



Cold Climate Grape Management: Dormant Pruning

Madeline Wimmer- Extension Educator, Fruit Production

Introduction

Each woody fruit crop has unique requirements for dormant pruning. Fruit trees are pruned differently than fruiting shrubs, and fruiting vines have much different requirements. For example, it's common for growers to remove nearly 90% of a grapevine's biomass annually. If applied to a fruit crop like an apple tree, this would lead to excessive vigor, but in grapes creates for a healthy fruiting vine. To the unfamiliar eye, many well-managed grapevines may be mischaracterized as little trees. In actuality, canopy management techniques and dormant pruning maintain vine shape.

Left alone, most grapevines would exhibit a sprawling or disorganized growth habit with fruit and vegetation on the canopy outside and blank, unproductive wood on the inside as it aged. Unpruned grapevines produce excess overlapping shoots leading to shading and decreased airflow, negatively affecting fruit development.

Dormant pruning is the first step to canopy manage and ultimately contribute to production sustainability for growers by influencing disease incidence, vine management, winter injury repair, and fruit quality.



Images: A wild grapevine, *Vitis sp.*, growing near a bike path intermixed with Virginia creeper, *Parthenocissus quinquefolia* (left) and a cold climate hybrid grapevine trained as a spur pruned, single curtain, bilateral cordon known as Vertical Shoot Positioning (right). Photos by Madeline Wimmer.

The following document provides information about grapevine anatomy, training systems, trellis systems, pruning techniques, factors influencing pruning, spur lifecycle, spur renewal, whole vine dormant pruning, winter injury, and tools necessary to dormant prune cold climate grapevines.

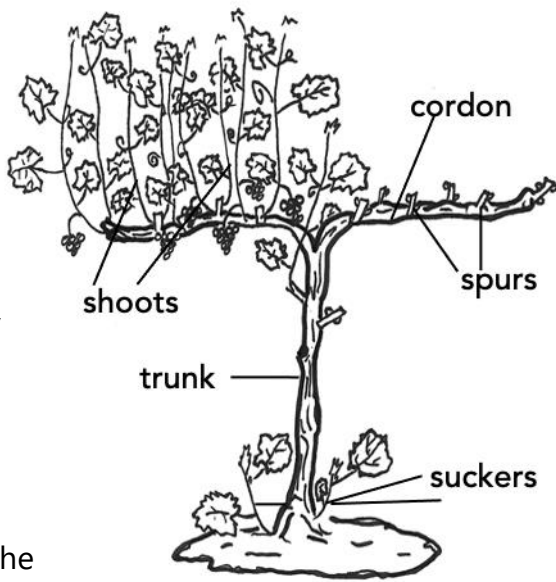
Vine Anatomy

Shoot—current season’s growth producing leaves, tendrils and clusters.

Cane— a matured shoot after one growing season. Shoots emerging from canes are typically fruitful.

Fruiting zone— region where fruit clusters exist.

Cordon— two-year-old+ wood, the “arms” that support the fruiting zone.



Dormant Bud— composed of overlapping immature leaves and clusters. Where shoots originate.

Cluster— the compound inflorescence that blooms and sets fruit.

Watersprouts— latent buds originating from the trunk, cordon, or other older woody parts of the vine.

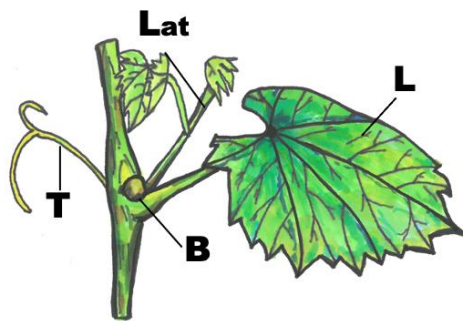
Suckers— shoots originating from the trunk crown/base.

Spur— a cane pruned back to 2-5 buds. Spurs exist in the fruiting zone and can “stack” on top of older spurs from previous years.

Trunk— semi-permanent, or permanent structure providing support for the arms and canopy.

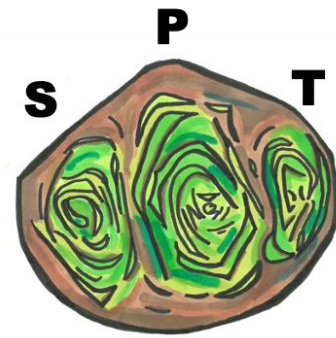
Head— grapevine trunk top where the cordons/arms and trunk meet.

Nodes are regions along a shoot where leaf attachment occurs/occurred. Each node also contains a lateral (side) shoot, tendril, and developing bud that will produce shoot(s) and potentially clusters the following growing season.



Grapevine node- where leaf (L), compound bud (B), lateral shoot (Lat), and tendril (T) originate.

Grape Compound Buds contain three separate buds, two of which, the primary and secondary, are fruitful. Living buds are a vivid green when cut in half as shown here.



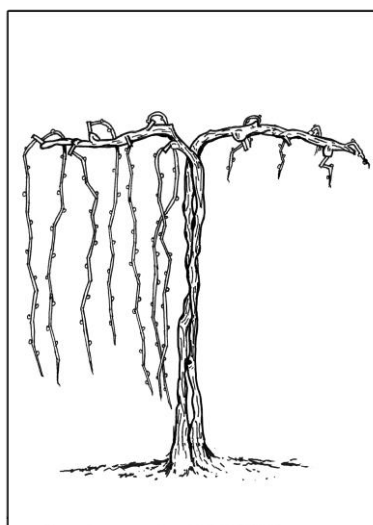
Compound bud showing the primary (P), secondary (S), and tertiary (T) buds.

Training Systems dictate the physical manipulation of a grapevine into a particular size, shape, and orientation. Training systems can help to maximize light interception and airflow; facilitate pruning, canopy management, harvesting techniques, and ergonomic needs.

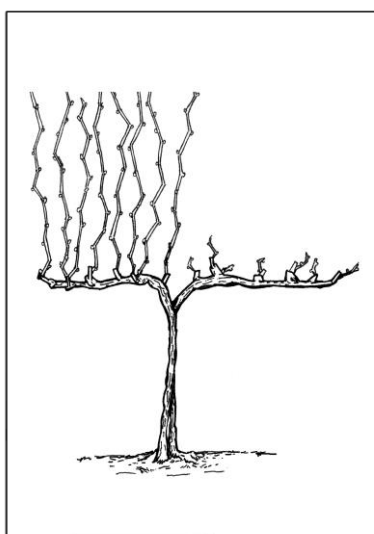
For the examples shown below, vines are trained in multiple years, starting with trunk establishment (year one), fruit zone establishment (cordon for spur pruned vines and cane growth for head pruned, year two), followed by spur establishment for spur pruned vines (year three). Each part is created by training a shoot in a particular height and orientation, which becomes woody and thicker each year.

Each system influences post establishment pruning. For downward shoot oriented, **spur pruned** training systems, 3-4 buds per spur are typically left. Upward shoot oriented systems are pruned to 2-3 buds per spur. For **head pruned** systems, 1-2 healthy canes originating near the trunk top (i.e., head) are selected to replace the previous year's fruiting canes.

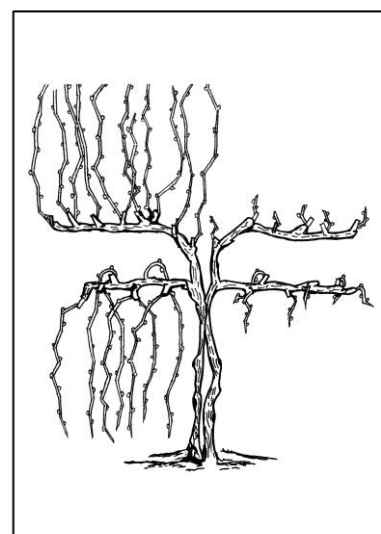
Spur Pruned Training Systems



High Wire Cordon

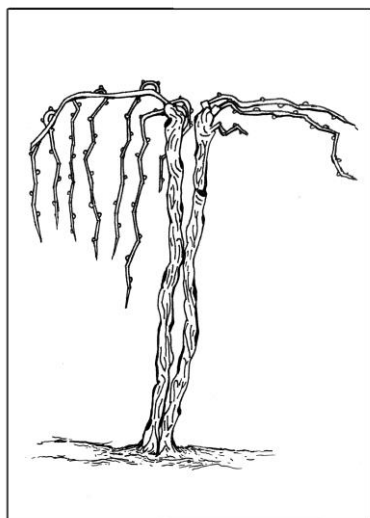


Vertical Shoot Positioning

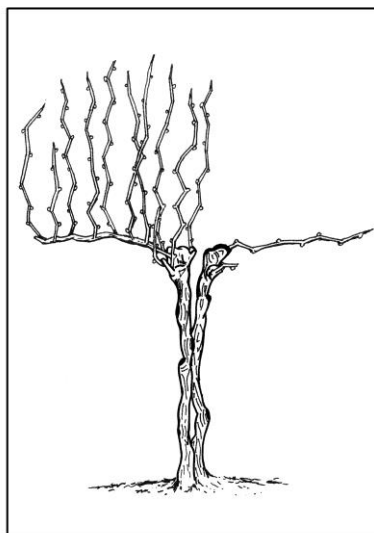


Scott Henry

Head Pruned Training Systems



Umbrella Kniffen



Guyot

Note: there are many ways to train grapevines on various structures (e.g., home pergola). Each vine may be pruned slightly different, but the key concepts remain the same.

Trellis Systems create the physical framework to guide grapevine growth. They are typically composed of wooden or metal posts, wires, anchors, fasteners, metal clips, and other hardware. They can be two-dimensional or three-dimensional.

End posts– posts installed at the row ends.

In-line posts– posts installed between vine panels (every 3-4 vines). Can be wood or metal.

Training pole– supports the grapevine trunk and maintains its alignment.

Training/fruiting wire– a single wire set at a specific height to support the fruiting zone.

Catch wire– double wire that creates a basket for shoots to grow into to support upward growth for Vertical Shoot Positioning (VSP) trained grapevines.

Earth anchor– one option to provide trellis counter tension. Prevents trellis from collapsing inward.

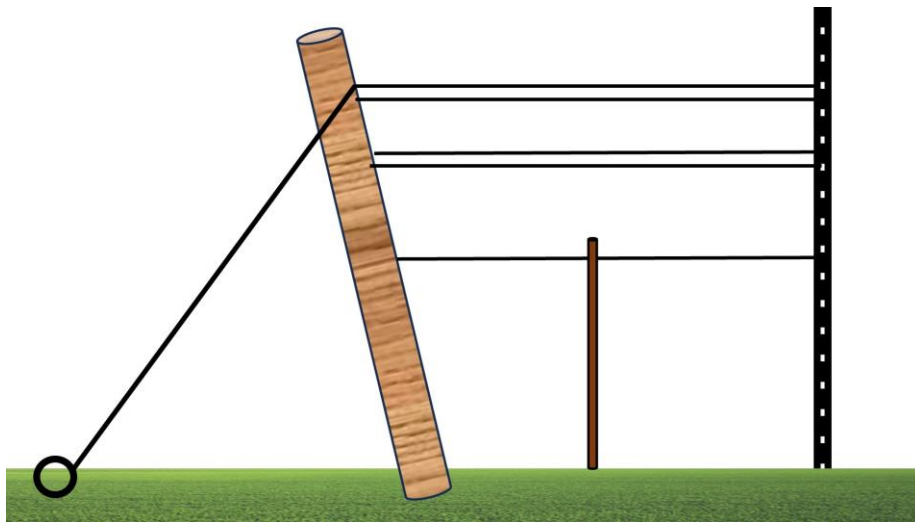


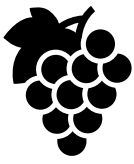
Image: a two-dimensional trellis example that can support Vertical Shoot Positioning trained grapevines.

Dormant Pruning grapevines removes or reduces portions of woody vine parts, including canes, cordons, and the trunk when necessary. Maintenance pruning is done annually to reduce total bud/shoot count, rejuvenate old spurs and cordons, and repair grapevine winter injury.



Pruning Technique

- Leave enough room (~1/2 inch) above the terminal bud below the pruning cut to prevent the bud from drying out.
- Cut canes diagonally to allow water from rain or melting snow to run off and prevent rot.
- When cutting older wood like cordons or trunks, avoid leaving a stubble which can create an environment for pathogens.
- After pruning, detach and remove all pruned canes from the trellis wire and off the ground.
- Remove all old tendrils and clusters from vines and trellis wires. Tendrils will build up over time and clusters can harbor diseases.



Node/bud retention:

- At each cane **node** there is a dormant bud, which will break in the spring and develop one or more shoots (secondary shoots typically removed) that can bear 2-3 clusters per shoot during the growing season. The number of buds retained at pruning is related to the desired crop load, which is determined based on observed vine size, vigor, and any winter injury that has occurred.
- Growers can calculate the number buds to retain based on the **Balanced Pruning** formula, which is related to the previous season's cane pruning weights for a few representative grapevines. Refer to the **Growing Grapes in Minnesota Chapter 7** to learn more about Balanced Pruning.
- Bud count can also be estimated at 4-6 buds per linear foot of canopy, practicing retaining more buds for high vigor or healthier grapevines.



Timing:

- If pruned too early, buds located close to pruning cuts can experience some level of drying out, putting them at risk for cold damage during extreme winter temperatures.
- Pruning too late when the sap starts to flow can increase susceptibility to trunk diseases.
- Late winter or early spring pruning after the extreme cold temperatures have passed and before sap flow begins is a healthy time to prune.



Cane selection:

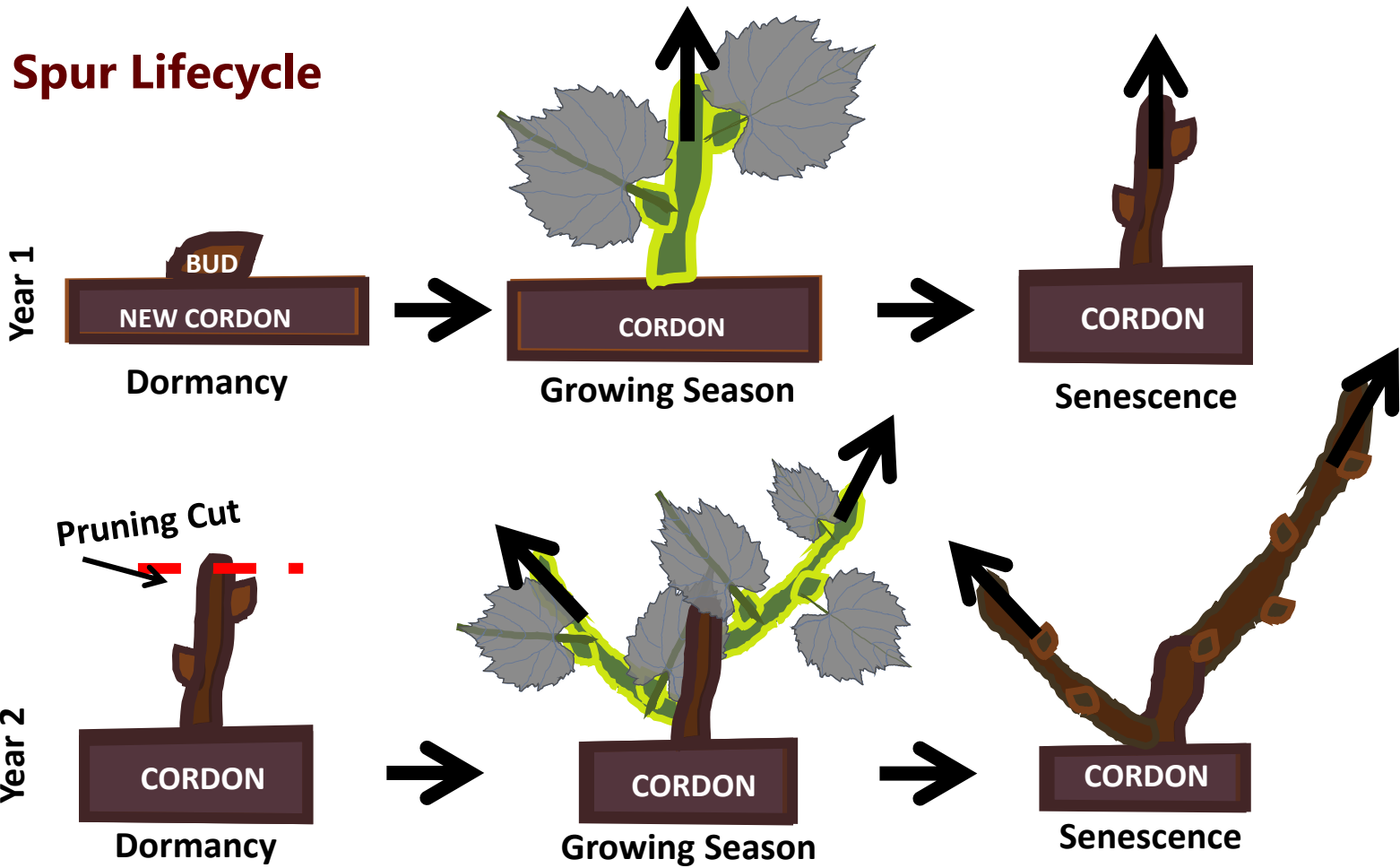
- Vine productivity and spur longevity depend on proper cane selection.
- Healthy canes are round, ~pencil size in diameter, have node space every 3-4 inches, with bark color ranging from tan to brown.
- Bull Canes are overly vigorous, oblong, and thick with long internodes. These are less productive, less cold hardy and should be avoided for selection.



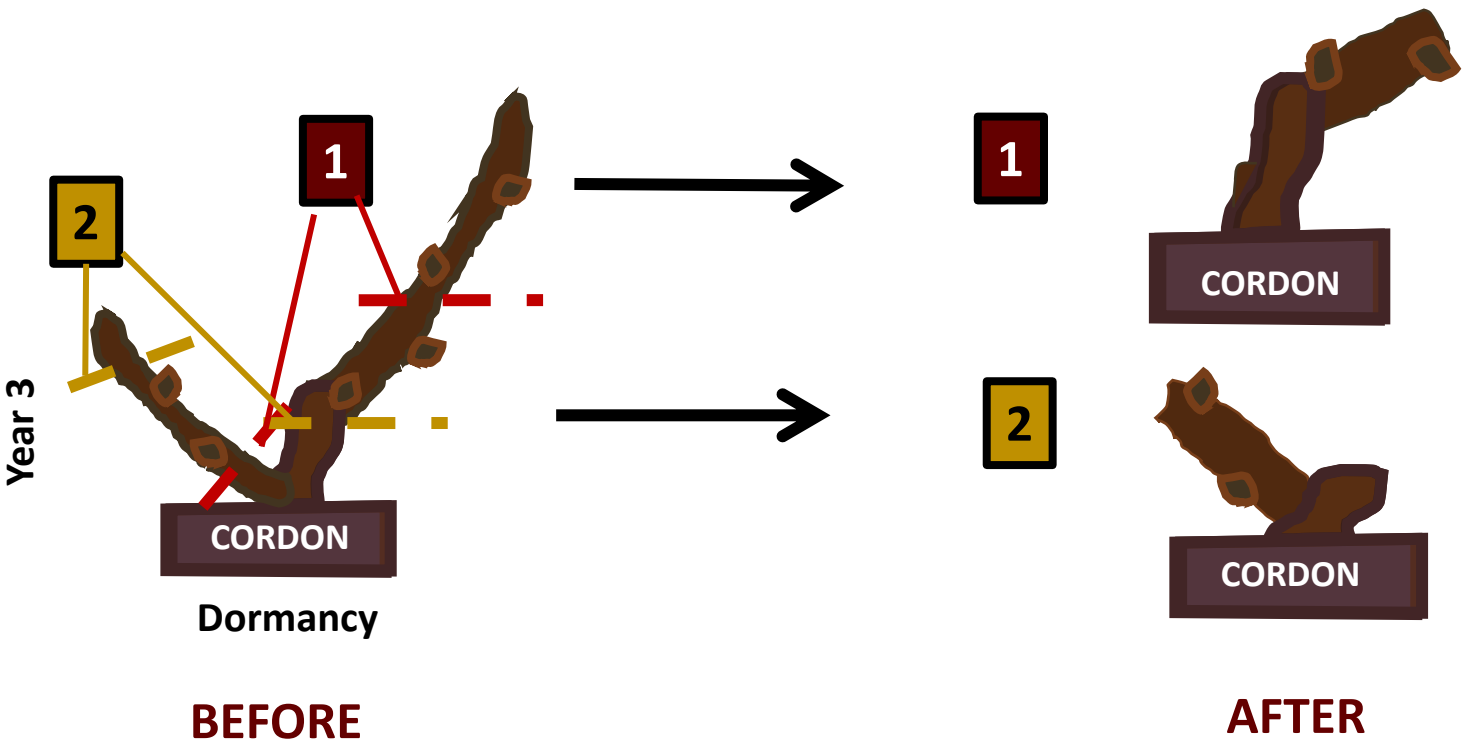
Cane location and orientation: For spur pruned vines, it is important to create spurs out of canes that are closest to the cordon and oriented in a desired direction (avoid choosing to spur canes that could grow into the canopy, for example).

Doing this prevents "**creeping spurs**" that can reduce canopy growing space and decrease options for eventual spur replacement/rejuvenation.

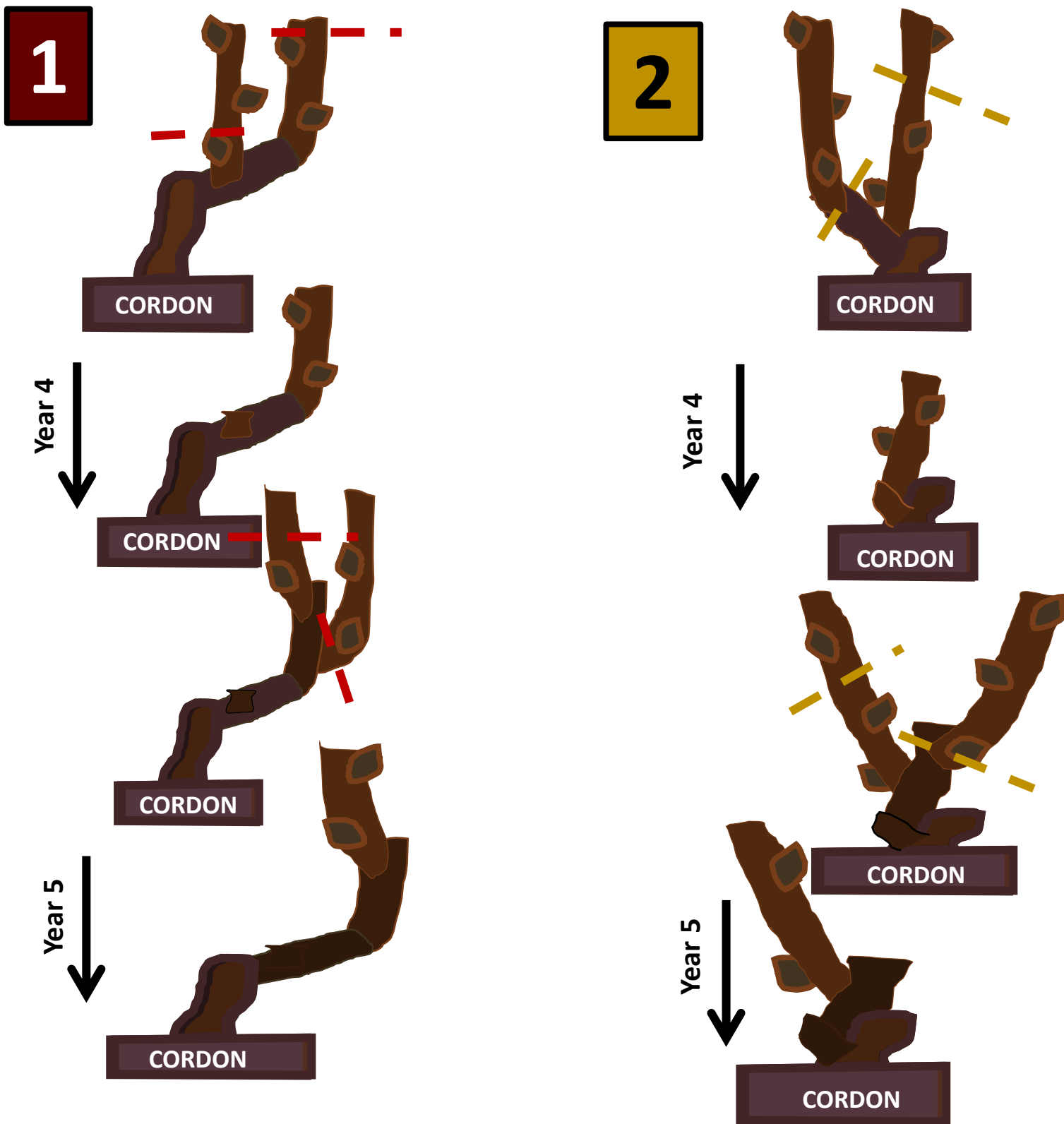
Spur Lifecycle



Creeping Spur vs Compact Spur



Two Outcomes Based on Yearly Spur Selection

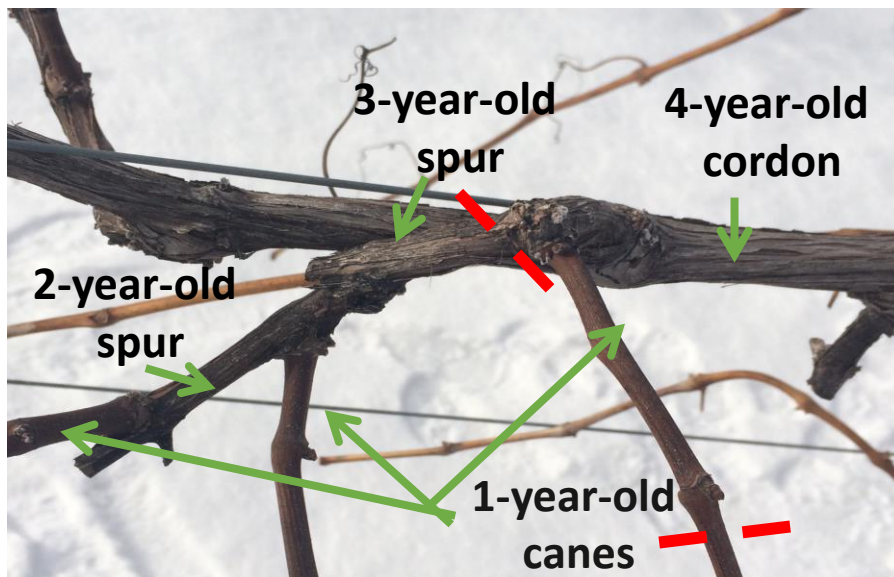


Conclusion: notice how long the spur in scenario 1 has gotten vs scenario 2 years down the road.

Spur renewal (next page) involves replacing an older unproductive or tall spur with a nearby cane growing out of the cordon. There is little chance of finding a bud to replace scenario 1's spur and this can lead to blank, unproductive canopy sections.

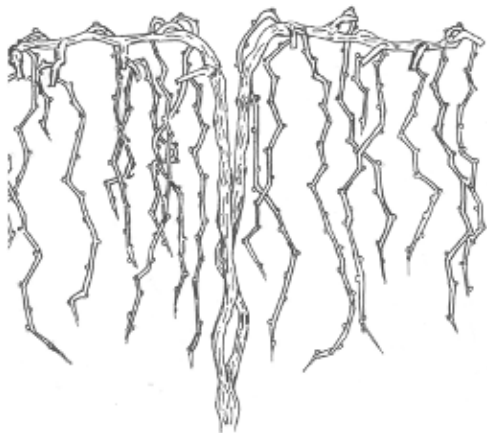
Spur Renewal

This picture shows the complexity of spur composition. This spur can be renewed by removing the three-year-old spur near the cordon and a shortening the cane on the right to 3-4 buds, which will become the new spur.

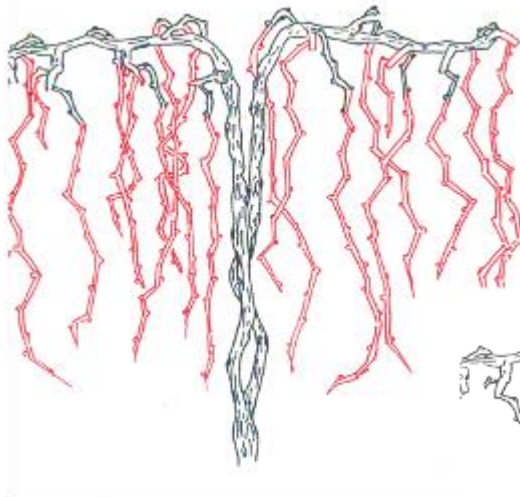


Pruning: Whole Grapevine Diagram

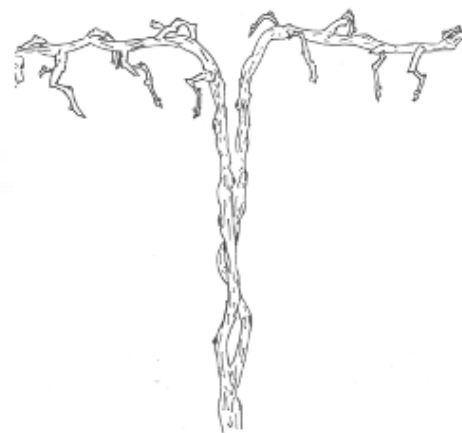
Before Pruning



Pruning Decisions
(anticipated cuts in red)



After Pruning



Note: Notice how some canes are reduced into spurs while others are removed altogether.



Winter Injury

- While cold climate grapes can tolerate low winter temperatures, they are still susceptible to winter injury to their buds, canes, spurs, cordons, and trunk.
- Because of winter injury risks, keeping “**spare parts**” by training double trunks is a common practice.
- Refer to Cornell University’s paper Anatomy of Winter Injury and Recovery to learn more about identifying injured grapevines: http://www.hort.cornell.edu/goffinet/Anatomy_of_Winter_Injury_hi_res.pdf
- Trunks can be replaced by healthy suckers (for non-grafted vines) and cordons can be replaced by canes located close to the grapevine trunk neck.
- Retaining a higher bud count can be done by:
 1. Keeping a higher spur count per linear foot.
 2. Pruning longer spurs (be cautious as this can lead to inhibiting bud break for basal buds located close to the cordon).
 3. Laying down canes over blank wood regions throughout the cordon.

Estimating Bud Injury

- A representative sample of canes is required to observe bud damage. Sample from vines that look like most of the vines throughout the vineyard.
- Sample from low and high spots in the vineyard.
- Sample at least 100 buds.
- Bring sampled canes inside to allow them to warm up.
- Slice each bud open to reveal the primary, secondary, and tertiary buds.
- Dead buds will be brown, while living buds are green. Note: all buds, including dead buds, look green if cut deep enough.
- Divide the number of dead buds by total buds analyzed to determine percent bud mortality.
- Only adjust pruning bud count if more than 20% of buds are damaged.

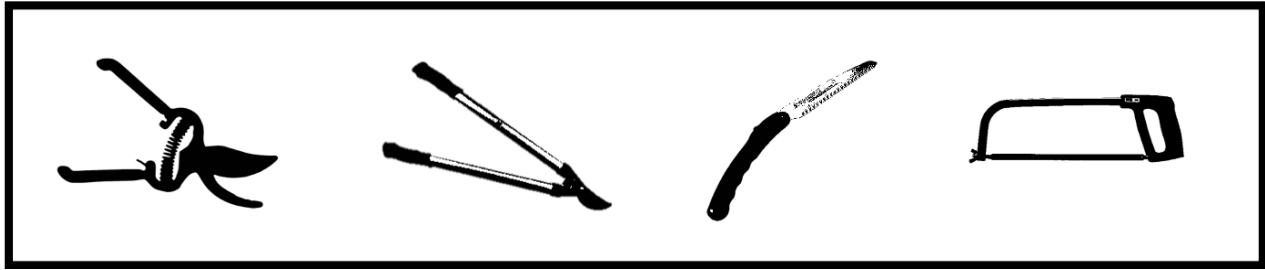
Suggested pruning strategies in relation to different levels of bud injury.

Bud mortality (%)	Suggested strategy
10-15	No need to adjust your winter pruning.
20-50	Leave a higher number of buds (more than 20-30%) at winter pruning; e.g., prune to four to five bud spurs rather than the standard two to three bud spurs and leave more spurs/canes per vine.
60	Double the number of buds of your standard pruning strategy.
More than 60	No dormant pruning or just reestablish the bearing structure of the vine.

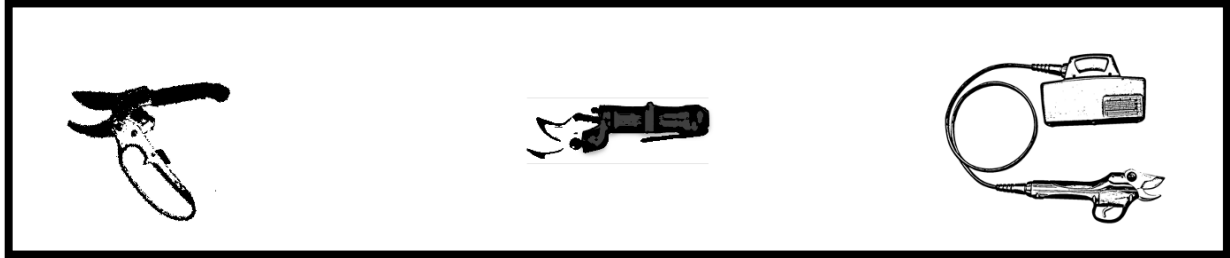
Table created by Michigan State University.

Tools

Hand tools include pruning shears (anvil or bypass), loppers, and handheld saws.



Semi mechanized tools include ratcheting pruners or loppers, electric pruners, and pneumatic pruners. These can sometimes help with thicker branches or for folks who do not have very strong hands.



Mechanical pruning (not shown here) is possible and practical for large scale vineyards. Often, growers will still need to go out to fine tune post mechanical pruning.

Resources

Madeline Wimmer, UMN Extension Educator, fruit crops
Email: wimm0035@umn.edu

UMN Extension Vineyard Management Canvas Course
<https://extension.umn.edu/courses-and-events/growing-cold-climate-grapes-vineyard-management>

Growing Grapes in Minnesota Chapter 7: Pruning
<https://www.mngrapes.org/page/GrowingGrapes>

UMN Yard and Garden Grape Webpage
<https://extension.umn.edu/fruit/growing-grapes-home-garden#pruning-986013>

YouTube Videos

“Evaluating Winter Survival of Grape Buds”
<https://www.youtube.com/watch?v=vv5axzMkYuY>

“UMN Extension Grapevine Winter Injury”
<https://www.youtube.com/watch?v=YHNE2pV17fQ>

“Pruning Out Grapevine Trunk Diseases 2019”
<https://www.youtube.com/watch?v=IS7Oiyx7bVE>

“Pruning and Establishing Cordons in New Cold Climate Wine Grapes”
<https://www.youtube.com/watch?v=k1P3XkkgO1E>

