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Winemakers Discuss Cap Management Best Practices

Lance Cutler

Lance Cutler has been a working winemaker in Sonoma County for 35 years. He has been a contributing editor for *Wine Business Monthly* for more than 10 years. His unique perspective on winemaking has led to our Industry Roundtable series and our Varietal Focus series. Lance is also the author of four books, including *The Tequila Lover's Guide to Mexico*.

DURING RED WINE FERMENTATION, yeast converts sugar into alcohol. In doing so, it creates extra CO₂. That CO₂ pushes the skins to the top of the fermenting must, forming a cap. Since the grape skins in that cap contribute to most of the flavor, color and tannins in the finished wine, it is incumbent on winemakers to keep the skins in contact with the juice as much as possible. How winemakers deal with the cap and the juice below it is “cap management.”

As our senior technical editor **Curtis Phillips** wrote in his story on automated cap management (*WBM*, December 2007), “The purpose, then, of cap management is to keep the cap cool and wet enough to keep the yeast happy enough to complete fermentation. A secondary goal for managing the cap is keeping the fermentation mixed so that it doesn’t become stratified enough to prevent yeast from using all the sugar present. In addition, since the whole point of fermenting on the skins is to extract polyphenols, including color, co-pigments and tannin from the skins, the skins should really stay in solution as much as possible.”

UC Davis professor **Roger Boulton** maintains there are loads of beliefs and plenty of anecdotal experiences but precious little scientific fact about the effects of specific cap management techniques. Boulton contends that the method of cap management, whether using punch-downs, pump-overs or delestage, is not as important as how often you incorporate the technique. “The idea,” said Boulton, “is to keep the interface between the cap and the juice as well mixed as possible. That keeps the temperatures the same and allows for steady, continuous extraction. That gives the winemaker the best chance of making the key decision, which is when to stop skin contact and achieve the best balance of fruit, middle palate and tannic structure to the finished wine.”

At its most basic, cap management is simple. All you are trying to do is keep the skins in contact with the juice and keep the cap wet. The two most basic ways to achieve this are with punch-downs or pump-overs. So many fermentations are carried out in individual macro bins and small open-top tanks that punch-downs remain a popular form of cap management. A wide range of punch-down tools are available in a variety of sizes with either manual or mechanical operating systems.



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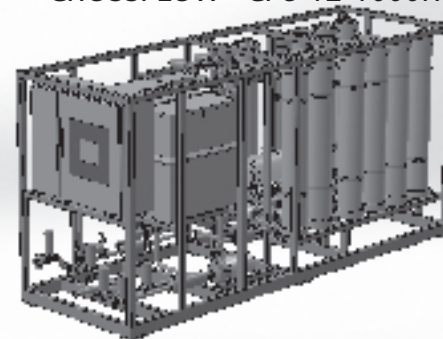
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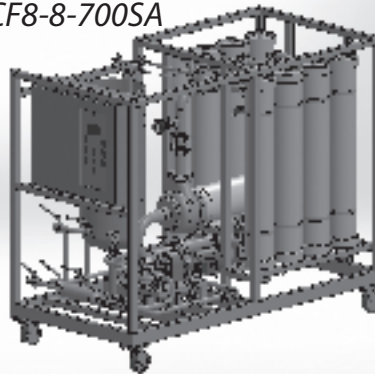
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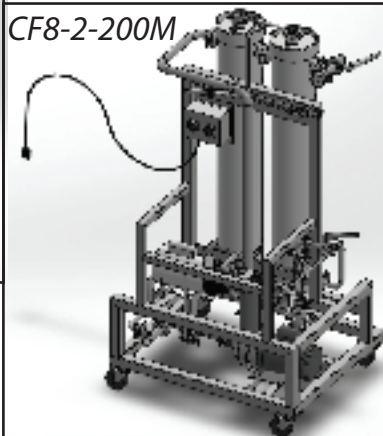
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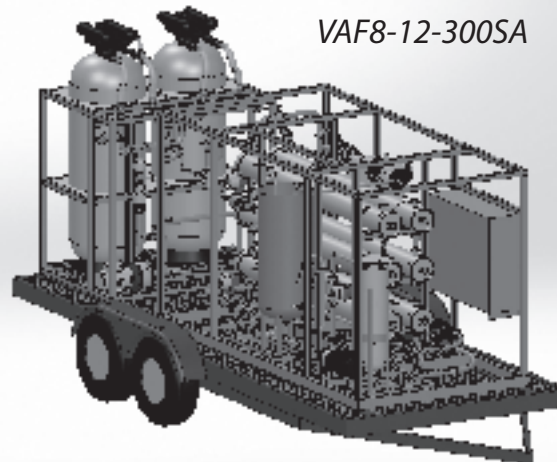
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Hank Beckmeyer at **La Clarine Farm** in California's Sierra Nevada Foot-hills punches down almost exclusively, but he eschews tools, preferring to stomp on the grapes. He ferments in open-top, 1-ton bins and a couple of open-top, 3-ton tanks. All of his red grapes are 100 percent whole-cluster and foot-crushed. Punch-downs are done by foot as well. He punches down twice a day in the beginning and during fermentation, backing off to just once a day towards the end of fermentation.

"It's all about tannin management in the most natural way possible," explained Beckmeyer. "Wines from this area can be pretty robust. Crushing and pressing by foot is a very gentle process. In fact, when we press the grapes, we usually have some intact whole clusters, which means we are even getting some semi-carbonic fermentation as well."

Not only is Beckmeyer crushing and punching down by foot, he has no temperature controls for his fermentations, all of which are carried on outside. "I view fermentation as the last piece of the growing season. It is part of the vintage," he said. Beckmeyer has tried extended maceration but prefers his wines without it. He generally presses out at 3° to 5° Brix because he finds that gives him wines with the best acid tannin balance. He admits that his observations and conclusions are based on experience and sensory analysis instead of testing.

Alison Crowe, director of winemaking for **Plata Wine Partners**, uses pump-overs for her cap management. She ferments primarily in closed top tanks, which makes punch-downs very difficult. More than that, she has conducted several tests with grapes from the same vineyards being fermented side by side in both closed-top and open-top fermenters. Invariably in subsequent tastings, both Crowe and her clients have preferred wine made in the closed-top fermenters.

"I have no real science to back this up," she explained, "but anecdotally, we almost always preferred closed-top fermentations." Like every other winemaker with anecdotal experience, she has developed a theory based on her observations. "I think it is sort of like cooking. If you make some Asian-flavored dish with delicate aromatics, like lemongrass, Kaffir lime leaves or star anise, you can simmer it with the lid on or off. If you keep the lid on, the steam is captured and drips back into the dish. I think that lends the dish more diverse aromas and flavors than letting that steam blow off. Fermenting in a closed-top tank is similar to simmering with the lid on. A lot of those delicate aromas and flavors will stay in the wine."

Crowe said that pump-overs serve different purposes. They can be used to moisten the cap or to break up the cap. She prefers gentle action during cold soaks, at the start of fermentation and toward the end of fermentation. During peak fermentation, she wants to get oxygen into the must to keep the yeast healthy and active, so the "firehouse method" or pumping through a screen might be used. Pumping through a screen has the added benefit of allowing you to remove seeds, which might add more phenolic astringency to the wine.

Below 5° Brix Crowe returns to more gentle irrigation pump-overs because she doesn't want too much oxygen in the finished wine. She rarely uses extended maceration, feeling that the wine is safer when removed from possible problem lees, pressed and resting in barrel or a topped-up tank.

The problem with both punch-downs and pump-overs is that they require labor and take time. Typically, the techniques are incorporated one to four times daily during fermentation. Boulton sees that as a problem, asserting that temperature variations between the cap and the juice vary widely, with the cap often getting much hotter. "Tannic extraction in a hot cap is much different than tannic extraction in cooler juice. Even if you mix the cap and juice three or four times a day, you are still getting heat spikes followed by



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cooling and then returning to heat. It is better to maintain temperatures between the cap and the juice at the same temperatures as much as possible.”

Michael Eddy is the director of North Coast winemaking for **E&J Gallo**. He has worked with virtually every type of cap management system available. “Delestage or rack and return are very effective,” he said. “When you track what is happening in different points in a fermenting tank, the variation between the cap, center of tank and edge of tank is huge. Getting a reliable tank sample is always a big challenge and delestage gives you homogenized juice.”

Delestage is also touted by winemakers because it allows them to remove seeds, which may give off astringent tannins. Eddy pointed out that seed removal is a timing issue. If your fermenting fruit consists of good, intact berries, seeds will not drop out as quickly. If you attempt seed removal too early, then berries will be lost as well.

Eddy also believes that different varieties appreciate different cap management techniques. Gentle extraction of Pinot Noir seems to produce better wine, so punch-downs and submerged cap systems work better. Heartier varieties, like Cabernet Sauvignon and Zinfandel, benefit from more aeration, so pump-overs and rack and return are better cap management choices.

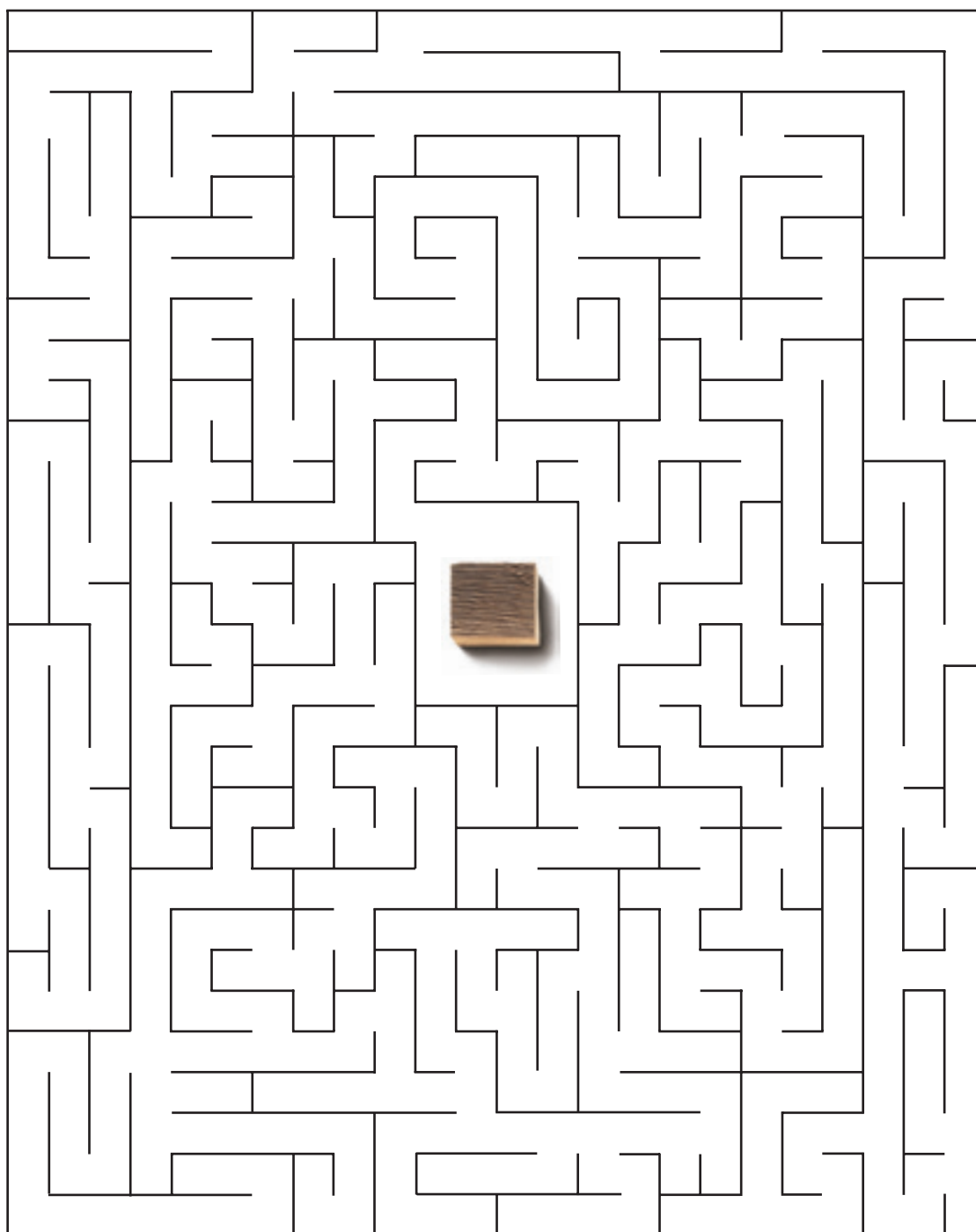
Chaim Gur-Arieh spent 35 years as a food product developer working on products as diverse as Cap’n Crunch Cereal, Power Bars and Hidden Valley Ranch Dressing before starting his wine-making career with **C. G. di Arie Vineyard and Winery** in the Sierra Foothills. Early on as a winemaker he experimented with different cap management techniques. He picked grapes from a single vineyard and distributed them among three identical tanks. One tank used pump-overs, one used punch-downs and the third used a submerged cap system. A year later Gur-Arieh and other tasters all agreed that the wine from the submerged cap tank was superior.

Looking to produce wines that were highly extracted and concentrated, yet elegant and not too tannic, he designed and implemented a system that would allow him to keep fermenting caps submerged. That early system evolved from a mechanical device that worked a bit like a French press for coffee to his current “Dual Compartment Submerged Cap Fermentation

Tank.” Gur-Arieh’s tanks now have both an upper and a lower chamber. Grapes are crushed into the upper chamber. Once they begin fermenting, the skins rise. Juice is then drained from the upper tank to the lower tank leaving the skins on the floor of the upper tank. The submersion device is inserted into the tank and locked into place. The juice in the lower tank is pumped back into the upper tank; and as fermentation resumes, the skins rise to the bottom of the submerging device.

According to Gur-Arieh, “The submerging device enables continuous skin contact with the wine, which adds color, flavor and texture to the final wine.” He realized that using the submerged cap system meant only the top portion of the fermenting juice was actually in contact with the skins. He added

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Winemakers Discuss Cap Management Best Practices



a **Pulsair** system to rotate the wine in actual contact with the skins. “The Pulsair system revitalizes the yeast while it agitates the wine and places more of the wine in contact with the skins,” he explained.

Squire Fridell from **GlenLyon Vineyards & Winery** in Glen Ellen loves his Pulsair system for medical reasons. “Our tanks are pretty tall and narrow,” he said. “The caps that formed during fermentation were almost impossible to break through. Years of fighting the caps with punch-down implements led to my having rotator cuff surgery. With Pulsair, I don’t need to worry about having another operation.”

The Pulsair system pumps filtered air through a wand into the juice below the cap. The air bubbles in the tank above the seeds, so they are not disturbed. The air rises, building pressure until the cap breaks up and rolls over on itself. According to Fridell, this action is very gentle on the grapes and skins—much less trauma than either pump-overs or punch-downs. Not only that, but he can move the wand from tank to tank and handle the cap management by himself, without harming his 72-year-old body.

The Pulsair system has added advantages. “The oxygen from the Pulsair makes the yeast happier. It finishes the fermentations cleaner, without H₂S or other off aromas,” he explained. “I’m no longer adding extra DAP during fermentations, nor do I need to use copper after fermentations. Those additions are to remedy problems. With the Pulsair, I am able to prevent the problems before they start.”

Pulsing air is also effective when fermenting red wine in barrels. These barrel fermentations require popping the heads off barrels, filling them with must and replacing the heads. The wine is fermented inside the barrels skins and all, making cap management a bit more difficult. **Jeffrey Stambor**, director of winemaking at **Beaulieu Vineyard**, called this method, “Stupid labor-intensive.”

The barrels sit in racks and cellar workers need to spin the barrels to mix the skins and juice inside. Most winemakers give the barrels six spins, six times a day. Barrel fermentation is pretty much a closed system, and clean fermentations require some oxygen to keep the yeast healthy. So, winemakers will bubble oxygen through the fermentation a couple of times in the process.

According to Stambor, who barrel ferments more than 600 barrels every year, Bordeaux varietals seem to do best with this system. “To get the full benefits of this process, you need good, clean fruit with excellent concentration. The



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quality you get out of this process is unbelievable. The wines get this balance much earlier in their life. There is a seamless integration and a textural advantage to these wines. It is worth the extra effort in certain economies.”

International winemaker **Nick Goldschmidt** has made wine in many of the world’s finest wine-growing regions, including California, Australia, New Zealand, Spain, Chile, Argentina, Mexico and Portugal in his capacity as winemaker, general manager and vice president for **Constellation Wines** and later **Allied Domecq**. Goldschmidt feels that cap management needs to involve the style and technique of the winemaker based on experience, past performance and conditions of the vintage, but basically it is not complicated.

“If you want to extract more, you raise the temperature during ferment, pump-over more and add more air,” he explained. “Then after ferment, you let the temperature of the tank cool to slow polymerization if you like. If you want to extract less, you do the opposite and warm the tank.”

Goldschmidt also believes that cap management has to vary with each varietal. With Cabernet and Merlot he focuses on temperature and the stage of fermentation, doing less at the beginning and end of fermentation and being more aggressive at the high point. He likes to leave Napa Cabernet on the skins for six to eight weeks, pumping over once every couple of days to maintain cap health until the tannins get to where he wants. For thin-skin varieties, like Petit Verdot, Petite Sirah and Zinfandel, he doesn’t go as long on the skins because of their tendency to break down easily.

Goldschmidt has worked with rotary fermenters and noted, “The extraction that you generate is much stronger. With these things, I hardly turn them, giving them a couple of turns each way twice a day and then pressing off around 10° Brix. Then I chill them down and go to barrel to finish them off.”

Goldschmidt said that similar techniques can be used in different places. “But the most important thing is to make sure that the wine is from the place. The ‘culture’ of the place needs to be of utmost importance. When someone gives me a glass of wine, I want to be able to say what the variety is as well as recognize where it is from, or at least be close.”

Palmaz Vineyards is a state-of-the-art winery pioneering certain aspects of winemaking. Recognizing that skin contact and temperature are key factors in extracting color, flavor and tannins and that the wide variation of temperature between the cap and the juice affects that extraction, the people at Palmaz set out to follow temperatures in all parts of the fermenting must.

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“The process causes the cell walls to relax, almost instantly releasing anthocyanins and other phenols. The steam that is blown off contains ‘flash water,’ holding the molecules with the longest flavor chains—usually off-putting compounds like pyrazines. That flash water can be discarded, reducing green and vegetal flavors in the wine.”

-Randy Zuidema, owner/operator, Flash Wine Technologies

Christian Palmaz patiently explained his thermographic system: “We have developed an algorithmic fermentation-control system that uses thermal imaging. This technology allows us to track temperatures continuously all over the tank and project that information onto the ceiling of the winery where our winemakers can study it. We can follow temperatures in the cap, in the center of the tank and along the inside edges of the tank where the cooling jackets are. We can see exactly how the heat is dispersed and where and when it collects after a pump-over or punch-down.”

Palmaz and his winemaking team realize that cap management is essential because 90 to 95 percent of the tannin resides in the skins and the seeds, but there are important steps even before fermentation begins. Picking the grapes at optimum ripeness is the first key step in the process. Berry integrity is next. At Palmaz grapes are destemmed and sorted. “We try to achieve the perfect whole berry,” Palmaz said. “We sort out berries that have nicks or cuts. We have a sieve that then cuts the berry with a sort of consistent imperfection, regardless of the berry size, and does it with a minimal amount of crushing and not much juicing.”

From there grapes get a four- to five-day cold soak before inoculation. Shortly after that, they can track the first exothermic points until density drops and fermentation begins. The cap forms and they vary their pump-overs based on the heat patterns they see in the tank. Early on, they may pump-over just once a day using gentle irrigation methods. Later in the fermentation they may go to four pump-overs a day using a much more aggressive “fire hose” pump-over. “Phenolics and aromatics extract at different delta points. We can track the various thermal profiles in the tank and use them to promote characteristics we want. Then we use the various types of cap management techniques to create homogenous events as best we can.”

At Palmaz, cap management is not focused on managing tannins. Rather it attempts to maximize extraction, aromatics and flavor. “Tannin polymerization is not our key focus during fermentation,” clarified Palmaz. “We have two years during the aging process to control the tannins. Our entire winery is geared to handle wine movements as gently as possible using gravity, not pumps, to move wine. This allows tannins to link up with longer polymers, which means the sensation of astringency is lessened in the mouth.”

If cap management is just not your thing, you might consider flash détente, a form of thermovinification. **Rudy Zuidema**, who is the owner/operator of **Flash Wine Technologies**, said that flash détente extracts flavor and color from winegrapes using extreme heat. First, the fruit is destemmed and lightly crushed. Then a portion of the juice is heated to close to 200° F. The skins

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get blended into the hot juice where they are heated rapidly. The hot skins are delivered to a vacuum chamber and immediately flashed, which creates steam that is removed through condensation and cools the must to 85° F.

“The process causes the cell walls to relax,” explained Zuidema, “almost instantly releasing anthocyanins and other phenols. The steam that is blown off contains ‘flash water,’ holding the molecules with the longest flavor chains—usually off-putting compounds like pyrazines. That flash water can be discarded, reducing green and vegetal flavors in the wine.” The rapid heating and cooling also eliminates or denatures microbes and proteins like *Brettanomyces* and *acetobacter* leaving the juice virtually sterile. Finally, during the process 3 to 5 percent of the volume is blown off in the form of steam, increasing the sugar in the juice and concentrating the flavors.

Once processed, winemakers can opt to press the must immediately, since all of the color and phenols have already been extracted, and then ferment the wine with no skins, therefore no cap management necessary. Some winemakers are experimenting with putting the flashed juice into tanks with normally crushed fruit and then proceeding with their regular cap management protocols because, while the process is highly effective, it tends to extract only the most soluble tannins. Extracting other tannins requires the presence of alcohol. Without those other tannins the wine can lack structure and balance.

In all red wine fermentations, skins will float to the top of the fermenting must and form a cap. Manipulating that cap in certain ways is essential to creating whatever style of wine the winemaker wants to produce. Based on anecdotal experience, most winemakers believe they know exactly what needs to be done to produce the wines they want to make.

The goal for many winemakers is to get maximum extraction of flavor and color with balanced structure carried by soft tannins. Cold soaks, punch-downs, pump-overs, submerged cap, pulse air, delestage and barrel fermentation are all techniques to do just that, and winemakers pick some and eschew others in their attempts to make the best wine.

Roger Boulton contends that many winemakers are making their decisions based on wishful thinking rather than scientific fact. For example, he points out that while there is a correlation between anthocyanins in grape skins and the color of a finished wine, no similar correlation has been found between the tannins in those grape skins and tannins in the finished wine. He also says there is no evidence of increased color in finished wine due to cold soaks or pump-overs.

It appears that the key to fine wine is extraction, and extraction occurs with contact between the skins and the juice. The more you can keep the skins and juice in contact with one another, especially at an even, constant temperature, the more likely you are to make high-quality wine. There is no recipe that works for all varieties. There is no particular methodology that works for all vineyards. There is no single procedure that guarantees success.

In light of all the unknowns about cap management, it seems prudent to this writer that winemakers do what makes them comfortable. One way or another, the wine gets made. Color, flavor and tannins are extracted. The pressure to consistently produce delicious wine representative of a particular place is enormous. Proven science, hunches or anecdotal experience can soothe a winemaker’s wildly beating heart. A calm winemaker with a plan will likely do a fine job, no matter the challenge. **WBM**

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