Shiloh Estate

SHILOH VINES & WINES KNOWLEDGE BASE SERIES

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Part III: Harvest & Crush

by

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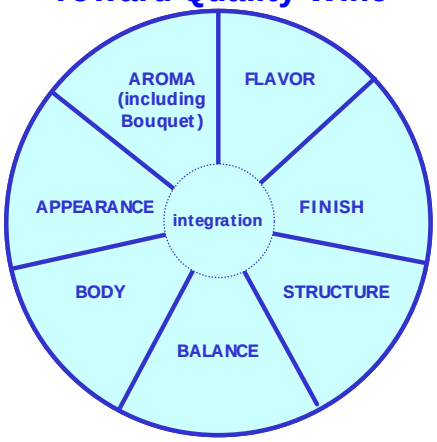
Coordination Draft
Comments Welcome

Toward Quality Wine



Quality—This paper is one of series dealing with winegrowing and winemaking. The lead paper "Toward Quality Wine" suggests a pathway to wine quality and quality wine where *quality* includes the *sensory components* shown above.[i]

Each stage and step comprising this pathway toward quality can have positive, neutral, or negative impacts on the final product.

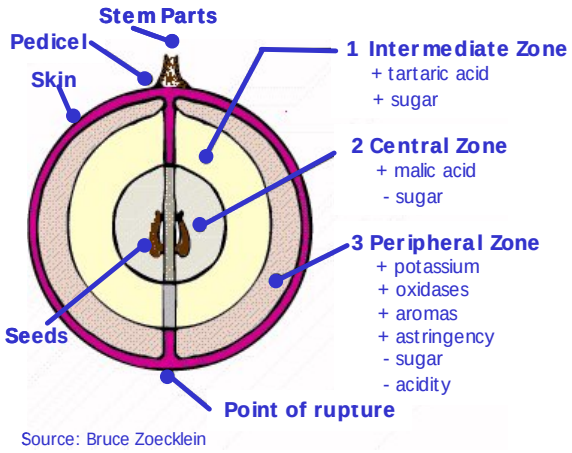
The stage that links the winegrowing and winemaking processes is Harvest & Crush.

Define the Wine—Grapes are grown to support production of specific wine *types* (e.g., red still wine), *styles* (e.g., dinner wine), with some idea of desired *sensory components* (e.g., *aroma*). Conversely, a specific wine demands grapes commensurate with the defined wine type, style, and desired sensory components.

Quality grapes allow—but do not guarantee—quality wines. Yet, it all starts with the berry.

The Berry[ii]

Berry Anatomy—There are three juice zones in the grape berry: (1) pulp, (2) pulp area around the seeds, and (3) pulp just beneath the skins. Juice from these three zones plus berry size, skin, seeds, and stems contribute to various components of the wine—e.g., *appearance*, *aroma*, and *flavor*.



Juice Chemicals—The concentration of tartaric acid is highest in Zone 1 and lowest in Zone 3. Malic acid concentration decreases from Zone 2 to the skin. By contrast, the concentration of potassium, the dominant cation, is highest in Zone 3. Juice from the first two zones has the highest acidity, lowest potassium, lowest pH, and the lowest susceptibility to oxidation (and can result in a wine of greater varietal freshness).

Berry Quality—Quality is affected by nearly all winegrowing factors (e.g., site location, climate, topology, variety and clone, rootstock, canopy, irrigation, rate of maturation, fruit maturity).

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Pathway Toward Quality Wine

PLANNING & MANAGEMENT

VINEYARD ESTABLISHMENT (or Vineyard Selection)

VINE & CROP MANAGEMENT

VINEYARD FLOOR MANAGEMENT

HARVEST & CRUSH

- Crop maturity analysis
- Pick & quality control
- Transport to winery
- Destem / crush
- Drain / press
- Other (e.g., add SO_2)

FERMENTATION & MACERATION

MAINTENANCE & MATURATION

EVALUATION & IMPROVEMENT

Crop Maturity Analysis & Evaluation

Transitions, Transformations & Transfigurations

NOT READY (UNDERRIPE)	→	READY (RIPE)
acidic	→	lower acid
hard	→	softer
green	→	black or yellow
small	→	bigger
not sweet	→	sweeter
astringent and bitter	→	softer tannins
low *flavor*	→	richer *flavor*

The crop should be harvested when the berries are at their maximal physiological ripeness consistent with the wine type, style, and desired components.

Crop Maturity Analysis (Quantitative)

Criteria—Quantitative analyses (e.g., °Brix, pH, TA) with the winemaker often establishing a target based on °Brix, an estimator for the alcohol content of the resulting wine (although judgment vis-à-vis berry maturity usually trumps °Brix).

Method—Periodically, collect a representative sample of 200 (or so) berries, crush in a plastic bag, and measure °B, pH, *titratable* acidity (TA), and (sometimes) malic acid:

Pinot noir	23 Aug	30 Aug	6 Sep	13 Sep	20 Sep	27 Sep	3 Oct
°Brix	**12.6**	**18.6**	**19.8**	**20.2**	**21.6**	**22.5**	**23.8**
pH	2.93	3.17	3.21	3.23	3.29	3.32	3.41
TA	16.6	12.5	10.0	9.4	9.1	8.9	8.6

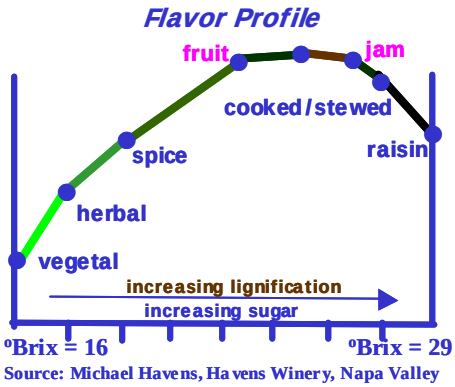
Influences—°B, TA, and pH are associated (mostly) with alcohol, tartness, and microbial stability, respectively.

Crop Maturity Evaluation (Qualitative)

Criteria—These evaluations rely on the senses.

Method—Observe, crush, smell, pinch and rub, chew and taste. The pick date is based mostly on the winemaker's qualitative evaluation.

Influences—The crop and berry ripeness at harvest influence nearly all wine components, most importantly, varietal "odors" that contribute to *aroma*, *flavor*, and *finish*—all reflect variety, rootstock, clone, terrior, and cultural practices.



Source: Michael Havens, Havens Winery, Napa Valley

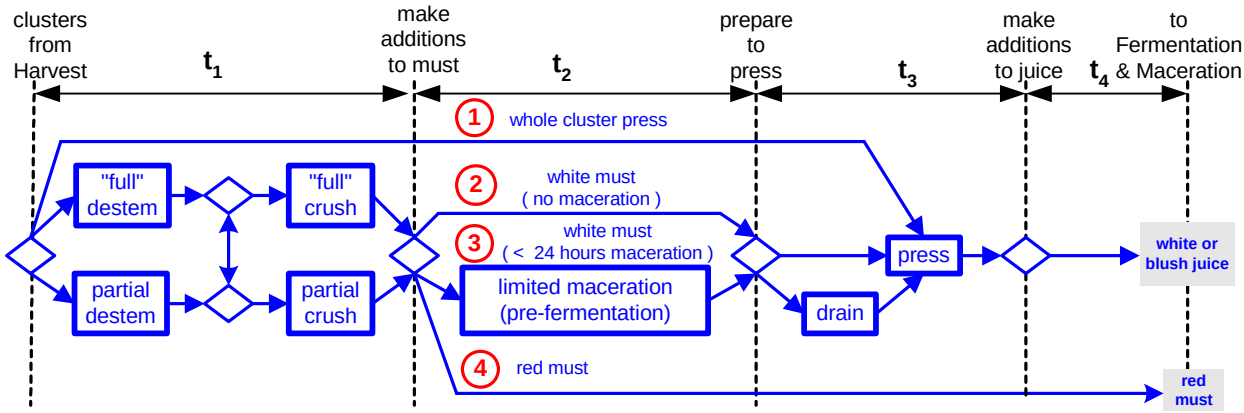
Pick / Transport / Sort

Criteria—Maintain the integrity of the fruit consistent with the wine's type and style.

Methods—There are numerous methods for harvesting grapes, transporting them to the winery. Blocks (or sub-blocks) within vineyards are picked at optimal maturity (to the degree feasible). Within the winery, blocks are often processed and maintained as separate lots until blended to achieve the style objectives of each individual wine.

Most importantly, grapes should be picked when they are cool and be quickly transported to the winery for processing. Although grapes for most high quality wines are still picked manually, mechanized harvesting is enjoying increased usage. Additionally: (a) the pick crew may pick only clusters free or nearly free of any damage or degradation, (b) they may pick to small lugs, (c) the clusters may be transported in 35-lb or 1/4-ton bins (to avoid undue damage), and (d) clusters may be sorted by hand at the winery (this step is often associated with very high quality/price wines).

Influences—Minimal if the berry is optimally mature, is disease-free, is picked when it is cool, and is not altered during harvest and transport to the winery.



Winemaking Paths

General Discussion—As suggested above in the highly simplified depiction, there are four paths through the Crush part of the Harvest & Crush stage. All four paths skip the operations in at least one of the first three time periods—t_1, t_2, and t_3—and t_4 is zero or minimal for all paths.

Process	Winemaking Path			
Step	**1**	**2**	**3**	**4**
Destem (full or partial)	n/a	yes	yes	yes
Crush (full or partial)	n/a	yes	yes	yes
Additions to must	n/a	opt.	opt.	opt.
Limited maceration	n/a	no	yes	no
Drain	n/a	opt.	opt.	no
Press	yes	yes	yes	no
Additions to juice	opt.	opt.	opt.	n/a

Note: opt. is optional; n/a is not applicable

Path 1: Whole Cluster Press—Some white wines and most sparkling wines[iii] skip the operations for time periods t_1 and t_2 and are put directly into the press where free-run and various press fractions are segregated for the next stage.

The objective for most white wines is to quickly drain and press the juice off the skins to avoid extraction of phenols found in skins, seeds, and stems that may cause bitterness and astringency.

Some maceration will occur during the t_3 drainage or press operations. In fact, maceration time in the drain/press steps can duplicate that of time period t_2.

Free-run juice is typically drained from the press prior to the first press fraction. There can be several press fractions, with the lots sometimes maintained separately until subsequent blending.

Whole cluster pressing results in lower phenol extraction, better juice composition, lower turbidity, less oxidation, and less vegetative flavors—but fewer aromatics and phenolics.

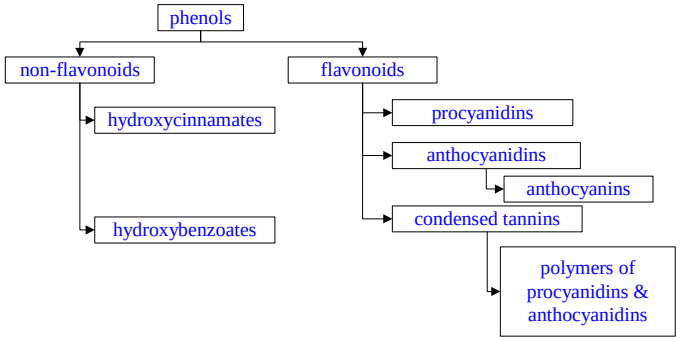
Path 2: Crush With "No" Maceration—This, the most common path for white wines, includes the t_1 destem and crush activities, skips t_2 limited maceration, and quickly goes to t_3 drain/press. Destemming and crushing berries allows skin contact producing enzymes that break down the pectic structure thus aiding juice extraction. Additionally, there is higher skin phenol extraction—but less stem phenol extraction and therefore less bitterness and astringency—and higher turbidity compared to whole cluster pressing.

Path 3: Limited Maceration—Most whites are quickly pressed off the skins—Paths 1 and 2—to preserve the primary aromas of the grape and to avoid extraction of phenols found in skins, seeds, and stems that may cause bitterness and astringency.

Some white wines ("white" skins) and most blush wines ("red" skins) are subjected to limited juice/skin contact (up to 24 hours) to allow additional extraction of phenolic compounds. Cool maceration temperatures coupled with a short t_2 duration minimize flavonoid extraction thereby limiting wine bitterness and astringency. Skin contact increases monoterpenes (good) but also tannins (not always so good). Red skins add color to blush wines. Minimal maceration at cool temperatures can result in young, fruity wines. Longer, warmer maceration can result in wines deeper in color, fuller *flavor*, and more complexity (at the expense of fruitiness).

Path 4: Red Wines—Nearly all red wines are destemmed and crushed in time period t_1 and skip periods t_2 and t_3. Maceration and press activities for reds are included in the next winemaking stage: Fermentation & Maceration.

Winemaking Steps & Influences



General Discussion—The steps associated with Crush influence the extraction of phenols from pulp or juice, skins, stems, or seeds—vis-à-vis quantity and intensity. Although small in weight, phenols contribute to all seven wine components and, after sugar and acid, are the most important constituents of the grape:[iv]

Phenol Distribution in Grams per Kilogram			
	Skins	**Juice**	**Seeds**
Red	**1.85** (0.185%)	**0.20** (0.02%)	**3.50** (0.35%)
White	**0.90** (0.09%)	**0.18** (0.018%)	**2.80** (0.28%)

In reds, berry phenols are classed as:

Non-flavonoids (15%) that comprise simple, small phenolic acids in musts, juices, and wines.

Flavonoids (85%) that create many of the desirable or undesirable effects of wine components—depending on their concentration and consumer sensory thresholds—especially *body*, taste, *structure*, finish, and *balance*. Note that pH has an effect on phenols, especially anthocyanins.

Another important influence in Crush is oxidation caused by contact of berries, must, or juice with air. In general, exposure to air is usually minimized.

Full or Partial Destem—Paths 2, 3, and 4 usually involve a full destem. This removes stems from the berries. Although crush can occur before destem, this is not considered desirable as more of the bitter, astringent phenols get into the must. In some cases, e.g., for Pinot noir, stems may be allowed in the must, or even added to help increase tannins and resulting in increased *body* and *structure*.

Full or Partial Crush—Most destemmer-crusher units have rollers that can be adjusted for: (a) whole berries (supports carbonic maceration as does the whole cluster method), (b) slightly crushed berries with the skins broken, or (c) more-than-slightly crushed berries—a "full" crush with the most phenol extraction and most extraction potential.

Limited Maceration (Whites & Blush)—This applies to Path 2. The result is to increase juice-skin-seed contact and, therefore, extraction of phenols that contribute to *aroma* and *flavor* and color of juice and wine through anthocyanins. Skins and seeds contribute to *body* and *structure*.

Drain & Press (Whites)—Free-run juice and low-pressure press wine are often kept in a separate lot from press fractions extracted under higher pressure(s). Juice extracted from must or whole clusters under no pressure or low pressure has less solids (turbidity), tannins, and color than more forceful pressing. Care is usually taken to avoid breakage of seeds; final press fractions are usually maintained separately (and may or may not be used in final blended wine).

Additions to Must or Juice—SO_2 may be added to the must or juice—in small amounts for high-quality fruit (say 30 ppm) or higher amounts for damaged or diseased fruit (say 80 ppm)—to prevent oxidation and spoilage. If the pH is too high, tartaric acid may be added (if too low, calcium carbonate or potassium bicarbonate may be added). In some cases, tannin or enzymes may be added. Other additions—not legal in all countries—include water (to lower alcohol), sugar (to increase alcohol). (Based on molecular weights, alcohol is 0.511 times °Brix, although in practice the multiplier may be closer to 0.570.)

Summary of Potential Contributions

Harvest & Crush	Wine Components						
Potential contribution of berry or step to component: **S**trong **M**oderate **W**eak	APPEARANCE	AROMA	FLAVOR	FINISH	BODY	STRUCTURE	BALANANCE
Berry pulp and juice	M	M	M	M	W	W	M
Berry skins	S	S	S	S	M	M	M
Berry seeds and stems	W	W	M	M	S	S	M
Additions	W	W	W	W	W	W	M

[i] See the "Toward Quality Wine" series at: http://www.shilohestate.com/

[ii] Zoecklein, "Review of Méthode Champenoise Production," http://www.ext.vt.edu/pubs/viticulture/463-017/463-017.html

[iii] *ibid*

[iv] VWT 180 Fundamentals of Enology, Napa Valley College (Fall 2002)