stage of maturity. Sugar content continues to increase after sap flow into the berry ceases and transpiration reduces the water content. Eventually, sugar content decreases as the berry metabolizes the sugar. Timing the harvest to provide optimal sugar levels and flavor compounds is an essential part of the art of winemaking. Determining of the response of clusters to the vineyard microclimates provides the opportunity harvesting of individual clusters at peak maturity and a more consistent – or if desired, a more diverse – set of wines from the vineyard.

Polychromix intends to collect data from different regions to provide variety-specific and -independent calibrations for the grape-growing industry.

Experimental

Materials

PHAZIR™ 1018
PhazirMG™
Handheld refractometer (non ATC)
Scapula

Procedure

Approximately 30 grapes each of Flame, Thompson and Sugraone seedless were chosen for producing calibrations. The spectra of the grapes were measured through the skin at three locations, near the stem, the equator and the blossom scar using the PHAZIR 1018. The grape was then sectioned to allow °Brix measurements of the three portions using the refractometer.

Two stock PHAZIR 1018 were used. The spectra were acquired with a 5-second integration time. No cleaning of the instrument was required during acquisition. Time between spectra was about 10 seconds. The speed of acquisition is dominated by positioning the grape in front of the instrument.

Phazir Method Generator™ was used to explore the data set. The PLS1 algorithm was used to find a correlation between the measured spectrum and the refractometer reading. Approximately 6000 mathematical treatments of the data were compared. The best choice, based on the comparison results and expert knowledge is presented.

Results & Discussion

As part of the calibration process, the variation of °Brix with position on the grape was investigated. It was found that the stem- (calyx, proximal) and blossom- (stylar, distal) ends of the grape could differ by as much as 2 °Brix, with the sweeter portion on the blossom-end. This is consistent with the flow of sap within the fruit vasculature.[1]

Individual PLS1 calibrations for °Brix were built for each of the three grape types. The parameters were identical for all of the types. The results are very similar to the literature.[2]

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Table 1. Results from optimization on flame grape variety.

Preprocessing	Parameters
Wavelength range	1075-1343 nm
Linear Baseline Correction	1075-1343 nm
Normalize, Unit Vector	1075-1343 nm
PLS1 Regression	
4 factors	
Rotation by concentration	
SEP cross-validated = 1.1 °Brix (typical)	

The calibration range is from 11-25 Brix. Table grapes are harvested when the minimum °Brix within a field is measured at 17 units based on a measurement of one hundred grapes or so. The scatter of the NIR result is well inside the distribution of °Brix within the cluster. The calibrations have also been used in prediction on a secondary unit with only a bias correction. Results are indistinguishable after the transfer.

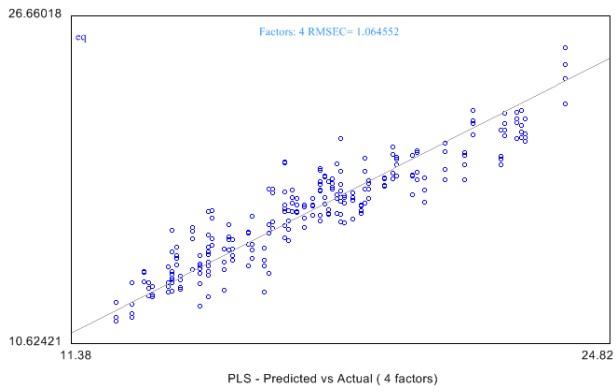

Figure 1. Calibration curve for Flame Seedless table grapes.

Conclusions

For the three types of grapes investigated, calibration and determination of °Brix are very similar. This is suggestive of a very robust and transferable method between grape varieties.

Calibrations for near-infrared spectrometers can be built rapidly by experts. In many ways, building calibrations for well-understood not more difficult than with other analytical techniques and may be more transferable between instruments.

Acquisition time of the instrument is very rapid. The speed at which field measurements can be taken is dependent on the speed at which the operator can position the grape in front of the instrument. Multiple measurements by moderately trained operators can take place as often as 6 times per minute.

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[1] Wm. Grierson, "Fruit Development, Maturation and Ripening" in *Handbook of Plant & Crop Physiology, Revised & Expanded.* Ed: M. Pessarakli, Marcel Dekker, Inc, p. 151 (2002).

[2] D. Cozzolino, R.G. Dambergs, L. Janik, W.U. Cynkar and M. Gishen, *J. Near Infrared Spectrosc.* **14,** 279 (2006).

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