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WineBoard Report

Electronic Nose Evaluation of Fruit Maturity

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The objective of this study was to evaluate the use of an electronic nose to monitor grape maturity. Grape maturity is a critical attribute impacting potential wine quality. Currently, grape maturity evaluation often includes measurements such as sugar content, and primary metabolites such as grape acid level, individually or in combination. These assays may be influenced by sampling method and accuracy, and sample processing variations. Additionally, specific levels of sugar and other primary grape metabolites do not always strongly correlate to potential wine quality.

We evaluated the capacity of a conducting polymer-based electronic nose system to monitor fruit maturity by measuring Cabernet Sauvignon, Merlot and Cabernet franc grape volatiles. The electronic nose was optimized as described by Athamneh et al. (2006). Fruit developing on VSP and modified Ballerina were wrapped in polyethylene bags for 45 min, followed by non-destructive electronic nose headspace analysis. During various stages of fruit maturity, results were compared with laboratory electronic nose readings and up to eleven physical and chemical indices used to evaluate fruit maturity (berry weight, pH, Brix, sugar per berry, titratable acidity, total phenols, color intensity, hue, total anthocyanins, and two groups of aroma/flavor precursors). Data were evaluated using canonical distributions, a statistical representation for looking at linear combinations of variables and separating them in two- or three-dimensional space. Canonical distribution demonstrated that separation based on volatile profiles using the electronic nose was greater than the separation provided by the physicochemical analyses, taken either individually or collectively (*Figure 1, top plate is physicochemical data, bottom is the electronic nose separation*).

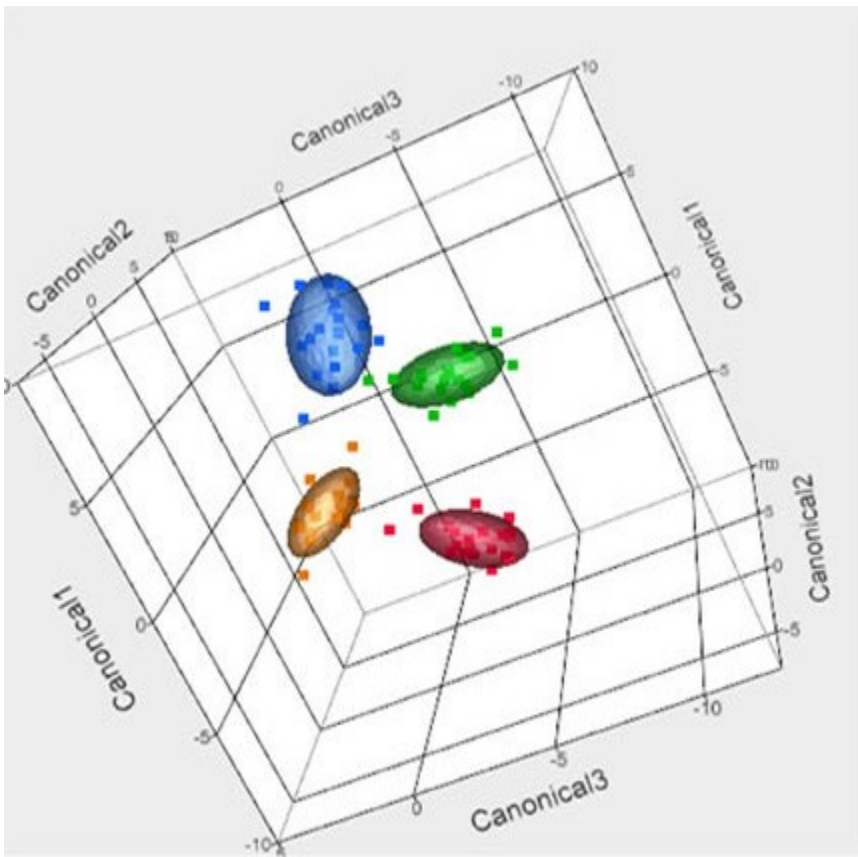
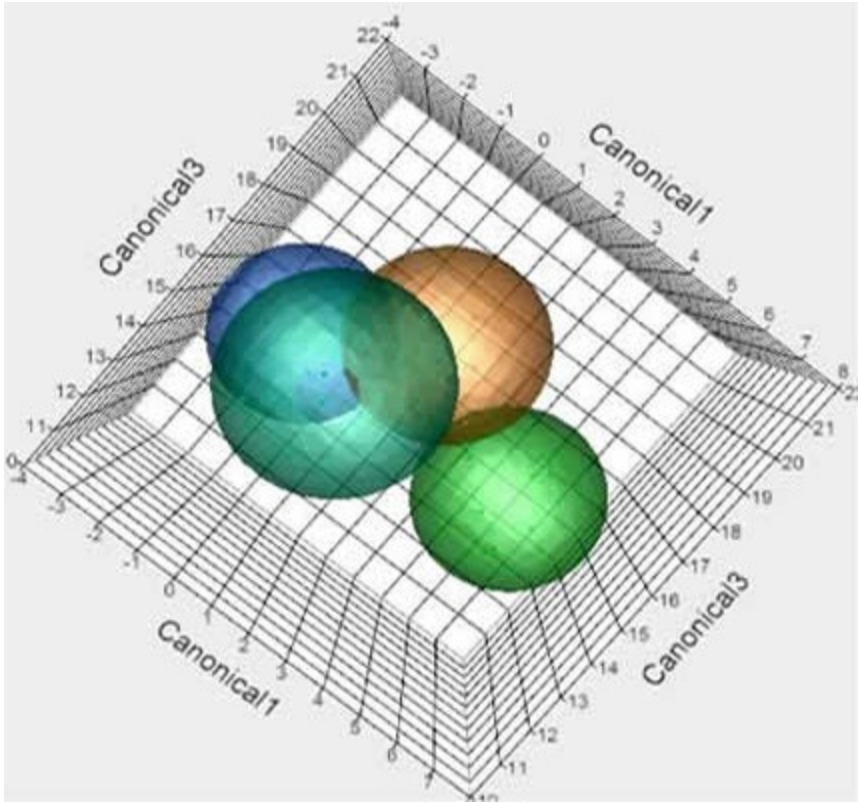
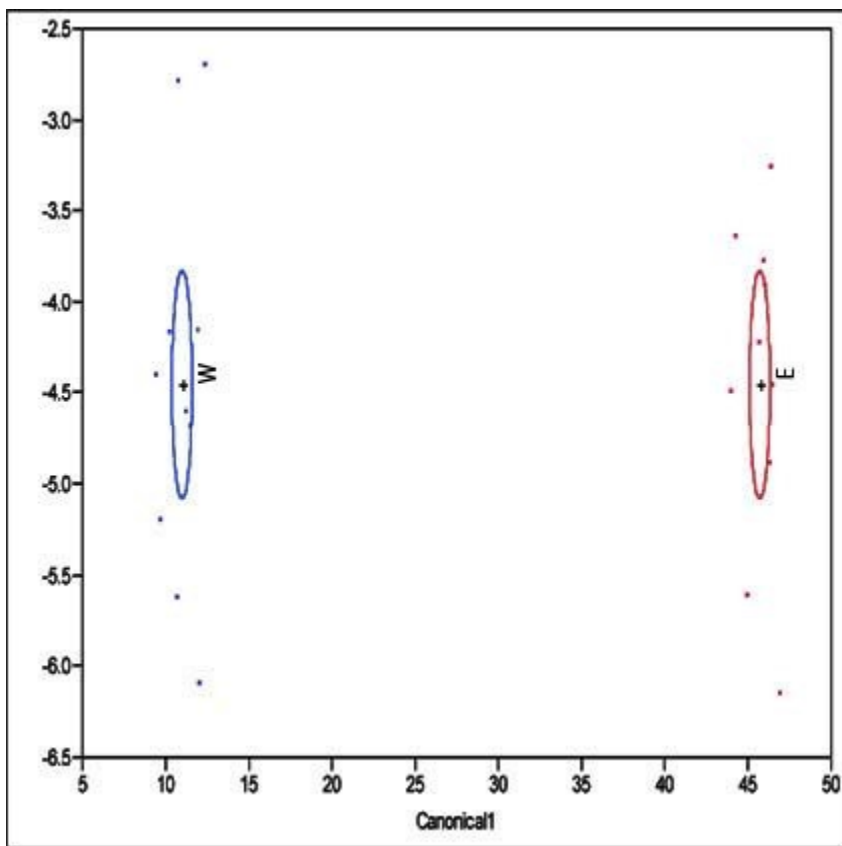


Figure 1. Canonical distribution of 11 physicochemical indices (top) and Enose (bottom) monitoring of Cabernet franc maturity over a four-week period. Note the overlapping and greater dispersion in the physical-chemical data.

Fruit on different sides of the grapevine canopy may vary in maturity due to variations in sunlight exposure and heat, among other factors. In a separate study, VSP-trained north-south running vineyard rows were evaluated by comparing fruit from the east vs. west side of the canopy from véraison to harvest. Traditional Cabernet franc grape maturity indices did not differ statistically based on canopy side at harvest. However, a conducting polymer-based electronic nose was able to differentiate between samples from east vs. west, based upon fruit volatiles using non-destructive measurements from clusters on the vine.



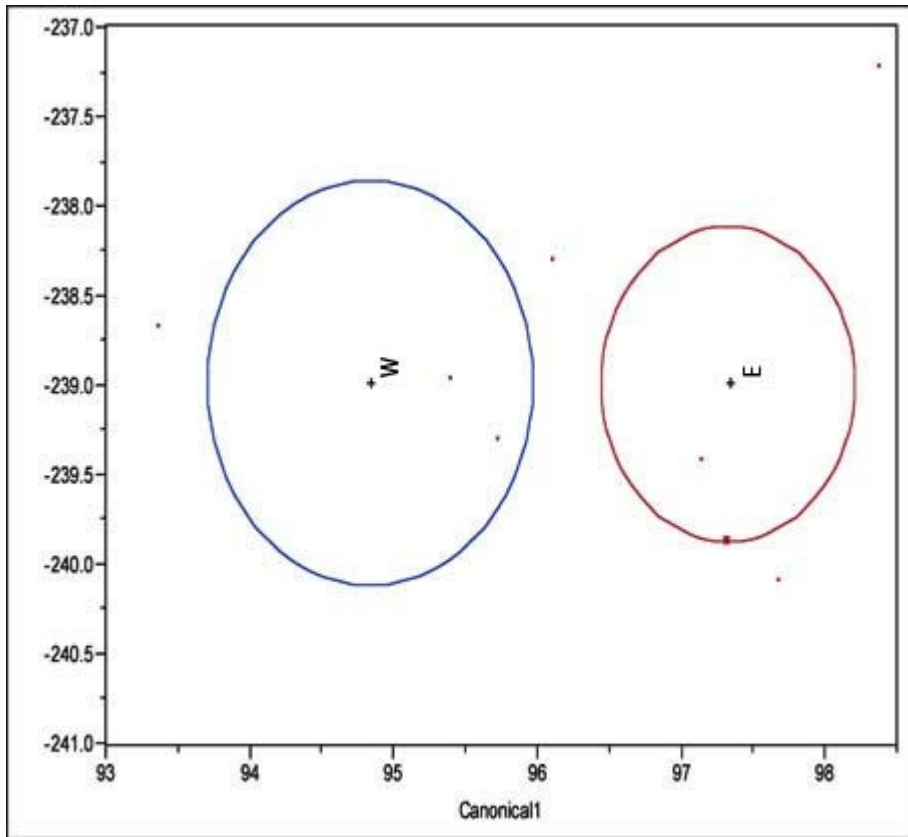


Figure 2. Canonical distributions of electronic nose data (top) and physicochemical indices (bottom) in canopy side differences (W = west, E = east). Note the greater degree of separation and tighter clustering of the electronic nose results.

Comparison of the electronic nose with conventional GC/MS analysis is in progress.

Information regarding the nature of this research and its goals has been conveyed to the industry through the following:

- Technical Briefs: *Enology Notes*
- Seminars and short courses
- Winery Roundtable meetings
- Website postings
- Trade journal publications