

Canopy Management Concepts

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Canopy Management is a critical and complex component of growing winegrapes. Canopy management starts out with the interaction of the cultivar, vineyard site, seasonal climate, inputs and the trellis system. Very little in-season canopy management should be needed if these foundational variables are in balance. Learning all you can about these variables and how they interact can greatly reduce the amount of in-season manipulation of the canopy and labor necessary to grow quality winegrapes. You cannot make a quality wine without first having quality winegrapes!

Canopy Management should be practiced if one or more of these problems are recognized: (a)

1. When vigor is high and yields are low.
2. When grapes do not ripen sufficiently.
3. When skin color is inadequate.
4. When sprays lose effectiveness.

We manage the grape canopy to:

- manage vegetative vigor
- improve sunlight exposure to fruit, foliage and renewal buds
- increase airflow to reduce disease pressure
- improve the coverage and effectiveness of pesticide applications
- facilitate pruning and harvest
- promote ripening and increase fruit quality
- reduce plant-to-plant variability within the vineyard.
- balance crop to vine size to reduce chance of winter injury or death

The primary characteristics of an ideal grape canopy would include: (b)

1. 4-6 shoots per foot of canopy
2. A maximum of 1.5 – 2.5 leaf layers from side to side in the canopy
3. A minimum of 12 to 15 nodes per shoot, (15-20) (c)
4. 20-40% average canopy gaps [40-50% (c), 20-40% (d) or 20% (c)]
5. 50 – 75% of the clusters exposed to the sun
6. 3-6 sq. ft. of leaf area per lb. of fruit (c)
7. 0.2 – 0.4 lbs. of pruning weight per foot of canopy
8. 5 – 12 lbs. of fruit produced per lb. of prunings removed
9. 2.4” - 3.1” average internode length for *Vitis vinifera* cultivars (d)
3” - 6” average internode lengths for cold hardy hybrids (e)
10. Untrimmed shoot lengths of 4-6 ft
11. Crop load of 3-5 lbs. per foot of cordon (f)

12. 0.06 to 0.10 lb. per cane during dormancy (c)

13. Minimal amount of lateral shoot growth

14. Cessation of cane tip growth after veraison

. The primary methods used to accomplish Canopy Management include:

1. Dormant Pruning – starts out the process of canopy management by identifying the location and number of buds that will produce the coming season’s crop. A balanced pruning approach is used to determine the number of fruiting buds to keep per plant. Suggested balance pruning formulas will vary by cultivar. Examples are shown below: (b)

Grape Cultivar	# of Buds Retained for 1 st lb. of Prunings	# of Buds Retained for Additional lbs. Pruned	Maximum # of Buds Retained
Concord	30	10	60-70
Norton (GDC)	60	10	80-90
Seyval	20	10	30-40
Traminette	20	20	40-50
Vignoles	15	15	60-70

Note: Balanced pruning formulas typically do not work well with hybrids because of the increased fruitfulness of their buds close to the cordon. Cluster thinning may be needed later in the season to reduce the crop load.

“**Kicker Canes**” are sometimes retained at pruning to increase the initial bud count to de-vigor high vigor vines. They are normally trained below the canopy and cut off later in the season after a crop is formed.

2. Sucker Removal -of unwanted shoots from the base of trunks. (Make sure to leave one or more suckers if winter injury has occurred to the trunk). This is best done early in the season before the suckers reach 4” in length. Some growers will retain one or two suckers at the base of the plant each year to keep for insurance purposes to replace a winter damaged, crown gall infected or a generally poor producing trunk.

3. Water Sprout Removal – on the trunk up to head region of the vine. Excessive water sprout growth is an indication of excessive vigor and/or winter cane or bud injury. They too are much easier to remove when small.

4. Shoot Removal involves removing undesirable shoots at the base of spur or “non-count” shoots along the cordon followed by unfruitful shoots along count nodes on each spur. Excess fruitful shoots can also be removed. This is best done early in the season prior to berry set. The shoots are much easier to remove when 6-12” in length. Growers with frost prone vineyard sites should plan for shoot removal after the spring frost threat has passed. Shoot removal needs to be completed before the tendrils start to form.

5. Cluster Thinning – Removal of all clusters during the first two non-fruiting years and removal of excess clusters during fruiting years to keep from over-cropping. Over cropping of young vines will reduce the size of their root system. Unless vines are very vigorous, fruit should not be retained during the first and second growing season. It is recommended to remove flower clusters early when the shoots are 12” long. If the vines exhibit a lot of vigor, a small amount of fruit can be left during the second season, but it should be only one or two clusters per plant. (g)

An early cluster thinning can be done when the shoots are about 12” in length for table grapes and some wine grapes that exhibit poor fruit set. This early cluster removal should increase fruit set and increase berry size. Early cluster thinning is not recommended for cultivars that normally set tight clusters due to the increased chance of tighter clusters causing bunch rots.

For mature winegrapes thinning shortly after fruit set can also increase cluster size and compactness. Waiting until 4-6 weeks after fruit set will minimize this plant compensation factor.(h) This practice works well for tight clustered cultivars like Seyval, Leon Millot and Vignoles.

The following rules of thumb for after bloom cluster thinning can be used : (g)

- Remove all clusters from shoots less than 12” long.
- Leave one cluster per shoot for shoots 12-24” long.
- Leave two clusters per shoot for shoots more than 24” long.
- Remove small or poorly pollinated clusters
- Remove late emerging clusters that probably will not ripen
- Remove small clusters on the distill end of shoots

A late cluster removal (green harvest) can also be done around veraison for a final crop load adjustment and promote ripening. Leaving a heavy crop load on very vigorous plants and then adjusting the crop load at veraison can be used to slow the growth of very vigorous plants. Removing all or most of the clusters on low vigor vines before berry set will help to increase vine vigor for future crops.

6. Shoot Positioning - Untangling and combing the shoots for maximum airflow and sunlight interception. Shoot positioning can also be used to reduce vegetative growth by positioning the growing points downward. Upward growing canopies should be evenly distributed and **tucked** into catch wires as they grow. Highwire downward oriented canopies should be untangled and combed downward. Getting 75-80% of the canopy oriented downward below the cordon in a highwire system is a good rule of thumb. This allows sunlight to hit the renewal buds forming along the top cordon. Whether canopies are oriented upward or downward, positioning the canopies should be started early in the season prior to the tendrils becoming attached and several more times during the season.

7. Lateral Removal – involves removing lateral shoots that are shading the fruiting or renewal zone. This is commonly done from after bloom through veraison. Lateral removal can be very time consuming. Lateral growth can be over stimulated by early hedging or skirting.

8. Leaf Removal in the fruiting zone can improve air movement, spray penetration, ripening and wine quality characteristics. The potential of bunch rots is reduced for tight clustered cultivars. Leaf pulling is typically done on the shade side of the canopy which is either the east side of N-S rows and the north side of E-W rows. Some leaf pulling may be done on the sun side of very dense canopies. Leaf pulling is more adapted for upright growing canopies where there is a definite fruiting zone that can be easily exposed. There is no need to pull leaves unless the canopy and fruit will benefit. If there are more than 2 layers of leaves in the canopy and the fruit clusters are shaded, leaf pulling may be considered.

Leaf pulling is typically done within 3 weeks after fruit set with one or more additional passes before veraison to remove old and yellow leaves. Waiting until late in the season or after veraison can lead to severe sunburn to the fruit. One to three leaves are often removed at the base of each

shoot and around clusters. The goal of leaf removal is to expose 50-75% of the fruit to the sun and to increase air flow. (i) Removing laterals in the fruit zone is another way to expose fruit. Exposing the fruit can increase the potential of bird damage.

9. Topping – is often done just prior to veraison in upright training systems to increase sunlight into the fruiting zone and renewal bud zone. Shoots are typically trimmed at a height of 12” above the top wire. Waiting until just before or right after veraison will help minimize the amount of lateral growth that can result.

10. Skirting-downward positioned systems is also done later in the season. Downward oriented vines should be trimmed up about 1’ above the ground. Depending on cultivar, the plant will need anywhere from 12 to 15 leaves per fruiting shoot to properly produce and ripen the fruit. It is recommended not to skirt shoots after veraison since it may delay fruit and wood maturity. (i)

11. Shoot Hedging - is also done later in the season to upward growing canopies to reduce shading within the canopy and increase airflow by trimming each side of canopy within 1- 1.5’ feet of the trellis center. One school of thought suggests delaying until at least 30 or more days after bloom to avoid stimulating lateral growth. Another recommendation is early hedging when the berries are pea sized with a maximum of 6-12” removed. A second light hedging can be done 2 weeks later to trim laterals that may have been stimulated during the first hedging. Depending on variety, the plant will need a minimum of 12 to 20 leaves per fruiting shoot to properly produce and ripen the fruit. It is recommended not to hedge shoots after veraison since it may delay fruit and wood maturity. (c)

Note: Be aware that the vines will respond to topping, skirting and hedging. The shoot tip removal will stimulate growth of lateral shoots from the nodes immediately below the cut position. This is particularly true for vigorous shoots and removal prior to veraison. The earlier the trimming the more stimulated the regrowth of laterals.

Advice from experts can often vary as to exactly how, when or if you should do the many canopy management procedures listed here. The modern science of winegrape canopy management did not really start until the 1980’s. We still have a lot to learn. Climate, cultivar, site, trellis system and input management will greatly affect your canopy management techniques. Learning the concepts about canopy management will bring about a greater understanding of why they are done.

a. David Lowe, page 3, *Sunlight into Wine* by Richard Smart & Mike Robinson

b. *Midwest Grape Production Guide*, p. 46, 56

c. *Wine Grape Production for Eastern North America*, pg. 127-132

d. *Sunlight into Wine*, p. 28

e. Dr. Bruce Bordelon, Purdue Univ. Feb, 2007 MN Cold Climate Conference presentation

f. Dr. Tim Martinson, Cornell Univ. *Shoot and Canopy Management*, Finger Lakes Vineyard Notes, 7-27-08

g. *Midwest Grape Production Guide*, p. 59

h. *Wine Grape Production for Eastern North America*, pg. 140

i. *Midwest Grape Production Guide* p. 60-61

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