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Color and anthocyanin evaluation of red winegrapes by CIE L*, a*, b* parameters

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• The concentration of anthocyanins in grape skins is a characteristic specific to each grape variety - even if environmental and cultural factors play a role in determining the final amounts. Knowing the anthocyanin characteristics of grapes before harvest would allow the winemaker to choose the maceration regime best suited to maximize the potential of each incoming grape load. The initial goal of this study was to compare the color of a wide variety of wine grapes. The final goal was to be able to develop a "colorimetric index" that could be used to complement varietal taxonomic data and to help determine harvest date.

• The authors used the CIELab color system to measure grape color. Briefly, the L*a*b* values describe a 3-dimensional color "space" in which:
- L* is the *vertical axis* and defines the lightness, ranging from completely opaque (L=0) to completely transparent (L=100),
- a* and b* are the *horizontal axes* and define the redness (or, in case of –a*, the greenness), and the yellowness (or, in case of –b*, the blueness), respectively;
- chroma (C) and hue (h) are mathematically derived from the L* a* b* values.

• In 2006, the authors studied 18 red varieties in Piedmont, Italy. In 2007, they studied mostly different samples of the same variety –Nebbiolo. The authors measured 3 parameters: 1) **CIELab color** (30 measurements based on 10 random berries per sample) was directly analyzed in the vineyard -after removing the waxy layer with a paper tissue- using a reflectance spectrophotometer. Then, by mathematically combining the CIELab values, the authors developed 3 different colorimetric indices: CI1, CI2, and CI3. (See original text for the exact formula of each index). 2) **Total anthocyanins** from the same berry samples were evaluated by spectrophotometry. 3) Finally, the authors determined **individual anthocyanins** by chromatography, identifying each anthocyanin by comparing its retention time with commercial standards.

• **Results**. 1) **CI2** and **CI3** showed the best potential for evaluating color, with a wide range of variability across varieties (from 1.5 to 13.7 for CI2, and from 0.9 to 10.6 for CI3). CI1, on the other hand, was not useful in differentiating grapes because of insufficient variability. Using CI2 and CI3, the authors were able to classify the 16 varieties into 7 groups, each exhibiting similar color. 2) The authors found a good correlation between these two color indices and both the anthocyanin concentration and the individual anthocyanin profiles.

3) Using the correlation between CI2 and CI3, the authors built a model that would predict total anthocyanin content based on the measurement of these two color indices. When they tested the model on two new varieties in 2007, the model failed. However, when they developed a new model based on the anthocyanin data of just Nebbiolo samples -and then tested it on additional Nebbiolo samples- anthocyanin prediction was greatly improved.

• In their discussion, the authors mention that the proposed model should be further evaluated for its ability to predict anthocyanins throughout ripening. This is due to previous reports that the CI1 index might no longer show a linear response with total anthocyanins when berries reach the last stages of ripeness.

In summary, the newly-proposed CIELab colorimetric indices were strongly correlated with total anthocyanin amounts and profiles within a single cultivar (Nebbiolo). Since these data are easily obtained using a small, portable instrument, they may allow a fast evaluation of total anthocyanins in the field, and some prediction of the color of the future wine. For the most accurate predictions, a different calibration curve should be developed for each variety tested.

CI 1 = (180-h) / (L* + C)

CI 2 = (180-h) / (L* x C)

CI 3 = [h / (L* x b*) x 100]

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