

Canopy Management

Viticulture Seasonal Training Module



Primary ITO
KNOWLEDGE TO GROW

Introduction by James
Crockett
Primary ITO Training
Advisor

Contents:

- [Introduction](#)
- [What is a grapevine canopy](#)
- [How to carry out canopy management](#)
- [Why we carry out canopy management](#)
- [How the plant responds to canopy management](#)
- [Glossary](#)



Kia ora and welcome to our viticulture
training resource on canopy management

You will learn how to look after grapevines during
November and December.

Grapevines are an amazing plant, and we hope you enjoy
learning about how we manage vine growth to grow New
Zealand Wines.



Video credit – New Zealand Wine

He kai kei aku ringa
*‘There is food at the end of
my hands’*



Photo courtesy: New Zealand Wine

Welcome

Over the year there are four main times when work is carried out. You are going to learn about canopy management.

HARVEST
February - March

WINTER PRUNING
May - September

THINNING
January - February

CANOPY MANAGEMENT
November - December

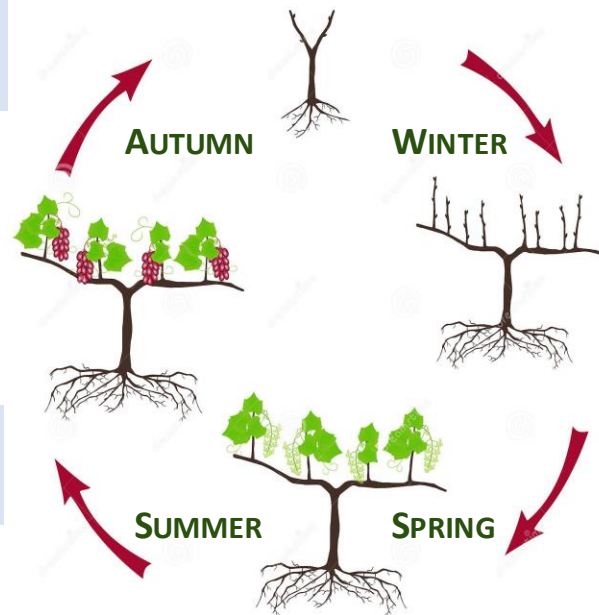


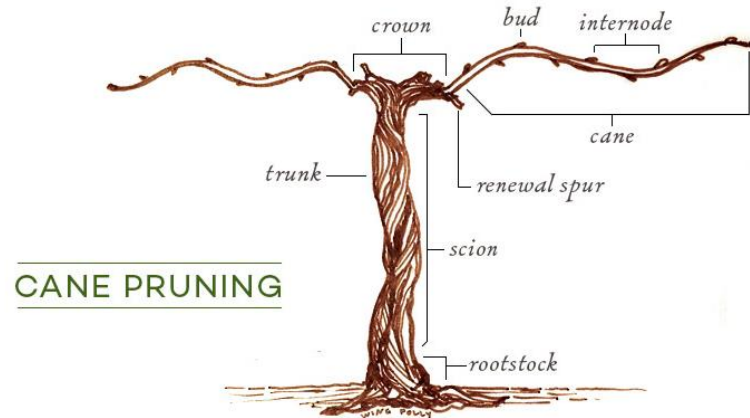
Image courtesy: www.dreamstime.com



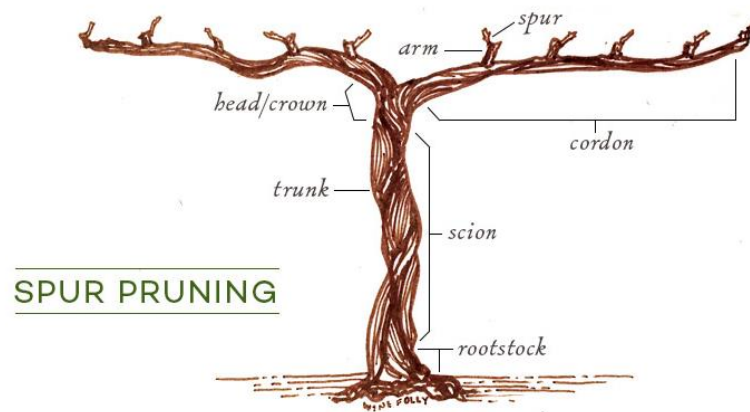


What is a grapevine canopy

What makes up a grapevine?



CANE PRUNING



SPUR PRUNING

Image courtesy: <https://somersetwinecompany.com/blogs/events/learn-to-prune-a-grapevine-pruning-workshop-lunch-sat-9th-feb>



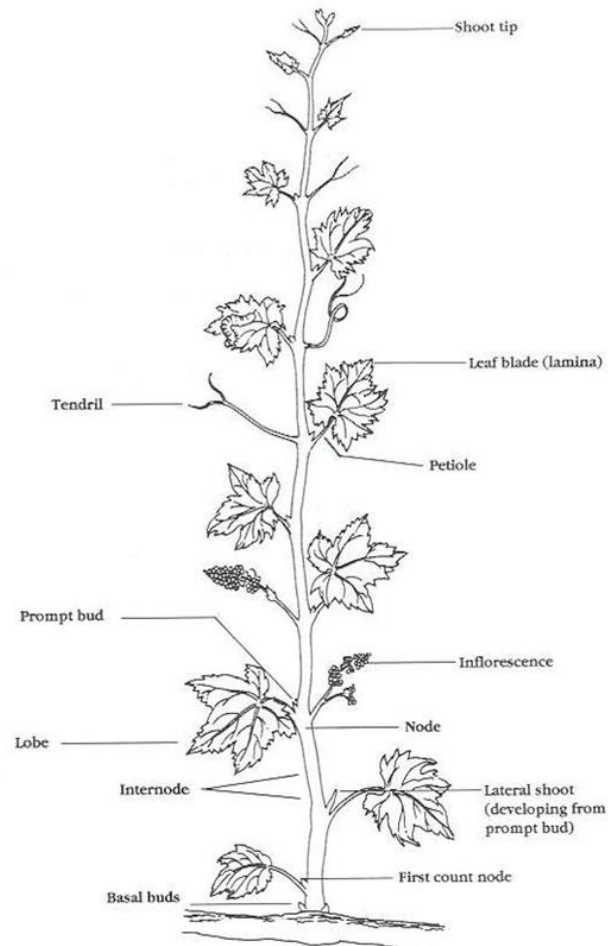
What is a grapevine canopy?

A grapevine's canopy consists of all parts of the plant that are above the ground and includes:

- Shoots
- Leaves
- Petioles
- Shoot stems
- Shoot tips
- Lateral shoots
- Tendrils

Also includes:

- Fruit/ inflorescence
- Trunk
- Cordons
- Canes



Vineyard Trellis Components

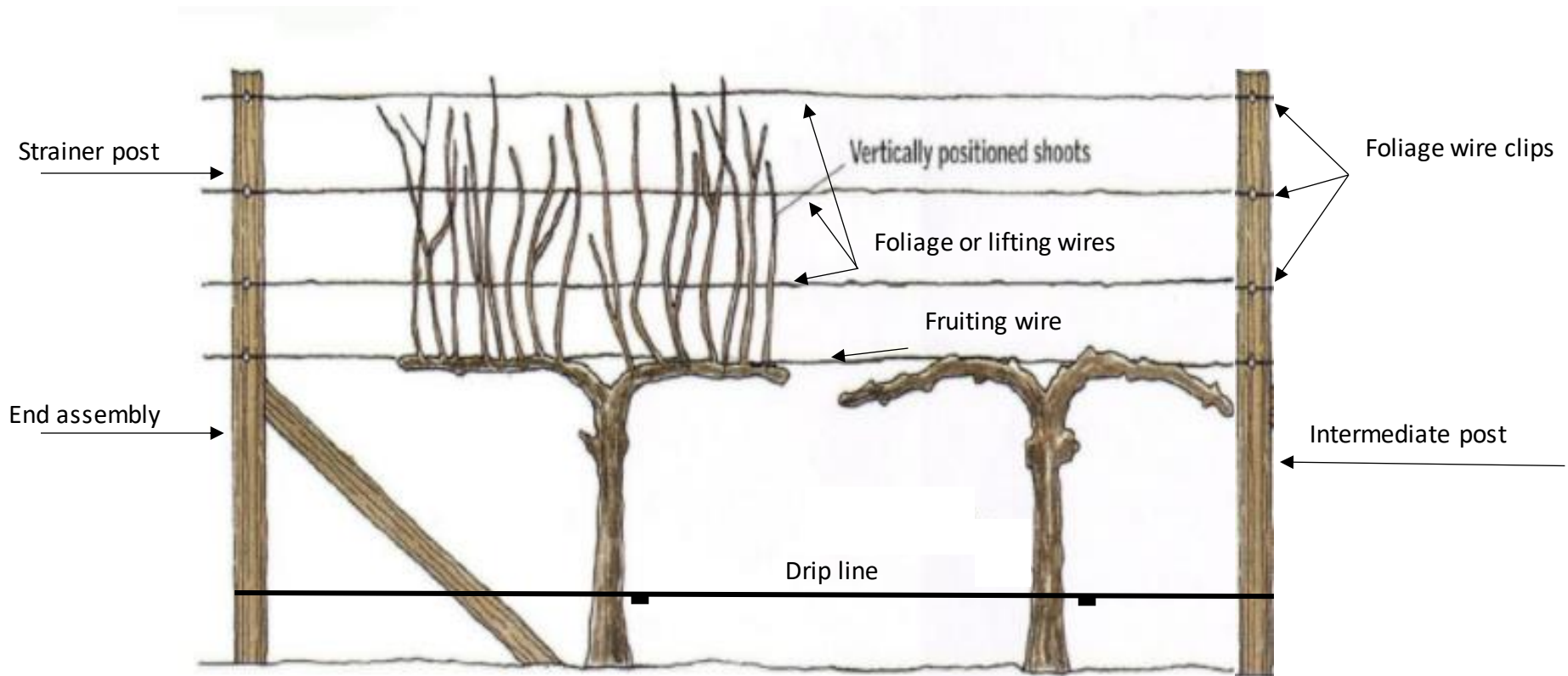


Image courtesy: <https://fliphtml5.com/ulmf/evag/basic/51-56>



What is canopy management, and why do we carry it out?

- Canopy management is carried out every year.
- **Aim:** To shape the canopy to capture as much light as possible but also allow air movement around and within the plant.
- Light is important for fruit production while air movement is important for pest and disease control.



Photo courtesy: López-Granados, Francisca. 2020



Photo courtesy: López-Granados, Francisca. 2020



How to carry out canopy management

Learning Outcomes:

- Check equipment availability and readiness for use.
- Position shoots or branches. Lifting and lowering foliage wires.
- Implement measures to optimise fruit quality.

Key words

SHOOT DEVIGORATION



<https://psuwineandgrapes.wordpress.com/2017/05/19/early-season-grapevine-canopy-management-part-i-shoot-thinning/>

Taking an upwards growing shoot and bending them down to reduce their growth rate.

SHOOT V CANE



Images courtesy:

Kirkwood, G. Personal Collection. 2020

Shoots are green, actively growing and able to carry out photosynthesis early in the season.

Canes are brown, not actively growing and preparing for the winter ahead.

FRUITING ZONE



Image Courtesy:

<https://grapes.extension.org/leaf-removal-on-grapevines/>

A horizontal band running along the row where all the bunches are located.

Is created so that certain vineyard operations (i.e. leaf removal around the bunches and harvesting) can be simplified.

LATERAL GROWTH



<https://www.lodigrowers.com/minimizing-and-managing-water-sprouts-and-suckers/>

Lateral growth occurs when the shoot tips are removed. This causes the lateral buds further down the shoot to burst and grow.



Personal Protective Equipment (PPE)

PPE is equipment, clothing or anything else used to protect a person from injury or harm while they are working.

- **Safety glasses**

Essential in any vineyard situation to prevent you being poked in the eye by shoots and canes, or from foliage wires that make brake while wire lifting etc...

- **Sun hats**

A good sturdy wide-brimmed hat is ideal for vineyard work as it not only protects your face, but your ears and the back of your neck as well.

- **Gloves**

Gloves can be an essential item as wire lifting can cause blisters if you are carrying out the task for a long period of time. Best to look after your hands!

- **Shoes or Boots**

A good sturdy pair of work shoes or boots is ideal, however not essential. As long as you are wearing closed-in footwear you will generally be okay to work in a vineyard.

- **Sunscreen**

Due to the harsh New Zealand sun a high quality sun screen is very important, and should be applied on a regular basis.

- **Water**

Last but not least, do not forget to drink plenty of water to stay hydrated so you can work better.



How to remove unwanted growth

There are many ways to remove unwanted growth. Below are six ways which are carried out every year

1. **Shoot thinning:** The complete removal of unwanted shoots.
2. **Shoot trimming:** The part removal of unwanted shoots.
3. **Shoot devigoration:** Bending shoots down to slow the growth of the shoots.
4. **Wire lifting:** Sets the best position of the shoots.
5. **Leaf plucking:** This removes the leaves from around the fruit. It allows the fruit to get more light and air movement. It also allows spray (for pests and diseases) into where the fruit is.
6. **Trellising:** Structures, generally made of posts and wire, that are used to train the vines to achieve a better canopy shape



Before shoot thinning: spur-pruned (top) vs. cane pruned (bottom) in Grüner Veltliner

Photos Courtesy: <https://psuwineandgrapes.wordpress.com/2017/05/19/early-season-grapevine-canopy-management-part-i-shoot-thinning/>

The ideal grapevine canopy

The ideal canopy is one with:

- Very low leaf shading of internal leaves.
- Ideal shoot positioning.
- 40% canopy gaps.
- 60% fruit exposure.
- Shoots that are approximately 1.2 m in length.



Photo courtesy: Kirkwood, G. Personal Collection. (2018)

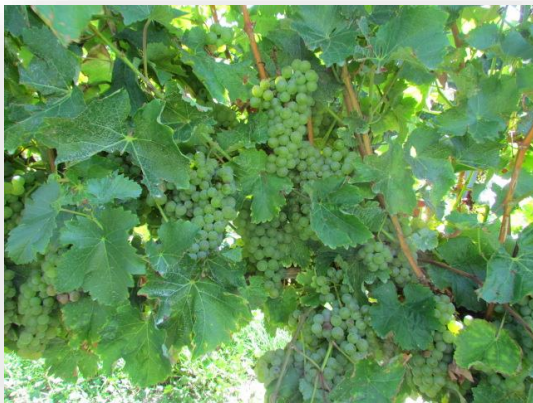


Photo courtesy: Kirkwood, G. Personal Collection. (2018)



Photo courtesy: Kirkwood, G. Personal Collection. (2018)



A dense grapevine canopy

If the canopy is too dense it will cause problems for the grapevine:

- Increased disease . Spray cant get in and air cant circulate and it will be more humid inside the canopy.
- Reduced quantity of fruit. This is due to poor bud initiation when they don't get enough light
- Reduced quality of fruit. This is due to the fruit being shaded from the sun.

THE DIFFERENCES BETWEEN OPEN AND DENSE CANOPIES

	Dense canopy	Open canopy
Sunlight	Increased shading produces low light levels	Very limited shading of leaves with good fruit exposure
Temperature	Milder temperatures within the canopy	At or just below surrounding air temperature
Humidity	High humidity	Only slightly higher than surrounding air
Airflow	Very low air movement	Good air flow



Canopy management techniques

Shoot positioning and wire lifting

This is when two or three sets of wires are moved upwards throughout the season. The wires help position the shoots so that sun can reach the fruit and improves air movement around the canopy.

- Means the shoots are even and fruit is not shaded by other fruit.
- Makes it easier to trim shoots and pluck leaves.
- Grows more fruit as the light is able to get to the flowers.

This is also known as vertical shoot positioning (VSP).



Canopy before wire lifting

Photos courtesy: KirkWOOD, G. Personal Collection. (2018)



and after lifting



Canopy management techniques

Shoot thinning

Shoot thinning is a task carried out by most vineyards to remove excess shoots from the canopy.

Reasons for undertaking shoot thinning are:

1. Better balance between the amount of fruit and the amount of foliage.
2. Increased sunlight onto the fruit, along with increased air movement around the fruit and leaves.
3. To space the shoots and fruit out more uniformly along the length of the cane.
4. To ensure the potential for disease is kept to a minimum.
5. To reduce the drying time of the leaves and fruit, therefore improving spraying efficiency (Goldammer, T 2019).



Shoot thinning bilateral cordons – before (A) and after (B).
Photo source: Progressive Viticulture, LLC ©



Canopy management techniques

Shoot thinning

The process of trimming the top and sides of the canopy. This is done to prevent cross-row shading and to prevent the canopies from becoming too dense. Shoot trimming is usually carried out in November to January after fruit-set, or as required (Goldammer, T 2019).

Trimming does not reduce vine vigour, instead it tends to promote growth by stimulating the lower buds to burst, therefore encouraging lateral growth.



A mechanical trimmer in action:

Video source: https://www.youtube.com/watch?v=K5lhY_Xl1zA



Photo Courtesy:

https://winesvinesanalytics.com/sections/printout_article.cfm?article=feature&content=196069



Canopy management techniques

Leaf plucking

This task is typically carried out in and around the fruiting zone of the grapevine for the following reasons:

- Leaves are removed from in and around the fruiting zone to improve light exposure to the bunches.
- Improves airflow and circulation which in turn improves spray penetration.
- Can be easily mechanised, but the best results are achieved from leaf plucking by hand.

Here is a good video for manual leaf plucking: https://www.youtube.com/watch?v=_yZ0KsbFTt0



Before fruit zone leaf plucking

After fruit zone leaf plucking

Video Source: <https://www.youtube.com/watch?v=qjc5igJ0wXY>

Photos courtesy: Kirkwood, G. Personal Collection. (2018)





Why we carry out canopy management

Learning Outcome:

- Describe the intentions of vegetative growth control in terms of canopy Management activities.

Key words

INFLORESCENCE



Photo Courtesy:

Kirkwood, G. Personal Collection. (2012)

The inflorescence of the grapevine is a cluster of flowers on a branch, or a system of branches.

FRUITFULNESS



Photo Courtesy:

Kirkwood, G. Personal Collection. (2012)

Buds are said to be fruitful if they have at least one bunch. But many buds have two or more bunches, so bud fruitfulness is often said to be the average number of bunches per shoot.

YIELD



Photo Courtesy:

Kirkwood, G. Personal Collection. (2015)

The amount of grapes produced per unit area, usually measured as tonnes/ha.

VÉRAISON



Photo Courtesy:

<http://winerabble.com/viticulture-101-veraison-in-the-vineyard/>

Stage of ripeness signalling the start of berry softening and colour change (pronounced “ver ray zon,” French).

APICAL MERISTEMS



Photo Courtesy:

Kirkwood, G. Personal Collection. (2020)

This is the scientific name for the shoot tip where active growth is continually occurring via rapid cell division.



Benefits of canopy management

There has proven to be many benefits to carrying out canopy management. Some of the benefits are as follows:

- Improved wine quality through greater light exposure by the fruit, via vertical shoot positioning and leaf removal.
- Increased grape yields due to improved bud fruitfulness due to them being exposed to direct sunlight during inflorescence initiation.
- A reduction in pest and disease due to improved air flow through the canopy, therefore reducing the internal canopy humidity.
- Reduced cost of production due to improved ease of mechanisation (Smart & Robinson, 1991).



Photo Courtesy: Kirkwood, G. Personal Collection. (2016)





How the plant responds to canopy management

How do grapevines respond to canopy management?

There are two key ways in which a grapevine will respond to canopy management activities:

- **When the apical meristem is removed:**

By removing the apical meristem or shoot tip, this will encourage the buds lower down the shoot to burst and start growing producing lateral growth.

- **When excess fruit bunches are removed:**

By removing excess bunches at véraison, particularly those that are lagging behind with development, will stimulate the vine to direct all its reserves and developing resources into the remaining fruit.

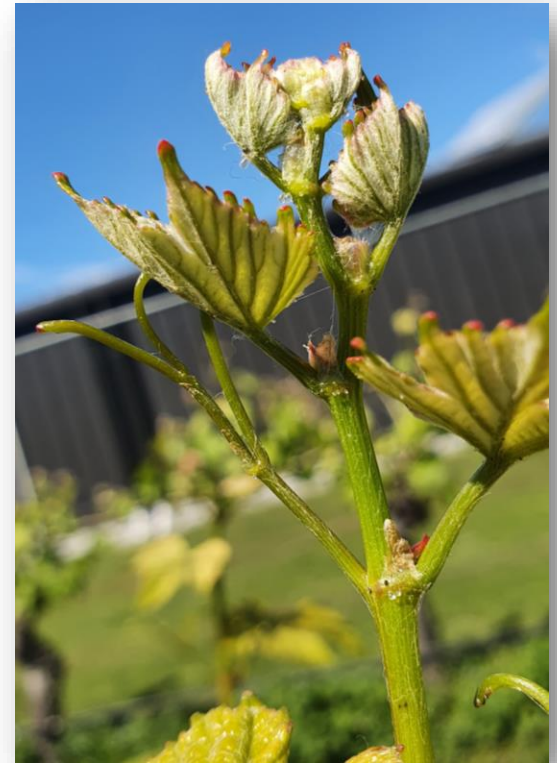


Photo Courtesy: Kirkwood, G. Personal Collection. (2020)





Glossary

Glossary

A

APICAL DOMINANCE

The tendency of the central mid-section region of a grapevine shoot, up to the apex, to exhibit the most growth and development of foliage, tendrils and bunches. Grapevine apical dominance also inhibits the growth of lateral buds.

APICAL MERISTEM

The growth cells located at the grapevines shoot tips, and have the ability to differentiate and continue growth. Unlike other plants, grapevines do not have terminal buds that limit growth.

B

BUD

The undeveloped, primordial grape shoot that is usually located along nodes of a cane.

BUD FRUITFULNESS

The ability of the bud to produce fruit and measured as bunches per shoot or weight of fruit per shoot.

C

CANE

A mature woody, brown shoot as it develops leading up to leaf fall. Canes were last year's fruiting or renewal shoots. The buds on the canes will produce this season's fruiting shoots.

CANE PRUNING

System of cutting the vine down to one or more 1-year old canes that will produce new shoots.

CANOPY

All the above-ground parts of the vine, especially its leaves, shoots and tendrils etc...

CANOPY MANAGEMENT

Viticultural techniques designed to manipulate the canopy to achieve a specific end, usually optimizing the quantity of grapes and quality of wine.

CROP LOAD

Crop load is used to describe the ratio of yield to the pruning weight or leaf area (i.e. optimal vine balance).

D

DEVIGORATION

Controlling high vine vigour, by using a devigorating rootstock, limiting irrigation, planting on shallower soils, or training the shoots downward.

DORMANCY

The stage when the vines are not actively growing. Dormancy is activated for grapevines when the average air temperature falls below 10°C. Vines generally require a minimum of 60 days of dormancy.

F

FRUIT (BERRY) SET

When the grapevines fertilised flowers 'set' to become berries, and eventually grapes.

FRUITING WOOD

The vine's one year old wood. This wood will produce the current season's crop as grapevines can only produce fruit from one-year-old wood.

FRUITING ZONE

A horizontal band running along the row of vines, wherein all of the bunches are located. Many grape growers will often aim to create a tight or narrow fruiting zone so that certain vineyard operations (such as leaf removal around the bunches and harvesting) can be simplified.

H

HEDGING/TRIMMING

Pruning during the growing season to remove shoot tips and laterals, retaining adequate nodes and leaves for fruit and wood maturation.

I

INFLORESCENCE

The inflorescence of the grapevine, is a cluster of flowers on a branch or a system of branches.

INTERNODE

The portion of the shoot or cane between two nodes.

L

LATERAL

Side branches of a shoot or cane.

LEAF

The grapevines leaves are the vine's primary engine for photosynthesis. Although the grapes get some of their sugar from the carbohydrates stored in the perennial wood of the vine during the earliest stages of ripening, the vast majority of sugar production is via photosynthesis carried out by the leaves during the middle and later stages of ripening.

LIGNIFY

The process that begins late in the summer, whereby shoots accumulate a polymeric compound called lignin, which allows the stems to become resistant to cold and water loss. The process where the green shoots turn from green to yellow, then to brown on maturity.

M

MACROCLIMATE

Regional climate, typically measured in square kilometres, depending on geographic factors.

MESOCLIMATE

Climate of a particular vineyard, which may differ within the regional climate because of factors such as elevation, slope, aspect, etc...

MICROCLIMATE

Canopy climate, within and immediately surrounding a plant canopy, which can show differences between small areas within the canopy, i.e. sunlight exposure, humidity, etc...

N

NODE

The thickened, swollen portion of a shoot or cane where the leaf and its compound bud are attached, including bunches and tendrils.

P

PHOTOSYNTHESIS

The formation of carbohydrates (sugars, mainly glucose and fructose) in the vine (mostly stored in the fruit) from water and carbon dioxide, by the action of sunlight on the chlorophyll in the vine (produced mostly in the leaves).

PRIMORDIAL SHOOTS

The buds which develop on this year's fruiting wood. They will give rise to the fruiting shoots for next year.

PRUNING

Pruning is the removal of portions of the vine for the purpose of maintaining its size and productivity. The size and productivity is maintained by ensuring that the vine retains a proper number of fruiting buds.

R

RENEWAL SPUR

A cane pruned to one or two nodes, generally on an arm or cordon. Its primary purpose is to position a cane for fruiting the following season.

ROOTSTOCK

A cutting taken from a vine (usually Native American or American hybrid) and cultivated to serve as a root system for a grafted vine. Hence a grafted vine consists of a scion (the above ground growth) and a rootstock (the below ground growth).

S

SCION

A cutting (or bud wood) taken from a vine (usually *Vitis vinifera*) and grafted onto a root system from another vine (usually native American or an American hybrid).

SHOOT

The green, leafy growth developing from a bud on a cane, spur, cordon, or trunk. The developing growth of the shoot is the source of all of the vine's leaves, stems, tendrils, flowers & fruit.

T

TENDRIL

A curled structure arising from some nodes of the shoot and capable of attaching itself to other portions of the vine and non-vine structures (like the trellis).

TRAINING

Shaping a vine into a specific shape, usually to effect some form of canopy management. Training systems are often referred to by indicating the location of the fruiting wood in terms of its relation to the vine's perennial wood (trunk, head or cordon) and by indicating the length of the fruiting wood (spur or cane).

TRELLIS

The hardware support structure which supports the vine and the crop.

TRUNK

The main upright structure of the vine from which cordons, shoots, & canes arise. Vines may have more than one trunk.

V

VARIETY

A clone, or series of related clones, propagated vegetatively from a single parent plant (monoclonal origin) or several genetically similar parents (polyclonal origin). Cultivar is used interchangeably.

VÉRAISON

Stage of ripeness signalling the start of berry softening and colour change (pronounced “ver ray zon,” French).

VIGOUR

Vigour is the quality or condition that is expressed in rapid growth of the parts of the grapevine. It essentially refers to the grapevines rate of growth. It depends on a combination of factors, including soil type, texture, and depth, water and nutrient availability, and variety choice. Inherently, some grape varieties are more vigorous (e.g., Syrah and Sangiovese) than others, which in turn can produce canopies with an excess amount of leaf area that require more intense **canopy management**.

VSP (VERTICAL SHOOT POSITIONING)

A method of vine training in which annual canes are tied horizontally to the wires and all new shoots are positioned vertically.

W

WATER SHOOT

Water shoots arise out of old dormant buds left on the permanent wood of the vine (trunk or cordons).

Y

YIELD

The amount of wine or grapes produced per unit area, usually measured either as ton/acre, tonnes/ha or, in much of Europe, hl/ha. Many factors such as planting density, pressing regime, grape variety, and style of wine affect the conversion of weight of grapes into volume of wine but 1 ton/acre is very approximately equivalent to 17.5 hl/ha.

References:

- Goldammer, T. (2019). *Grape grower's Handbook: A Guide to Viticulture for Wine Production* (2nd Ed.). Apex.
- Smart, R., & Robinson, M. (1991). *Sunlight into Wine*. Winetitles.
- Leão, Patrícia Coelho de Souza, Nunes, Bruna Thaís Gonçalves, & Lima, Maria Auxiliadora Coelho de. (2016). Canopy management effects on 'Syrah' grapevines under tropical semi-arid conditions. *Scientia Agricola*, 73(3), 209-216.
<https://doi.org/10.1590/0103-9016-2014-0408>
- López-Granados, Francisca & Torres-Sánchez, Jorge & Jiménez-Brenes, Francisco & Oñeca, Oihane & Marín, Diana & Loidi, Maite & De Castro, Ana & Santesteban, Luis. (2020). Monitoring Vineyard Canopy Management Operations Using Uav-Acquired Photogrammetric Point Clouds. *Remote Sensing*. 12. 2331. 10.3390/rs12142331.

Photos:

- Slide 3: <https://grapes.extension.org/canopy-management-for-hybrids-hudson-river-umbrella-umbrella-kniffen/>
- Shoot thinning: <https://www.lodigrowers.com/shoot-thinning/>
- Shoot trimming: https://winesvinesanalytics.com/sections/printout_article.cfm?article=feature&content=196069
- Bunch thinning: <https://www.youtube.com/watch?v=oZ3pVgzBsRI>



Noho ora mai



NEW ZEALAND WINE
PURE DISCOVERY