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Canopy and Fruit Zone Management for High Quality Wines and Vines

In any given growing season there are probably no two management areas that can affect the outcome of grape quality more than proper canopy and fruit zone-crop management. Many of the critical quality decisions such as variety, clone, rootstock, vine density and spacing, trellis and training systems have already been made. These decisions will converge into a vine of a particular size and balance which now has to be managed according to the targeted style and price point of the wine being produced. In the best of all worlds, the resulting vines are in perfect balance and very little intervention or manipulation must be done. But this is the rare case, perhaps only witnessed in vineyards with ideal terroir, such as a great vineyard like Romanee-Conti or Chateau Lafite-Rothschild. These vineyards virtually balance themselves. In the absence of canopy and crop balance, the grower must apply viticulture practices to guide the vine and fruit into balance with the result being perfectly mature fruit for wine making. As wine growers we have two key objectives:

- To produce optimal mature fruit for wine making
- To fully acclimate vines to maximum cold hardiness

Canopy and yield management begin before any vines are planted. The concept of vine size and balance are important to achieving a manageable canopy and fruit zone. The grower is trying to balance the vegetative and reproductive processes of the vine. The site, of course, will have the greatest impact on vine performance. Proper site selection and evaluation will provide valuable insight into the growth habits of the vines. If the site is fertile with ample rainfall it is likely a large vine will emerge with lots of foliage and fruit. In fine wine production, however, a small to moderate size vine is preferred, one that will focus less on producing leaves and more on ripening fruit, which is our desire as wine growers. We want a site that will support these objectives.

In practice canopy management involves pruning, shoot thinning, suckering, shoot positioning, leaf and lateral removal, hedging and any other practice that manipulates shoots and leaves. Within each of these practices is tremendous nuance and variability in why, how, where, what and when the practices are performed. Good canopy management begins with careful and proper vine training with special considerations given to canopy architecture such as overall canopy height and fruit wire height. These dimensions will have great implications for the performance of canopy and fruit.

Pruning sets the tone for canopy and crop while the vines are still dormant. Pruning severity will affect just about every parameter of the canopy from shoot length and number to distribution of shoots within canopy. Of course, it will affect crop level also. Pruning is the first attempt in the season to balance the vine's foliage with the crop size. Guidelines set by Richard Smart and

others help the grower to determine if the vines are in relative balance. The system of balanced pruning developed by Nelson Shaulis is another way of measuring the balance of mature vines. It is important to pay particular attention to the head and apical parts of the vine to prevent shoot and cluster crowding in these areas. Renewal spurs should be minimally used and always in the proper position.

As shoots begin to grow suckering and shoot thinning allow the grower to adjust shoot numbers to achieve optimal distribution, density and leaf area to ripen the expected crop. It improves canopy configuration by limiting shoot density and is the first effort to regulate crop size. In most cases, double shoots are thinned to the single, primary shoot. Watersprouts on the upper part of the vine and suckers below are removed. Shoot thinning usually is done when shoots are relatively short.
Shoot positioning will improve the canopy performance of almost any training system whether single or divided, vertical or horizontal. As with shoot thinning, shoot positioning seeks to improve canopy configuration and reduce the amount of shading created by overlapping shoots. In its most rigorous form, individual shoots are fixed to wires with ty tape or branch locks to keep them in position, vertical and evenly spaced. These canopies are ultra-efficient and looks very neat and tidy. But this is an expensive practice that can be justified on high priced red wine vineyards. Otherwise, shoot positioning usually involves hand labor of separating and placing shoots in the preferred direction.

Wire moving is also a key part of shoot positioning. If it is done properly and in a timely manner, it can greatly enhance canopy architecture and reduce the amount of hand positioning needed. Timing is probably more critical for wire moving than any other canopy management practice. Wires are moved during the “grand period of growth” when shoots, if conditions are right, can grow a five centimeters a day! If done too early, the shoots will not stay in place. If too late, it becomes necessary to bend and tuck shoots which often leads to breakage. Movable catch wires are preferable over fixed wires so they can be pulled away from the canopy and used to sweep shoots inside the wire and into an upward position. In most cases, 2-3 pairs of movable catch wires are adequate for this task. Shoots can be held into place with wire clips or the aforementioned branch locks.

Leaf removal may be the most complex and controversial of canopy management practices. The purpose of removing leaves is to open up the interior of the canopy to light and air to help promote fruit ripening and reduce disease pressure. If correctly done the benefits to grape quality can be dramatic. While the potential benefits are readily accepted, exactly how to achieve them is not. The timing, severity and method can different widely according to local philosophy and conditions. If there is a typical scheme, it is to remove leaves opposite clusters on the morning side of the vine shortly after fruit set. Timing, in this case early removal, is important so the berries will not get sunburn. If cool and wet conditions prevail, leaves on the afternoon side may be removed. Variations include very early removal of basal leaves as practiced in Piedmont to help with early season disease control, to no leaf removal at all in the case of an extremely well-balanced canopy or high temperature/light conditions in a very warm to hot region. Cooler regions tend to pay much closer attention to leaf removal, early in the season for disease control and later for fruit ripening benefits. In some cool areas such as Long Island, as the ripening period stretches into mid to late October and the sun lowers on the horizon

and days are cool, the fruit zone will be completely stripped of leaves to increase the temperature of the berries. The additional heat helps to drive temperature dependant metabolic processes responsible for the maturation of flavor, color and phenolic compounds, as well as continue to dissipate methoxypyrazines.

Leaf removal can also take the form of lateral removal, which is sometimes preferred to retain basal leaves that protect fruit from sunburn, yet still open the interior of the canopy. Tunneling is a practice where lower, interior leaves are removed. This must be done by hand and is time consuming and therefore expensive. It is generally required in higher vigor vines with bigger canopies.

There are a variety of mechanical leaf removers with an astonishing array of different removal mechanisms, from using pulsed air bursts to shred leaves, to fans and blades, rollers that pull leaves into cutting knives. The trick is to remove the correct amount of leaves in the proper location and not to cut off or damage fruit. It is surprising how easy it is to bruise berries if they are brushed by a hand or machine.

On a vertical shoot position system other late season canopy management practices include hedging, often on sides and over the top. The application of bird nets will also have an effect on canopy configuration and not always for the better, but it needs to be taken into consideration.

It may be necessary to repeat any of these practices later in the season to get the best and desired effect. For example, leaf removal may require an early, mid and late season pass. Crop thinning may also require multiple passes in order to get the crop size just right.

Of course, all of this work, especially if done by hand, is very expensive. The fastidiousness of the work is usually strongly correlated to the price of the wine in which the grapes are destined. In most cases, high priced red wines get the most attention. But even Concord grapes will benefit from proper and timely shoot positioning.

Insect, disease and other abiotic causes such as frost, hail, lightning, wind damage will also impact the vine canopy during the growing season and must be accounted for when considering the amount of leaf area necessary to ripen the grapes. If excessive damage occurs the crop must be adjusted to reflect the remaining foliage's ability to fully ripen that fruit.

Canopy and fruit zone management are two distinct concepts and practices yet they are intimately intertwined and anything done to one will affect the other. Crop size can affect vigor of a vine and is sometimes used to slow down the growth/vigor of a vine, sort of an anchor that drags along the bottom. The canopy represents the solar panels that catch sunlight to convert to sugars that create alcohol that gives wines texture and balance. The sugars also are used for energy to drive plant metabolic processes, including those that synthesis flavor, color and phenolic compounds that characterize each variety. The canopy is also host to the fruit zone in which clusters nestle comfortably throughout the season. As discussed earlier, the manipulation of the canopy has a direct effect on fruit chemistry, composition and quality.

Correct management of the fruit zone is important for disease control and to promote ripening. One of our stated goals is to achieve fully mature fruit for wine making. There can hardly be a single more important contributor to that goal than the correct regulation of crop size. The amount of crop is determined by the quality, style and price point of the wine. For super premium reds, a vine may be expected to ripen 1-2 kgs of fruit. But for a white wine or a fighting varietal red, it may carry 5-10 times that amount of fruit. It all depends on the wine goals and economics. The job of the viticulturist is to set the proper crop size and make sure conditions are right for getting it ripe. No matter what the grower determines the optimal crop size to be, only fully ripe fruit can make good wine.

Fruit zone management encompasses practices aimed at preventing disease and promoting maturity. Disease can quickly compromise wine quality or destroy a crop completely. Cluster positioning is very important to both disease reduction and fruit ripening. It begins with proper pruning, especially the placement of spurs. While pruning for production is always an important goal, pruning for position is just as important. Equal distribution of clusters throughout the fruit zone is ideal. Certainly no clusters should be touching. If they are, then shoot crowding is probably also a problem and canopy balance needs to be assessed. Visually, all of the fruit should be in a narrow band, equidistant from the fruiting wire depending if it is the basal or apical cluster.

Leaf removal in and around the fruit zone is where canopy and crop management merge. This is where timing and method can have a significant impact on fruit quality. It should be managed very carefully.

Crop estimating is the only way to accurately measure the amount of fruit on a vine and if it is necessary to remove fruit in order to get the remaining fruit completely ripe. Crop estimating is explained in an accompany article.

In regard to cold hardiness, it is the good fortune of the wine grower that virtually everything done to promote full fruit maturity, mainly the nurturing of a well-balanced and healthy vine, will help to promote vine acclimation and maximum cold hardiness. One of the goals in a cool to cold climate is to get the fruit ripe and off the vine as early as possible to beat the first fall frost, hurricanes, birds, deer or other harvest threats. Once the fruit is off the vine it can devote its full attention and energies to hardening off for the winter. With that accomplished, the vine and grower can look forward to another productive vintage.

There is a lot of written materials about canopy and fruit zone management. Dr. Mark Greenspan, a viticulture consultant in California has written numerous fine articles on the topic which you can find on his web site www.advancedvit.com/. But the best way to learn about these important practices is to see and do them at vineyards where they work. How can you tell if they work? Taste the wines. In vino veritas.

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