

Sources of variation in methoxypyrazine accumulation

Gavin Sacks and Alan Lakso, summarized by Bibiana Guerra

Department of Food Science & Technology and Department of Horticultural Sciences, Cornell University, NYSAES, Geneva, NY

- Methoxypyrazines (MP) are compounds present in the grapes that cause green, unripe, bell-pepper aromas in the wines. Whereas at levels near their detection threshold (10-16 ppm) MPs can have a positive contribution to the varietal character of certain wines (e.g. Cabernet Sauvignon, Cabernet franc, Merlot, Sauvignon blanc), their excess causes an herbaceous character that is considered a defect. The purpose of this research was to determine what the environmental and physiological factors are that influence MP levels at harvest. The ultimate objective is to be able to optimize management strategies to achieve a desired flavor profile.

- The authors started out with a clear working hypothesis, which they divided in three sub-hypotheses. Through a series of ingenious experimental designs, they were able to test each individual hypothesis, obtaining the following results:

- **Hypothesis 1 and Results:** “MP accumulation prior to veraison is proportional to shoot vigor, whether clusters are exposed or not”. To test this hypothesis the authors had to come up with an unprecedented way of un-coupling *cluster exposure* and *vine vigor*. They accomplished this by shoot-thinning various vines in such a way that there were always two canes on one side of the vine (to keep fruit exposure constant), but a varying number of canes on the other side (to achieve various degrees of vigor). They found that there was a significant correlation between shoot growth rate (vigor) and levels of the most important methoxypyrazine, IBMP (isobutyl-methoxypyrazine). That is, **vine vigor was correlated to MP synthesis**.

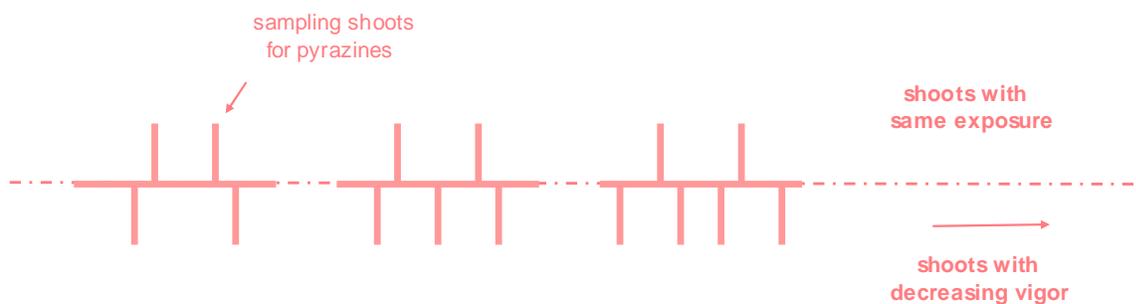


Diagram by authors

- **Hypothesis 2 and Results:** “MP accumulation prior to veraison is inversely correlated to cluster exposure, regardless of vine vigor”. To test this hypothesis the authors un-coupled *vigor* from *cluster shading*. This time, they left 20 canes on every vine, but they varied the spacing between the canes to recreate regions of shaded and unshaded clusters along the cordon. They found that shading clusters resulted in an increase in IBMP pre-veraison, but did not affect their degradation rate post-veraison, that is, **the most effective canopy management to reduce MP is to decrease pre-veraison shading**.

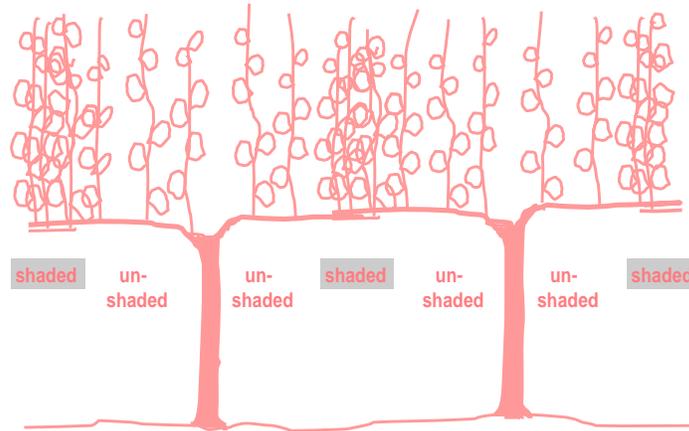


Diagram from Ryona et al, 2008 (modified)

• **Hypothesis 3 and Results:** To test the hypothesis of whether “*Malic acid and MP levels are highly correlated pre-veraison, therefore malic acid can provide an early- season indicator of potential MP levels at harvest*” the authors monitored the levels of malic acid and pyrazines of both shaded and unshaded vines throughout the growing season. They found that the timing when differences between shaded and unshaded vines occurred was very different for both compounds (early season for IBMP, post-veraison for malic acid). Thus, **malic acid is probably a poor indicator of MP levels**. When the authors explored the correlations between MPs and other maturity parameters (TSS, pH, TA), they found a similar poor correlation.

In summary, the authors showed that **vigorous vines accumulate higher levels of pyrazines than weak vines, and shaded fruit accumulates higher levels of pyrazines than well-exposed fruit**. Malic acid, total soluble solids, pH, and total acidity are all poor indicators of pyrazine levels at harvest. However, **high levels of pyrazines pre-veraison were correlated with high levels of pyrazines at harvest**. The take-home message is that management strategies aimed at reducing herbaceousness (e.g. shoot thinning, leaf removal, vigor reduction, training to increases exposure) should be focused on as pre-veraison interventions.

Author: Bibiana Guerra, Viticulture and Enology Technical Writer