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Vine Size and Balance and Balanced Pruning

In question are two separate issues: big vs. small vines and balanced vines. You can have balanced vines with both big and small vines. While pounds of fruit and brush will differ between the two, ratios of fruit to brush should be similar. Vine balance is something to strive for, no matter the terroir and no matter the price point of the resulting wine. Achieving balance, whether with big or small vines, is about manipulating the two elements of the fruit weight to brush weight ratio. If a vine is out of balance visually or according to Smart rules, you can either manipulate the fruit weight by leaving more or fewer buds at pruning or manipulate brush weight by watering or fertilizing more or less. A grower can manipulate to create a bigger vine that can be balanced with more fruit or to create a smaller vine with less but better fruit by watering less and fertilizing less. Rootstock selection and spacing decisions are more about what vine size you want than vine balance. Deciding on how big a vine should be is a separate issue from balance and it can be confusing when talked about together. So if we are exclusively talking about vine balance after all the decisions about vine size have been made, a grower can be measuring fruit and brush weight every year and still never be in complete balance. Shatter one year, greater than normal rainfall the next are examples of unpredictable factors that can influence balance. These all can affect the balance numbers. It is a process that needs constant adjustment and that hopefully will over time trend toward a more consistent balance.

- *Jeff Newton, Coastal Vineyard Care Associates. Santa Ynez, CA.*

That's a great summary of the complexity of issues swirling around vine size and balance by my friend and ace viticulturist, Jeff Newton (see his name mentioned in the preface of Robert Parker's Wine Buyers Guide no.7). I'll try to go a step beyond his concise summary and explain some of the principles and ideas behind the concepts of vine size and balance. With pruning season upon us, it's a good time to think about balance pruning and balanced vines. I wish there were a simple formula for achieving balance in vines but it is an elusive goal in many vineyards. Vineyards are dynamic systems, as are the growing conditions from year to year, so finding consistent balance is a real challenge. I am reminded by Jim Law at Linden Vineyards in Virginia that pruning in the East is confounding due to our tremendous variability, both intentional and unintentional, within individual vines and vineyard blocks. This is its own problem with large consequences on quality. The cumulative effects of winter injury, differences in vine age (and, hence, vine size), variation in soil and moisture (influence on vine vigor), species/cultivars of vines, rootstocks, vine density and trellis, and yield goals all make it virtually impossible to make general recommendations.

In much of Eastern viticulture vine balance is critical to high quality wine production and the long term sustainability of the vineyard. Vine balance impacts two critical goals common to all wine growers in colder Eastern regions.

- Ripen the correct amount of fruit to full maturity for optimum wine quality
- Ripen wood to maximum maturity for cold hardiness

A vine in balance makes both of these goals more realistic and achievable. It is the result of careful site selection, high quality vineyard design and development, utilizing viticulture best practices, and a lot of hard work and luck.

We know from reading our history books that wine growers have been considering the conundrum of vine size and balance for a long time. Agoston Haraszthy has been called the "Father of California Viticulture." The Hungarian was one of the first to bring European ideas and practices of vine cultivation to a nascent wine industry in California. He felt that the conditions were perfect for wine production, and to this day he has been proven correct. In his travelogue of European wine regions, and an explanation of viticultural practices written in an essay for the State Agricultural Society in 1858, Haraszthy gives provides these insightful comments on the matter of vine spacing. . .

In regard to the distance between vines, we would observe that, for California, our opinion in regard to the space of eight feet has not changed; but we have some hesitation in expressing a recommendation for the same distance after having seen the fine Burgundy Pineau and the work-renowned Riesling planted so closely. Whether these grapes will give the same generous wine, with that exquisite bouquet, if planted eight feet apart, remains to be proved by experiments. Our doubt originates from the generally established facts that, when vines are pruned for <u>quantity</u>, the <u>quality</u> will suffer. This fact is proved by scientific observation. The question which arises in our mind is, whether the vine planted eight feet apart, producing eight pounds of grapes, pruned to the very minimum of the Californian yield, or whether sixteen vines, planted on eight feet of ground, producing one fourth of a pound of grapes to each vine, would make a better wine. It is true that one vine has, in the first case, as much soil to live on as sixteen vines in the other, but whether the sixteen vines do not possess more roots, leaves, and power to extract from the atmosphere more congenial elements for the development of that fine quality and bouquet they should have, is a question which we are not prepared to answer. It is our intention to make experiments on this subject in the future and it would be well if other planters in different localities would do the same.

Wow! This is some great stuff! To this day, I'm not sure we are any closer to understanding these critical relationships in the vineyard, and the discussions are just as intense and wide-ranging.

<u>Size before Balance</u>

Before balance can be achieved, vine size must be established. Vine size, and its associated balance are determined by the terroir of a vineyard. Terroir, according to my definition, is the cumulative effects and interaction between soil, climate, plant, and viticulture on the grapes of a vine. Each terroir will have its own peculiar effect on a vine, and within certain viticultural boundaries, yield a vine of a particular size. A vine in a deep and fertile soil will grow to a bigger size than one in a shallow, well-drained, nutrient-depleted soil. To some extent, we are able to apply viticulture to the equation and manipulate vine size with techniques and tools such as rootstocks, fertilizers, irrigation, etc. A particular terroir has its own kinetic potential (strength or vigor) which is expressed by a vine in its growth characteristics, both perennial (size of permanent parts like trunk and cordons) and annual vine vigor (growth of shoots, leaves, and

fruit) – this can be defined as site capacity. Vigor is an important viticulture term that refers to the relative strength of a vine's growth during the growing season but is subject to viticulture decisions and manipulations. For example, even on a deep, fertile soil, if you space vines 20 feet apart they will calculate and appear to be weak and lacking proper vigor. Likewise planting vines too closely will entangle each other and lack balance. Balance is that happy medium where a vine has just enough three dimensional space to fulfill all of its obligations, no more and no less. This utopian condition is difficult to achieve. Once a vine's size has been determined, it is up to the grower to bring that vine into balance to optimize its form and function to produce the greatest amount of the best quality fruit possible.

A site needs to be analyzed for potential vine size and vigor before many critical decisions on rootstock, vine spacing and trellis and training systems can be made. In a place with many vineyards, like Napa Valley, that might mean looking across the fence at your neighbor's vineyard to observe growth habits. But in the East, it usually means getting out a crystal ball and trying to divine what lies beneath the surface and how that, along with climate and the vine, will result in a balanced vine. The only way to do this is with a backhoe and a soil scientist/viticulturist who knows how to read soil physical and chemical properties. Also important are the results of soil tests, remembering that the numbers are only as useful as the expertise of the interpreter. Using this information, a judgment on site capacity can be made and a prediction of vine size. A grower will only know the truth once vines are planted and reach full size and maturity.

Vines come in all shapes and sizes and are in or out of balance, consistently or within particular growing seasons (such as those affected by drought or excess rainfall). It is important to note that no matter what the size of a vine, there is an associated level of balance that should produce good fruit. A vine trained to Geneva Double Curtain on 14 x 8 spacing with 100 nodes has just as much need for balance as a small, guyot-trained vine with 8 eyes on meter spacing. In both cases, if the vine is in balance the result will be better fruit quality. In the case of the GDC and other divided systems, the result is often more and better fruit – a very rare win-win result in a compromise-driven discipline that is viticulture. In my humble estimation, the very upper echelon of wine quality demands a small vine on a very low capacity soil with ideal seasonal water inputs and the right nutrient balance and viticulture inputs. But very high quality wines in production quantities are possible with a bigger, balanced vine. The shades of variation in fruit quality and resulting wine quality are infinite and, in many cases, indistinguishable, especially to the average wine consumer.

Vine size and vine balance intermingle and must be understood as separate yet interactive phenomenon. A vine of a particular size is grown according to expectations for wine type, style and price point, and the terroir. In many cases, the wine style and price will guide the definition of size and balance. Ideally, all components of terroir are in such proportions that a vine grows in balance within its natural size limitations, and the canopy size (measured in cane-brush weight) and crop size (measured in yield components) are available in just the right amounts to result in perfectly mature fruit at harvest. Of course, other factors such as weather, diseases, and pests will conspire to influence this scenario. When components of vine size take a vine out of balance, then viticulture attempts to come to the rescue. After the fact viticulture to control vine size is often difficult to execute and enforce. It may mean adjusting bud numbers by changing

training systems, water, nutrients, crop size, or simply forcing a vine to exist within enforced parameters, but by this time opportunities to change rootstock or even location are lost. That is why pre-plant choices to create vine balance are so important. In its essence, viticulture is the band-aid we place on vines that are in a poorly evaluated and-or designed vineyard.

The Utopian Vine

Let's say you picked just the right place on Earth to plant your vines. Rule #1: vines get the best spot, house with a view second. What is the wine potential? It will be influenced by vine size and the ability to achieve balance. Think of Pinot Noir in La Tache, or Syrah in Hermitage, Riesling along the Mosel, or Cabernet Sauvignon in the Medoc. These are rare examples of a convergence and agreement of terroir components in one small area supported by viticultural knowledge and experience accumulated over centuries that, added up, result in great wine. Boy, are these vines in balance. In a recent trip the vines at veraison were not perfectly tended but they didn't need to be because they were in such fine balance. These are classic examples of well-balanced vines in extremely different terroirs. Can you visualize a cultivated vine in perfect natural balance? After being pruned to the proper node count, just the right number of shoots grow to the exactly the proper length and size – no shoot thinning, leaf removal, or hedging is necessary – the resulting canopy is in perfect proportion. The vine sets the right amount of fruit relative to photosynthetic capacity so that no cluster thinning is needed. Shoot growth ceases just before veraison and the fruit ripens to perfection. Nutrients and water are available in just the right amounts. Temperature is in the ideal range to fully ripen the grapes. Cane diameter, internode length, leaf area index, leaf size and color, and all the statistical measures of balance are achieved. The grower has minimal input. I'm not sure if this ever happens in viticulture, but I think it is important that every grower have a mental image of what a perfectly balanced vine would be like in his vineyard. It is a goal that a grower can strive for as we try to match the best soil, climate, and plant to minimize our viticulture inputs. But in the real world of growing wine, it is viticulture that gives us the ability to manipulate the vine into balance.

A balanced vine can be measured according to both qualitative and quantitative criteria. For the experienced viticulturist, there is certainly a visual sense of what a balanced vine looks like. It just looks "right" from the front and sides, up close and from eight feet away. These measures constitute all the visual cues that can be supported by a quantitative analysis, but it is based on experience and is adjustable according to the evaluation of visual analysis and collected data. So a small vine on high density spacing on shallow soils will have a different set of measures than a large vine on a divided trellis on wide spacing. Both vines can be well-balanced and have the potential to produce excellent quality fruit.

Tools to Balance Vines

Creating a balanced vine begins with balance pruning in the dormant season. Balance pruning is a concept developed by Dr. Nelson Shaulis, the esteemed research viticulturist at Cornell University. It is best explained by the authors (all disciples of Dr. Shaulis) of *Cultural Practices for Commercial Vineyards…*

Balanced pruning is a research-developed technique that uses measurement – the weight of canes (the preceding summer's shoot growth) – node counting and a pruning formula for estimating vine capacity.

It assumes the selection of well-exposed canes with fruitful buds. Each pruning formula (nodes per pound of cane prunings) is based on the growth and fruiting characteristics of the variety. Vine capacity can, and does, vary greatly between adjoining vines in a row. Balanced pruning, with an appropriate formula, avoids either overpruning or underpruning these vines of differing capacity and is the first step in achieving the annual desired quality, with maintained or improved vine capacity for the following year's crop.[1]

Dr. Shaulis developed these principles mainly for native vine species in New York. He made correlations between the amount of biomass a vine produced in a season and how much it might expect to sustain in the following year. In order to make this correlation, brush weights are taken while pruning and an appropriate number of buds or nodes are assigned according to those weights. On Concord, as well as on other native species, the formula is 30 + 10, meaning 30 nodes for the first pound of brush and another 10 nodes for each additional pound of pruning weights. Concord vines tend to be large in size and mass. It is not unusual to leave 120 nodes on a vine. Some recommendations are offered for hybrid varieties, generally lower than natives and based on relative cluster size. It is amazing how durable Dr. Shaulis' vine balance principles have proven to be over time. Dr. Terry Bates, the viticulturist at the Cornell University Research Lab in Portland, NY has refined many of these concepts – he states that,

"*…the goals and recommendations (by Dr. Shaulis and others) were based on two things…1) you appropriately adjust bud number based on vine size (i.e. vine size management) and 2) at a given vine size you maintain the balance between vegetative and reproductive growth (i.e. crop load management) so that desired fruit maturity could be achieved in every year. In the past crop load was determined strictly by dormant pruning with little regard for balance. 10+10 was usually too aggressive and resulted in undercropping vines. 30+30 would offer a big crop that could only ripen under ideal conditions. Eventually, 20+20 pruning was the "big winner" because it was properly cropped in cool years and slightly undercropped in good years."*

Adjustments should be made according to expected cluster weights on hybrid and *vinifera* varieties. Large clustered varieties like Seyval and Vidal should have lower bud counts. Terry suggests that wine growers seeking quality with hybrids and *vinifera* should expect to adjust crop in the summer to a proper leaf area to fruit ratio as part of creating vine balance. Shaulis recommended light dormant pruning in cold areas to accommodate possible winter injury and recognized that 20+20 would likely require flower-cluster thinning. He set a 60 node limit on 8' foot vine spacing.

As with the balance parameters offered by Dr. Richard Smart, another disciple of Nelson Shaulis, these formulas are not etched in stone. They are guidelines that each grower should adjust according to the specific performance of the vineyard. They are a starting point towards achieving vine balance. We will also see how total brush weights can be used to balance vines against other vine measures such as yield.

One frequently asked question about balanced pruning is if it is necessary to account for brush trimmed during the growing season. In a word, no. As long as brush is trimmed consistently

[1] Cultural Practices for Commercial Vineyards. T.D. Jordan, R.M. Pool, T.J. Zabadal, J.P. Tomkins. Miscellaneous Bulletin 111. Cornell University. 1966.

from season to season, brush weights should be consistent. It isn't necessary to weigh each vine. In a uniform block of vines, a few vines per acre will give a good indication of brush weights. Areas of notable weakness or vigor should be weighed and node counts adjusted accordingly. The grower should then make an effort to understand why vines are under or overly vigorous and the proper viticulture solutions should be applied.

There are a variety of viticulture tools that can help to bring a vine into balance. Site selection is the most important followed by viticultural tools such as variety/clone, rootstock, irrigation, soil and vine nutrition, vineyard floor management, crop load, etc. In the right application, they can have a dramatic impact on vine performance. Vine density and trellis choice are also important. Giving a vine room to stretch out and seek its natural balance point (nodes per linear foot of trellis) gives the grower a shot at high quality fruit. Yes, small and close is definitely in vogue now, but it may not always be the best or fastest route to quality.

There is very little in wine growing that yields to a formulaic approach and pruning is no exception. Balance pruning is not a substitute for the wisdom of viticultural experience to discern if a vine, as you stand before it, is in or out of balance and how then do you respond to it. There is no substitute for experience or imagination in pruning as you attempt to shape and guide a vine into balance.

Quantifying Vine Balance

The goal of vine balance is just the right ratio of leaf area (measured as brush weight) and crop load (measured as yield per vine). Can this balance be put into numbers? Richard Smart travels around the world spreading the gospel of canopy management and vine balance. His book *Sunlight into Wine* is considered to be the bible of canopy management. In it, a set of "golden rules" of vine balance are offered. Ratios comparing measurable components of the vine and yield, as well as specific vine characteristics, are the indicators of balance. These are guidelines for creating, adjusting, and measuring a balanced vine. All growers should understand that these guidelines are useful guidelines and not viticultural doctrine. Every vineyard, in fact, every vine is unique and only the grower of those vines can fully understand the cultural and environmental impacts on the vine that will affect balance. Smart's rules were developed for *vinifera* vines growing in an arid climate in Australia. These conditions alone vary dramatically from those experienced in the Eastern U.S. So accept the utility of the rules but approach with caution. And unfortunately, the grower must wait until a mature vine is available to determine balance with these metrics. Young vines offer insights into site capacity through their relative vigor, but these are just clues, not answers.

In the golden rules, ratios between measurable vine characteristics are used. Here are a few of the key values that can be used during the dormant pruning season:

- 12-16 nodes per pound of pruning weight
- 5-10 pounds of fruit per pound of pruning weight
- 0.2 – 0.4 pounds of pruning weight per linear foot of trellis
- 4-5 shoots per linear foot of trellis.

Note that Smart's 12-16 nodes/lb pruning weight is less than the Shaulis recommendation. Jeff tells me that in Santa Barbara 4-5 lbs of fruit/lb of pruning weight is the target so you can see right away the variability depending on region, vine balance and wine goals. There is another set of measures that apply to a full canopy and include shoot and internode length, leaf area index, leaf layers, proportion of exterior leaves and fruit and other more obscure indices. Fruit to brush weight and total brush weights may be the most important indices for a grower to collect and consider when determining size and judging balance.

Dr. Andy Reynolds, the respected viticulturist at Brock University in Ontario, recently summarized his view of vine balance…"*There is a general acceptance that high quality wines are produced from vineyards where balance is maintained between yield and vegetative growth. Balance is defined variously as either a range of crop loads (yield:cane pruning weight ratio of 5-12:1) or as a cane pruning weight of 20-30 g/cane. Vine balance may be achieved in vigorous vineyards through increased canopy length; for example, canopy division or increased vine spacing."* [2] This illustrates a few of the essential measure of balance and adjustments that are possible. But clearly, size and balance should be designed into any vineyard for the best possible viticulture outcome and wine quality.

On a recent trip to the Finger Lakes, wine grower John Santos at Hazlitt 1852 reminded me that cane weight is another good measure of balance. He asked us to look at dormant vines and pick out the best cane and then pulled out his little hand scale and started cutting and weighing canes. We all have our idea of what a proper cane looks like, but does it represent balance? A balanced cane according to Dr. Smart is 20-40 grams (0.7-1.4 oz). Train yourself to visualize a cane of this proper length and diameter.

If your harvest and pruning weight measurements fall generally between these boundaries, your vine is probably in pretty good balance. Confirm these with a visual analysis of vine and canopy size and position, crop load and growing conditions during the season. For hybrid and native varieties, these numbers can generally be increased up to 50%. Experience on a particular site will be the guide to setting consistent numbers that will balance production and quality.

The hard part, of course, is getting this incredible array of balance measures into alignment with each other. If you adjust one, you affect another, or many others. I believe the analogy of herding cats may be appropriate. Do not fixate on one or two but seek the best compromise between as many balance components as you can handle. If you find yourself outside of these parameters, then some difficult decisions must be made. An out of balance vine can be a real struggle to manage. Vines with too much vigor have canopy management issues that create disease, bud fruitfulness, and fruit ripening problems. An under-vigorous vine may lack productivity and also struggle to maintain a proper size canopy and fully ripen fruit. It is an irony of viticulture that vines too big or small may both struggle to ripen grapes properly. Adjustments must be made to bring the vine into balance. In the case of a small vine, the soil may need amending, more water and nutrients, or even a different rootstock choice may be necessary. If the vines yield >0.4 lb of pruning weight per foot of trellis, it may be necessary to divide the canopy to increase the node count. Recent research by Dr. Tony Wolf at Virginia Tech on managing vine vigor in Virginia

[2] Timing of Shoot Thinning in *Vitis Vinifera*: Impacts on Yield and Fruit Composition Variables. A.Reynolds, T. Molek, C. de Savigny. Amer J. Enol. Vitic. 56:4 (2005)

and North Carolina using rootstocks, cover crops, root pruning, and root restriction bags offer some hope for the high capacity site seeking balance. While not directly addressing this issue, Dr. Terry Bates' research on the effects of soil pH and rootstocks also shows influence on vine size. This is research helps us to understand the complex nature and interactive nature of the vineyard system, and how it might be manipulated to achieve certain viticultural goals.

Jim Law reminded me that cluster weights are important, especially in any cropping decisions based on two clusters per vine that will influence bud counts at pruning. He has found that on 6' spacing, double guyot training that 2-2.5 shoots per foot give him the optimal yields for quality without creating too much shoot vigor.

Lucie Morton never fails to remind me that pruning a vine is not a numbers game. Instead, it is visual based on experience and how a vine should look both before and after it is pruned. Unfortunately, it takes years to acquire this pruning instinct so until you are comfortable with pruning it is a good idea to balance prune a few fines as a check. There are many visual cues that guide an instinctive pruner and these must be learned, but the goals are the same.

All of this implies that a grower who cares enough about wine quality and the health of his vines will take the time to collect the data to develop a historical record and pruning continuum. I know of no grower who likes to collect data but if you believe it can serve a useful purpose maybe it won't be so painful. Choose random sentinel vines in each distinct vineyard block, mark them and set up an spreadsheet for the data, 2-3 vines per acre for large vineyards, more for smaller ones. In sections with problems or unique features, sample these specifically. Then collect the yield and pruning data each year. Apply the golden rules and see how your vines measure up.

While balance and uniformity are not the same thing in a vine, they interact closely to impact fruit quality. Vine balance is a component of uniformity. A lot is said these days about achieving uniformity in vineyards in order to achieve optimal grape quality. A key component of uniformity, at the vine and vineyard level, is an ability to bring balance at both levels. With mature vineyards normalized differential vegetative index (NDVI) or infra-red technology can be used to detect subtle differences in canopy size, and this can help to unmask a variety of potential problems such as water availability, nutrition, disease, phylloxera, or a host of other vine maladies. Alone or in combination, these problems will likely affect vine balance and should be taken into account during any vineyard analysis.

The Economics of Vine Size and Balance

The argument rages on… big vine vs. small vine. Which makes better wines and better profits? It is no secret that the cost of farming small vines is very high and that the practicality of an estate winery is almost required to support the viticulture. Yet, single canopies on wide spacing and divided systems in balance and meticulously farmed can produce wines of prodigious quality and discerning qualitative differences can be a matter of splitting hairs. One undeniable fact, however, is that the realities of vine size and balance are inevitably linked to bottle price. It is the trickle-down economics of wine. Smaller vines with small yields and "fussy" viticulture are more expensive to farm than big vines with high yields. In order to pay for the higher development and management costs, a higher price for wine is necessary. In essence, we are

talking about the difference between Cabernet Sauvignon in the Medoc and Chambourcin in SE Pennsylvania. Almost all of the viticulture and economic objectives are different but the goal is to make a really good wine.

The economics of the vineyard are different between independent and estate vineyards, often dramatically. The costs of development and operation need to be closely scrutinized, considering the diminishing return in perceptible wine quality and vine densities and costs go up as size decreases. I was astonished to see some Bordeaux chateau planting upwards of 15,000-20,000 vines per hectare. Where does this close spacing insanity end? 9 x 5 or a similar vine spacing and size may be the best return on quality and investment even though it may not make the very best wine.

I encourage anyone who is thinking of planting a vineyard to do the proper site assessment to determine soil capacity and potential vine size. At this point, there is no sample vine to take pruning weights from, so it becomes a matter of collecting and assessing data and then looking into a crystal ball. Having a good soil scientist and viticulturist behind your decisions will certainly help. A mature vineyard should be subject to regular analysis for vine balance through pruning weights and other important indices.

Finally, I encourage all growers to get off the farm and visit other vineyards known for excellence. There you will form a visual impression of what a balanced vine should look like. Talk to the wine grower and find out exactly what was done to achieve the balance in the vines. Ideally, visit around harvest and taste the grapes and analyze the canopy and crop level. Taste the wines for affirmation, preferably with the wine grower or with family and friends and good food and then go back and create your own balance and fine wines.

I'd like to thank Jeff Newton, Terry Bates, John Santos, and Jim Law for their help with this article. These are three of the best viticulturists in the business and between them they bring an incredible amount of experience and knowledge to bear on this complex topic.

Additional reference resources:

1. Smart, Richard and Mike Robinson. 1992. *Sunlight into Wine.* Winetitles.
2. Hellman, E.W. 2003. *Oregon Viticulture.* Oregon State University Press.
3. Wolf, Tony, et al. 2008. *The Wine Production Guide for Eastern North America*. NRAES

Recommended balanced pruning node counts for some varieties:

Variety	Formula
Cabernet Sauvignon	20+20
Cabernet Franc	20+20
Chardonnay	20+20
Riesling	20+20
Seyval	5+10
Vidal	15+10
Other Hybrids	20+10
Concord	30+10
Niagara	40+10

Some general pruning rules that I have learned over the years…

- Keep trellis full, vines in full production for maximum balance yield, quality and profit
- Anticipate. If something goes away how will you most quickly replace it
- Efficiency: prune well to maximize all vineyard operations and practices
- Have a concept of what you are pruning towards visually, philosophically and economically
- Prune for crop first, position second and always for vine shape, think a year or 2 ahead
- Stop, look and think: check and select fruiting wood first then prune around it
- Measure twice, cut once rule. Once you make the cut it's gone.
- Prune for sun canes
- Do not use laterals for fruiting wood
- Make clean cuts, close to the old wood
- When disbudding use the flat side of the shear against the older wood
- Check wood quality, especially in cane pruning for punky or dead wood
- Use the right tool for the right cut, if you are twisting or laboring you do not have the right tool
- Have the best and right tools and take good care of them. Sharpen blades multiple times each work day.
- Dress appropriately. A cold and wet worker does poor quality work.
- Leave ¾ - 1" from apical bud to cut on canes and spurs
- Cut with angle down and away from tip
- Do not let spurs get too long, look for and retain replacement shoots during the growing season.
- Leave 6-8" between end of shoots and canes
- Keep the head and shoulder area of the vine uncluttered, manage renewal positions carefully
- Prune to 5/8 inch or pencil diameter
- Vigorous vines: more buds. Weak vines: fewer buds
- Check for trunk diseases: Eutypa, Botryosphaeria, Petri disease, and crown gall
- Treat large pruning wounds
- Keep pruning tool clean, sharp and oiled

- Sanitize if there is disease: clorox in a spray bottle to treat tools
- Remove cluster mummies from the vine and the vineyard
- Do not cut wires or stakes
- Leave extra canes or spurs, double prune, insurance against winter injury or other damage
- Be careful when cutting away laterals, do not cut the bud.
- Remove old tendrils
- Remove old ties and junk on the trellis
- Mark vines with problems or that need to be re-visited right away
- Let only a very experienced, trusted crew member or leader command a pruning crew. If there are any doubts about the skill of a crew, you must be in the field working beside them to insure quality. It is not enough to work with them for a few minutes or an hour in the morning and leave.

Mark L. Chien
Viticulture Extension Educator
Penn State Cooperative Extension
http://pawinegrape.com/

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