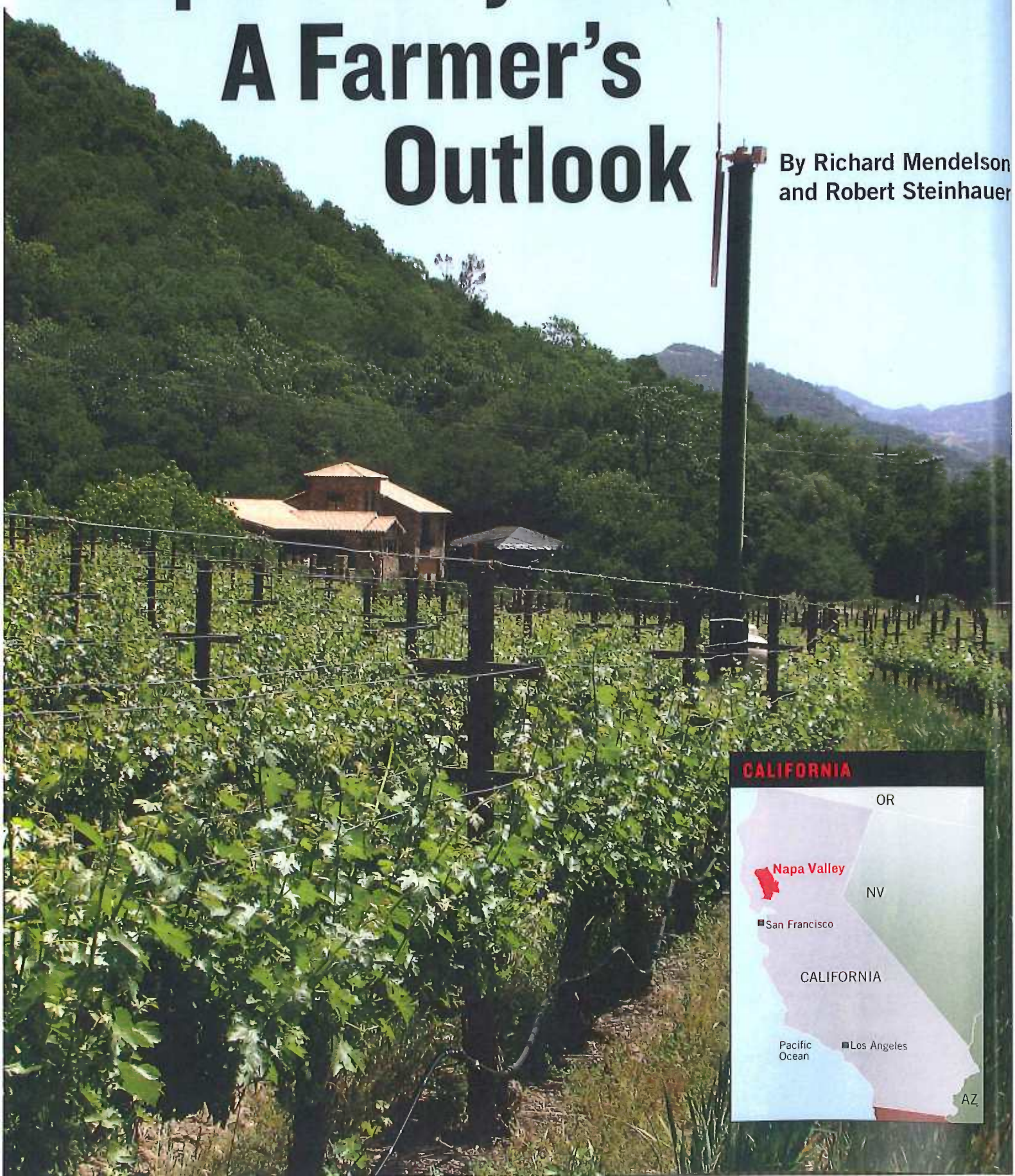
Napa Valley Viticulture: A Farmer's Outlook

By Richard Mendelson and Robert Steinhauer



This article is excerpted from a chapter written by Richard Mendelson and Robert Steinhauer, two well-known wine industry experts, about modern-day viticulture in the Napa Valley. Their chapter appeared in "The Science of Viticulture: Volume 1" (K.V. Peter, editor), published last year by New India Publishing Agency. The chapter covers a broad range of topics, from the Napa Valley's viticultural uniqueness and the legal protections for this irreplaceable agricultural resource to vineyard development (site selection, infrastructure and plant material) and farming in an environmentally sound and sustainable manner. The excerpt that follows is about cultural practices. The entire chapter and citations are available at winesandvines.com.

Cultural practices tailored to the vintage, along with vineyard designs that augment natural features of the particular site, determine the ultimate wine quality in any given harvest year. The most important cultural practices are pruning, canopy management, irrigation, fertilization, vineyard floor management, yield management and harvesting. Pruning is a critical factor in managing yield and wine quality. The Napa Valley winegrower strives for a balance between yield and vegetative vine growth on a consistent, sustainable basis. Optimal values include 0.66 pounds to 2.20 pounds of pruning weight per meter of canopy length and between 5 and 7 pounds of fruit for every pound of dormant vegetative growth.[1] Some growers relate pounds of prunings to retained bud count. For example, an average of seven buds retained per pound of prunings will provide for a balanced vine at most Cabernet Sauvignon sites. The experienced winegrower also will take into account the historical yields at the specific site, vine vigor, wine quality and the amount of summer trimming.

There is no clear preference for cane pruning versus spur pruning in the Napa Valley. Both methods are used depending on grower preference.

The Napa Valley is subject to spring frosts. Once bud break occurs, the green shoots can be damaged if temperatures fall below 32°F. The most common type of frost event is a radiational freeze.[2] On some very rare occasions, an advective freeze[3] may occur.

Most vineyards that are vulnerable to frost are protected in some manner. The use of wind machines (one per 10 ± acres) mixes the warmer, inverted air with the colder air on the vineyard floor. *(Wind machine shown in photo, page 32.)* During a radiational freeze, a wind machine will raise temperatures by 2°-3°F. The air movement of 2 to 10 miles per hour caused by the wind machine also results in a shallower boundary layer, a larger heat gradient, enhanced heat transfer and a warmer leaf. As a result of these combined effects, wind machines can protect vines against temperatures as low as 26°F. It should be noted that wind machines will not protect the vine, and they may even cause greater damage during an advective freeze.

Overhead sprinkler systems

Another commonly used method for frost protection is a properly designed overhead sprinkler system. Heat released by the freezing of the applied water, which forms an ice film around the green leaves, clusters and shoots, protects the vine by keeping temperatures near the 32°F mark. This water application can protect to approximately 24°F, although co-author Robert Steinhauer has observed protection down to 21°F.

The overhead sprinkler system consumes large volumes of water—52 gallons per minute per acre. For most properties, large reservoirs and large pump capacity are required. In return for this investment, the sprinkler system will protect against much lower temperatures than will a wind machine. It also will provide protection in most advective conditions, and the same system is sometimes used for irrigation and cooling during summer heat spike events.

Part of the trend to sustainable practices in Napa Valley is the management of the vineyard floor, both in-row and under vine. Best farming practices generally have moved away from pre-emergent herbicides under the vine row to mechanical tilling or applications of glyphosate for weed control. Generally, between rows are permanent sod cover crops that are mowed or cultivated row centers. Currently, many sites alternate every other year between sod cover crop and cultivated row middles. Some growers plant a winter cover crop that is incorporated into the soil as a source of nutrition as well as erosion control. Other growers utilize compost for the same purpose. Typically, these management practices are site-specific.

The benefits of cover crops are reduced tractor wheel compaction, improved physical properties of the soil, increased organic matter, reduced chemical use, habitat for beneficial insects, dust control and reduction in water runoff. However, permanent sod cover crop has been found to compete for water and nutrients, which, over time, potentially reduces vine vigor.

Vine nutrition is an important component of a successful vineyard—both for the particular vintage and for the long-term health of the vineyard. Most growers rely on field observations to determine nutrient status, along with soil chemistry

Common tools to combat frost damage include wind machines and overhead sprinklers.

Cabernet Sauvignon vines are managed using a VSP trellis spaced 6 feet between rows and 4 feet between vines—also known as a six-by-four.

analysis, bloom time petiole nutrient status and leaf blade nutrient analysis. The Napa Valley winegrower has at his disposal many advanced nutrient and soil amendment application capabilities such as fertilization by drip irrigation, mechanical soil incorporation and materials that can be sprayed on grapevine leaves.

The ultimate goal of the winegrower is to produce the largest quantity of the very highest quality grapes that are in the greatest demand in Napa Valley. To achieve this goal, the viticulturist must have a solid scientific understanding of the effects of cultural practices, the vintage and *terroir*, plus the historical perspective of farming on the particular site. The grower must be flexible in adjusting cultural practices throughout the growing season from site to site, block to block—and even within a block.

Canopy management

While many factors influence the selection of grape variety and the ultimate wine character and quality, site (*terroir*) and season (vintage) are perhaps the most dramatic. In terms of farming practices, canopy modification and irrigation strategies are demonstrated mechanisms for manipulating wine quality. The response to these and other management practices is dependent upon variety, row orientation and trellising.

Canopy management is important because filtered light has a positive influence on fruit composition. However, too much light and high fruit temperatures are deleterious to wine quality; therefore, the foliage must protect the fruit from

sunburn and dehydration. Additionally, sunlight on the shoots will improve bud fruitfulness the following year.

Most Napa Valley winegrowers retain about five shoots per foot of canopy. The spacing of the shoots generally allows for optimum sunlight on the leaves. The shoot length on a balanced vine should be uniform and grow to between 3.5 feet and 5 feet by veraison (the point at which the grape berries turn from green to their final color, representing the change from berry growth to berry ripening.) The shoots should stop growing about two weeks before veraison and retain about 12 to 15 active leaves that remain green and healthy until harvest. The grape clusters typically are protected by filtered light through one or two layers of leaves. Growers may decide to remove basal laterals or laterals plus a few leaves based on observations of the site and leaf cover. Row direction and leaf size (Merlot and Zinfandel are varieties that have large leaves) will influence the decision about leaf removal to obtain the desired amount of fruit exposure. North-by-south row direction may require leaf removal on the east (morning sun) side and no leaves on the west side of the canopy to shade the fruit.

This drip-irrigated vineyard uses a Geneva double curtain trellis spaced 12 feet by 6 feet.

The water status of the vine has a major effect on the canopy and ultimate fruit and wine quality. As such, irrigation management is one of the most important viticultural tools. The Napa Valley generally receives enough rainfall from November through April to fill the soil profile. Normally, very little rain occurs during the summer and fall months. Almost all Napa vineyards are either dry farmed or

Note the overhead sprinklers for frost protection and drip irrigation in this Sauvignon Blanc vineyard. A modified Lyre system using movable foliage "catch" wires is spaced at 12 feet by 7 feet.

equipped with drip irrigation systems. Following the advent of drip irrigation, water use by Napa Valley growers has become very efficient and prescribed. A tremendous amount of research on irrigation treatments and their effects on vine physiology and wine quality have been completed.

There are sites with deep loam or clay loam soils that require no irrigation or are intentionally dry farmed. Many growers advocate deficit-irrigation strategies. These irrigation strategies maintain the vine water status post-veraison at 70%-80% of the evapo-transpiration rate. Most growers understand spatial variations in the vineyard and adjust irrigation within blocks or sub-blocks of the vineyard. Along with constant visual inspection to determine the water status of the vines, many growers rely on soil moisture measurements and gauge the midday leaf water potential utilizing a pressure chamber. Many growers will not start irrigating until the vines get to -10 bars of midday leaf water potential. Along with the soil and plant water measurements, the field observation of vine status, especially observing shoot tips, is critical.

Cluster removal, known as thinning, occurs just prior to veraison or at veraison in almost every ultra-premium vineyard in Napa Valley. Typically, the grower removes the clusters that are touching or are compacted together in order to provide light to the berries and also reduce the potential for fungal disease.

Many growers, especially the producers of red grape varieties, "color thin" at 80%-95% veraison by removing any green or partially green clusters. This process is un-

dertaken in an attempt to achieve uniform maturity at harvest. Some growers will remove clusters in excess of one cluster per shoot. This process is gaining favor among some ultra-premium producers of Cabernet Franc, Cabernet Sauvignon, Pinot Noir and certain other varieties.

Growers understand that thinning early, while the berries are in the growth phase, will increase the size of the remaining berries. For this reason almost all growers wait to thin until veraison.

Winemaker demands for concentrated flavor and supple tannins at harvest have led to the practice of leaving grapes on the vine for days or weeks after the traditional harvest date. This practice is commonly referred to as "hang time." This requires continued maintenance irrigation to keep leaves green until just before harvest.

Viticulturists in Napa Valley are divided on the effects that yield (expressed as tons per acre) has on wine quality. Undercropping (too few clusters) can lead a vine to excessive vegetative growth, vegetative wine flavors and high total pH. At the opposite extreme, overcropping (too many clusters) a vine can lead to low alcohol and light, poor-quality wines. A majority of growers believe that precision farming for small yields produces the highest quality ultra-premium wines. The success of these growers makes it difficult to argue with this position. Another group, however, believes that precision farming for balanced capacity and vine vigor is the best avenue to produce ultra-premium wines. Whichever approach is correct depends ultimately on a multitude of fac-

A "T" trellis in this drip-irrigated Cabernet Sauvignon vineyard is spaced 10 feet by 7 feet.

This Goblet-trained Zinfandel vineyard is spaced 10 feet by 8 feet. The vineyard is drip irrigated, although the drip line is not shown.

tors. Dr. Mark Matthews reports, "Prior research has shown no effect of yield on wine quality." He also states, "Quality cannot be measured by a scientist because it is so subjective."

Most viticulturists agree that for the ultra-premium wine market, small yields that are balanced with the vine's vigor result in superior wines. The Napa Valley average yield for Cabernet Sauvignon from 1986 to 2004 was 3.8 tons per acre. By contrast, the California average for Cabernet Sauvignon for this same period was 5.55 tons per acre.

The Napa Valley climate allows for the full maturity of even late-ripening varieties like Cabernet Sauvignon and Cabernet Franc. For many years, harvest date was determined by measuring sugar, acid and pH. These measurements are still made today, but the winemaker also tastes the fruit to determine when to harvest. For red varieties, most winemakers look for ripe, intense flavors with supple tannin structure. They also want the grape seeds to be brown and mature. Bibiana Guerra describes an Australian research project about Syrah confirming that seed color is a good indicator of physiologically ripe berries, ready for harvest. A given vineyard may be harvested block-by-block or even sub-block-by-sub-block on different days, based upon the flavor profile of the fruit.

Most ultra-premium fruit is harvested by hand. However, the mechanical harvester technology is so advanced that a substantial amount of Napa Valley fruit is now machine harvested.

Harvest is the culmination of growers' efforts. Before and during harvest, the winegrower and the winemaker (sometimes one and the same) observe the conditions of the vines and determine how best to meet the winemaker's parameters for the fruit. They observe conditions down to the level of the blocks and sub-blocks (precision farming), and the grower then adjusts the cultural practices accordingly, including irrigation, fertilization and canopy management.

When harvest concludes, the winegrower and winemaker focus on the wine to determine if modifications to the cultural practices would improve yields and quality. The grower then considers whether to adjust those practices in future vintages, cognizant that each vintage year will present its own unique conditions and challenges.

The winegrowers and winemakers of Napa Valley understand that they are fortunate to grow grapes and make wine in such favorable *terroir*. Winegrowers and winemakers work collaboratively to ensure that their grapes meet the wine quality parameters and will vinify high-quality wines. This strategic alliance of winegrower and winemaker is a key component of the success or failure of a vineyard.

The grower and winemaker also constantly work together to improve their know-how and stay at the forefront of technology. They recognize, respect and appreciate that each winegrowing region of the world has its own valuable history, tradition, science and practices that may differ from those of the Napa Valley, and they remain open to learn and adapt their skills and practices to improve the quality of Napa Valley wines. This commitment to excellence has been evident in the Napa Valley for many generations, resulting in the well-deserved international reputation that Napa Valley has long enjoyed. W&V

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Footnotes

1. A pruning trial conducted in Napa Valley utilizing Cabernet Sauvignon grafted to 110R rootstock resulted in significant differences in sensory attributes. That seemed to defy the conventional wisdom. The low yields of 1.74 tons per acre resulted in "veggie aroma and flavors, bell pepper aroma, bitterness and astringency," while the high-yield wines of 8.98 tons per acre were "higher in red/black aroma, jam aroma and fresh fruit aroma." Other research has pointed out the need to achieve balance between capacity (yields) and vine vigor.
2. A radiational freeze occurs when a cold but dry (low dew point) air mass moves into the valley. Temperatures can be in the 60°s (Fahrenheit) in the afternoon, but after sunset radiational cooling of the soil surface causes temperatures in the lower atmosphere to fall, sometimes by 30°F or more. Temperatures a few hundred feet above the ground remain fairly constant, forming an inversion (temperature increase with elevation).
3. An advective freeze occurs when a cold air mass from the Arctic regions migrates into the Napa Valley. The temperatures at the vineyard are below freezing and become colder at higher elevations.