

NORTON WINEMAKERS ROUNDTABLE
Chrysalis Vineyards
JULY 26, 2004

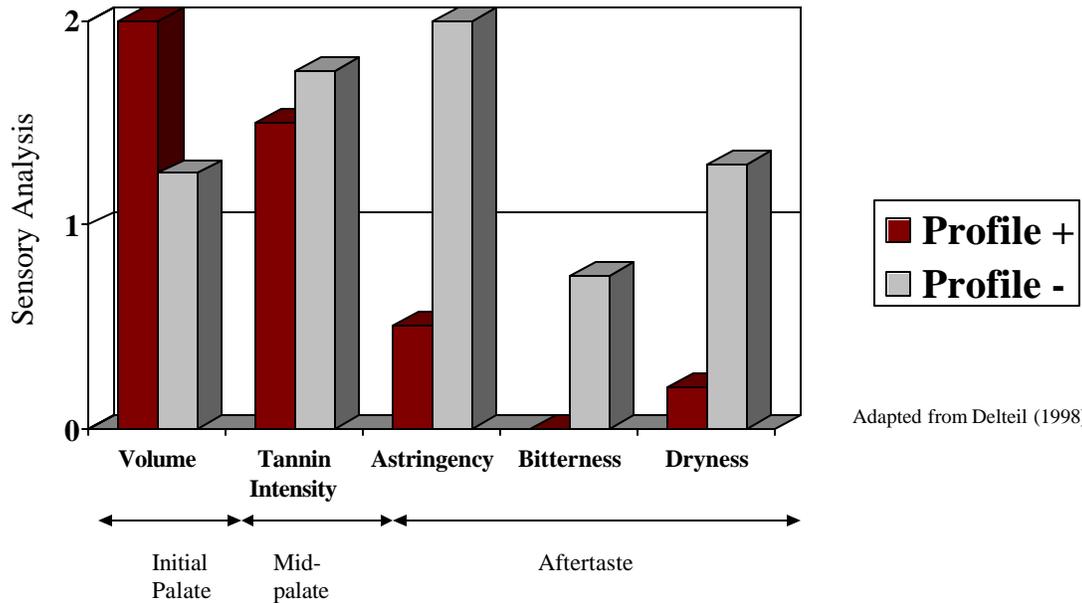
Features of the Norton grape:

- high TA
- low tartaric/malic ratio
- high concentration gallates and diglucoside pigments
- aggressive tannins
- small berry size and high seed #

Production Challenge:

- structural/textural balance
- The seven components of importance in structural/textural balance include: volume (body), acidity, roughness, tannin intensity, astringency, dryness and bitterness.

Red Wine Mouthfeel Profile



VC=Vintner's Corner news journal issues where these topics are discussed, EN=Enology Notes electronic communications. Both are available on my web site.

Structural/Textural Quality: the result of : 1) the quantity and quality of phenolic components in the fruit, 2) the interaction and stabilization of anthocyanins, tannins and certain polysaccharides, and 3) TA and the sense of sweetness.

Structural Balance:

Sweet <—> Acidity + Bitterness and Astringency

The sweet elements of a wine (derived from alcohol, polysaccharides, etc.) must be in relative balance with the sum of the acidic elements and phenolic elements (astringency and bitterness).

Thus, the higher the TA, the lower the desirable phenolic load for balance. A wine with a high level of sweet elements (e.g., alcohol) can support a higher level of TA and phenolic elements. Structural balance is similar to the concept of Suppleness Index. Suppleness Index = Alcohol-(Acidity + Tannin)

The ratio of bitterness to astringency helps to explain the concept of hard vs. soft tannins. The interaction of phenols and other wine components is an important feature in wine texture.

Norton Style: (VC, 11:4,12:2, 14:1, EN#4) Style and textural quality are influenced by quantity and quality of phenols, phenolmaturity, extraction/management, and interaction with other structural elements (acids, polysaccharides, peptides, sugars)

Varietal Descriptors: spicy, jammy, earthy, dusty, black pepper, black raspberry, mushrooms, spice, cloves, nutmeg, tobacco, chocolate.

Key Questions: (VC 14:5) What vineyard management tools are available to influence structure/texture quality? How can we monitor the quantitative and qualitative changes in the fruit and the wine? What are appropriate concentrations and proportions of texture/structure components for specific wine styles. What production methods will reach our stylistic goals? **Answer**-establish a HACCP-like plan.

Establish a HACCP-Like, Viticultural and Enological Plan (VC 12:6,15:1, 15:2, EN# 8, EN #19)

1. VITICULTURE COMPONENTS OF A NORTON HACCP-LIKE PLAN

Norton Vine Nutrition

Training and Trellising

Canopy Management (VC 12:1, 14:1)

optimum degree of fruit shading

optimum degree of leaf shading

influence of canopy management on structural balance, e.g., TA, tartaric/malic acid and phenols

influence on asynchronous ripening

influence of row orientation

Vine Stress (VC 12:1)

soils and soil pH

Mg⁺⁺ nutrition vs. soil concentration

monitoring nutritional status

correcting Mg⁺⁺ deficiencies

crop load

Vigor Control/Management

shallow soils/low vigor

Defining Optimum Crop Load (VC 12:1, 15:5)

vine balance

avoid delaying maturity

Fruit Ripeness Indicators (VC 11:4,12:1,12:5, 12:6, 16:1, EN#53)

goal driven

fruit sampling methods

degree of asynchronous ripening: clusters, berries. Sugars are usually fairly uniform (small coefficient of variance), secondary metabolites can be much greater

sensory evaluation of skin, stem, pulp and seed phenol maturity

chew skins, use phenol descriptors (see Mouth Feel Wheel)

seed maturity - color, texture and brittleness

anthocyanin content and maturity

evaluate crushing ability, berry softness and diffusion of pulp

relationship between berry weight, shriveling and engustment

relationship between berry weight and physiological maturity

estimation of berry size (EN# 23)

sugar per berry

relationship between days post-bloom and maturity

pH, Brix, TA (EN#6). Brix and aroma/flavor, phenol development are not the same. Changes in pH are not necessarily a function of berry 'age' and relate to K⁺ and vigor. Tartaric/malic low

Brix to alcohol conversion rate

2. ENOLOGY COMPONENTS OF A HACCP-LIKE PLAN

Prior to the harvest, each of the following factors which influence wine structure/texture should be reviewed. How is each of these influencing your red wine structure/texture and quality?

Solar exposure of the fruit

Degree of leaf shading

Fruit maturity, including tannin maturity

Uniformity of fruit maturity

Berry size

Fruit rot

Fruit handling and non-soluble solids

Degree of crushing/de-stemming, whole cluster pressing, short vatting, extended skin-contact

Cold soak

Sulfur dioxide addition, pre- and post-fermentation

Acid addition

Tannin addition

Barrel/wood fermentation

Enzyme addition

Yeast, uninoculated fermentation, fermentation rate, polysaccharide/manoprotein, sulfur dioxide producer, TA reducer

Cap management, delestage

Chaptalization and the Brix to alcohol conversion rate

Chaptalization material
Bleeding
Size and shape of fermentor
Fermentation temperature
Pre- and post-fermentation aeration (microoxygenation)
Alcohol at dejuicing
Free-run and press run
Storage *sur lie*

Processing (VC 14:1)

should be site driven and goal driven: integration and balance of structural elements, conversion of monomeric anthocyanins to large polymeric anthocyanins. Avoid the extraction of ethanol soluble hard tannins

De-stemming/crushing/whole cluster press

planning maceration-know the extent of mechanical resistance from various parts of the fruit
importance of gentle fruit handling, low non-soluble solids, to wine integration
degree of berry breakage

Cold Soak (VC 13:2)

enhance 'bright fruit' character, increase color stability
time/temperature
w/o enzymes
w/o sulfur dioxide
w/o oxygen

Bleeding/Co-fermenting (EN#3)

bleed juice has lower arginine/proline ratio, which will influence pH evolution

Delestage (Numerous issues of VC and EN)

This may be the most important varietal in Va. for this processing method. Grape seed tannins differ from skin tannins in that they contain a higher concentration of monomeric flavan-3-ol and those which have esterified to gallic acid. As such they are very harsh and bitter. Delestage can remove as much as 40% of these seed tannins.

Fermentation (VC 14:2, 14:4, 15:4)

Brix to alcohol conversion rate/Chaptalization
alcohol and structural balance
must TA, tartaric/malic, pH
TA reduction methods
tannin addition, can add mid-palate depth
fermentable nitrogen, not a matter of simple fermentation sticking(VC 13:4,14:2, 14:4)
yeast(s), high malate reducer, high polysaccharide producer, high tannin absorber, fermentation rate (VC 13:3). Common yeasts include: 71B, BM45, D254
sulfur dioxide, polyphenol oxidase, phenol polymerization (VC 13:4)
role of oxygen (VC 16:3)
size and shape of fermentation tank
open vs. closed
temperature, liquid and cap
MLF, strain(s), timing, volume of inoc.
w/o wood (VC 14:3)
punch down, pump over, irrigation systems, sweeper tanks, delestage (VC 15:3, EN# 8)
alcohol at time of dejuicing (VC 13:2)

post-fermentation maceration
free run vs. press run

Cellar Management for Norton

wood(s): sources, seasoning age, fill age, barrel type, etc.
lees (VC 14:3, EN # 6), very helpful for structural integration
sulfur dioxide, keep low (15 mg/L free) for first year (VC 12:2, 13:5, 14:6)
oxygen, first year process oxidatively, thereafter anaerobically
measure oxygen pick-up (VC 12:3, 13:5, 14:3)

Maceration enzymes may be desirable, particularly if you have a lot of whole berries in the fermenter. These contain pectinase, hemicellulases and cellulases which, like native enzymes, aid in the diffusion and association of anthocyanins, tannins and polysaccharides.

Yeasts. Species and strain have a significant influence on grape and wine phenols as a result of binding and polysaccharide liberation, and reduction in TA. Desirable strain features include: 1) low color adsorption, 2) a high production of manno-protein polysaccharides available during fermentation and autolysis, 3) malate reducer, and 4) a low production of volatile sulfur compounds (some of which can enhance the perception of astringency).

Cap Management should occur to limit the formation of non-soluble solids and seed tannin extraction. Process to encourage phenol polymerization and stabilization (oxygen exposure and low sulfur dioxide). Delestage reduces seed extraction and enhances oxidative polymerization

Tannin Management and Textural Quality. Tannin quality (suppleness, creaminess) is the result of: 1) the quantity and quality of phenolic components in the fruit, 2) the interaction and stabilization of anthocyanins, tannins and certain polysaccharides, and 3) TA.

Integration. During fermentation, yeast species and strain, oxygen and maceration influence the stability of phenols and their resulting mouth feel. What is the sensory significance of specific phenols including specific tannins? All phenols are both bitter and astringent. Bitterness is the result of access to membrane bound receptors and is likely limited by molecular size.

Bitterness and astringency increase with increased molecular weight. Polymerization increases astringency due to an increased number of possible hydrogen binding sites.

With concentration, the bitterness of monomeric flavonoids increases at a faster rate than the astringency. This is in contrast to the astringency of polymeric seed tannins, which increases more rapidly than bitterness with increases in concentration. Astringency masks bitterness, an extremely important concept to understand as it relates to fining.

Post-fermentation microoxygenation. This technique is ideally suited to a variety such as Norton which has a high concentration of hard-harsh tannins. See numerous issues of Vintner's Corner and Enology Notes.

Post-fermentation blending

filtration and wine quality (VC 16:2)

See fruit and wine chemistry data

See Patterson and Zoecklein, 1990. Vegetative and berry chemistry response to canopy manipulation and Ethephon on Norton. Hort Science 25(8):905-908. Previously, published data reported that delphinidin and cyanidin were the most frequently occurring pigments in *Vitis aestivalis*. Our works showed that not to be the case, suggesting possible natural hybridization.

Fermentation of Red Wines with Wood. There are two types of wood fermentation used in red wine production, the Australian red method and fermentation with cubes. The Australian Red approach, so named due to its origin, involves several steps. Crushed and destemmed fruit is cold soaked with maceration enzymes for 24 to 48 hours. Cold soaking is effective in aiding the extraction of anthocyanins and stabilizing color. Additionally, co-pigmentation promoters are extracted. Wine is dejuiced at 18-16 EBrix, depending upon the initial maturity, and barrel fermented. The alternative is to add cubes (not chips) to the fermentation.

During wood fermentation, two factors help to influence the structural integration of the wood. Mannoproteins are released by the yeast, which help to bind phenols. Additionally, yeast adsorb about 1/3 of the ellagic tannins, lowering the perception of astringency. The process of wood fermentation is used by some to create wines for blending.

Sur lie and structural component integration. As has been previously suggested in several Enology Notes, do not overlook the power of macromolecules. Polysaccharides are found in wines at concentrations ranging from 300-1000 mg/L. They are of two general types, those found in the fruit, such as pectins, and those produced by yeast and bacteria during fermentation and released during autolysis. A number of compounds classified as polysaccharides also have significant protein components and vice versa.

The yeast cell wall is composed largely of β -glucans and mannoproteins. Mannoproteins are released during *sur lie* storage. This release post-fermentation is the result of enzyme hydrolysis of the lees caused by β -glucanases, present in the cell wall. This enzyme retains activity for several months after cell death, releasing mannoproteins into the wine. This increase can be as much as 30% in four months of aging *sur lie*. Heavy lees contact results in a high concentration of polysaccharides compared to light lees; the difference can be as much 200 mg/L (Ribereau-Gayon et al., 2000).

Wine balance can be depicted as in the following relationship: Sweet^o Acid + Phenolic Elements. This relationship suggests that as the perception of sweetness increases, the perceptions of those elements on the right-hand side of the equation will decrease. The converse is also true, as the sweetness diminishes, the perception of the acid and phenolic elements (bitterness and astringency) increases. Lees contact can have a major impact on structural balance. Polysaccharides have the ability to bind with phenols, thereby lowering the perception of both the tannin elements and, therefore, acidity.

The impact of polysaccharides on astringency is evidenced by a reduction in the gelatin index (see Zoecklein et al., 1995). This reduction can cause an increase in the wine's volume or body. Lees contact is particularly effective at modifying wood tannin astringency by binding with free ellagic tannins, thus lowering the proportion of active tannins. *Sur lie* storage can reduce the free ellagic acid by as much as 60%, while increasing the percentage of ellagic tannins bound to polysaccharides by 24% (Ribereau-Gayon et al., 2000).

Lees and color. High lees concentration can reduce color, as a function of adsorption onto the yeast cell surface.

Lees and oak bouquet. Lees modify oaky aromas, due to the ability to bind with wood-derived compounds such as vanillin, furfural and methyl-octalactones

Lees and oxidative buffering capacity. Both lees and tannins act as reducing agents. During aging, lees release certain highly reductive substances which limit wood-induced oxygenation. Wines have a higher oxidation-reduction potential in barrels than in tanks. Inside the barrel, this potential diminishes from the wine surface to the lees. Stirring helps to raise this potential. This is a primary reason why wines stored in high-volume tanks should not be stored on their lees. Such storage can cause the release of 'reductive' or sulfur-containing compounds. If there is a desire to store dry wines in tanks *sur lie*, it is recommended that the lees be stored in barrels for several months, then added back to the tank (Ribereau-Gayon et al., 2000).