Can we predict grapevine starch non-destructively?

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Introduction

- Vine starch reserves accumulated in summer support new root and shoot growth in the following spring.
- Knowledge of the level of accumulated starch in winter provides opportunities to make informed management decisions.
- Traditionally, quantification of starch concentration has relied on wet chemistry analytical methods performed in the laboratory.
- Near Infrared (NIR) technology has proven to be a powerful analytical technique for the assessment of plant starch.
- Generally samples need to be freeze dried and ground.
- Simplifying sample presentation could increase sample throughput and potentially allow for non-destructive *in vivo*

Aims

- Investigate the feasibility of using NIR technology to assess starch in ground and intact vine wood samples.
- Use partial least squares (PLS) regression on spectral data and compare to the contents measured using a conventional wet chemistry method.
- Determine if the removal of the bark layer will improve the accuracy of prediction.

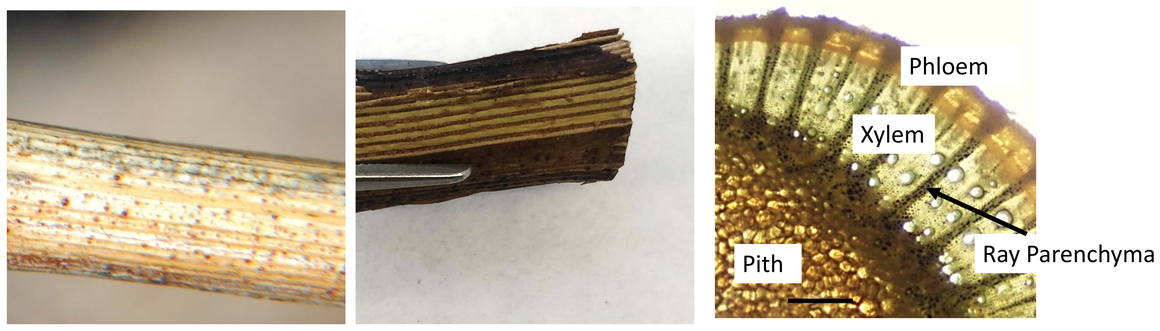

Figure 1. (a) cane section with bark intact (b) cane section with bark removed c) Light micrograph of transverse section, stained with 1% aqueous solution of iodine-potassium iodide, showing starch grains in the ray parenchyma of Pinot Noir. Scale bar = 2 mm

Results

- An accurate calibration model was obtained for ground cane wood samples (R^2 > 0.78 root mean square error of prediction (RMSEP) of 4.2 in the validation models) (Fig 2).
- NIR spectra of intact wood samples poorly correlated with starch values, indicated by the low R^2 value (0.20) (Fig 3). The removal of bark did not improve the accuracy of the model (0.36) (Fig 4). However, the low RMSEP values (<0.85) of intact cane wood indicate good predictability of the model.

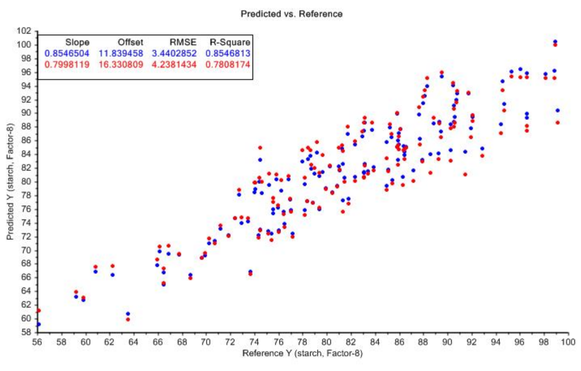

Figure 2. **PLS for** ground cane wood samples taken in 2018

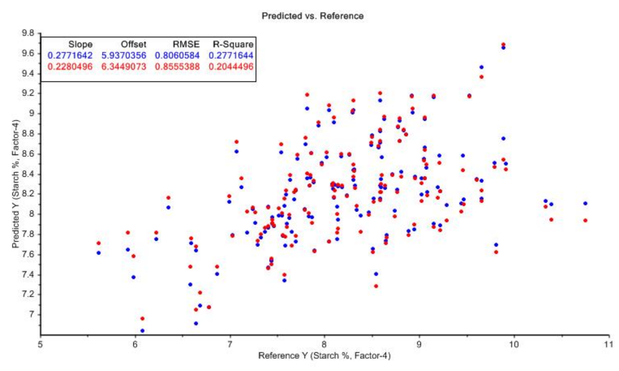

Figure 3. PLS for intact cane wood samples (bark on) taken in 2018

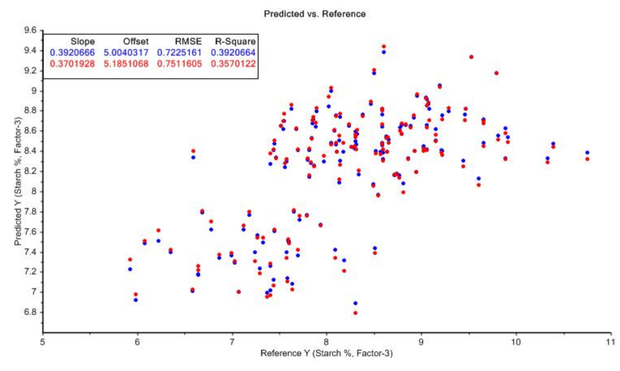

Figure 4. PLS for intact wood samples with bark removed take in 2018

- The poor correlation for intact wood is likely due to the heterogeneous distribution of starch in the cane wood (Fig 1c), which is overcome by grinding. A lack of low starch values and variation in water content in the samples may have also contributed to the low R^2 value.

Conclusion

- Drying and grinding are important preparation steps for predicting starch in cane wood using NIR due to the heterogeneous distribution of starch in the cane wood.

NIR spectroscopy is suitable for the determination of grapevine reserve carbohydrate of ground cane wood samples. Further work is required for intact cane wood samples.

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