



# Training systems for cold climate hybrid grapes in Wisconsin

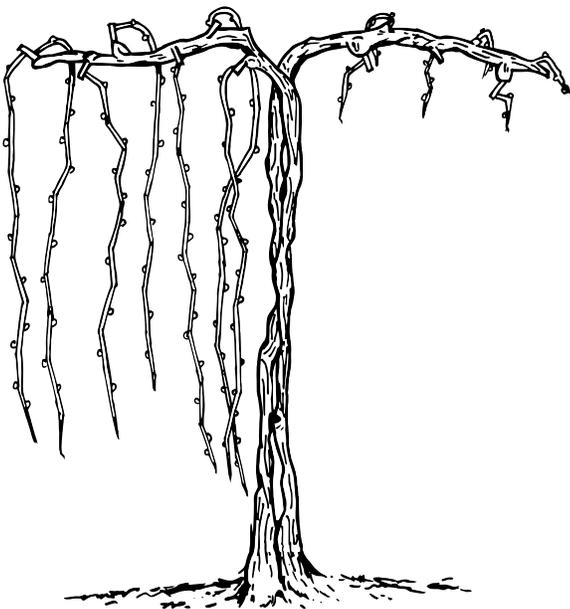
A. Atucha and M. Wimmer

Cold climate hybrid grape cultivars (e.g., 'Marquette', 'Frontenac', 'La Crescent', 'Brianna', etc.) differ from European grape (*Vitis vinifera*) cultivars in several respects and require separate consideration with regard to the most appropriate training system. This publication focuses on aspects to consider when choosing a training system for cold climate hybrid grapes.

## Introduction

The training of grapevines refers to the physical action of manipulating a vine into a particular size, shape, and orientation. The main objectives of training grapevines are to:

1. Maximize the interception of light by leaves and clusters, leading to higher yield, improved fruit quality, and better disease control;
2. Facilitate pruning, canopy management, harvesting, and mechanization of the vineyard;
3. Arrange trunks, cordon, and canes to avoid shading between vines; and
4. Promote light exposure in the renewal zone (i.e., spurs or heads) to maintain vine productivity.



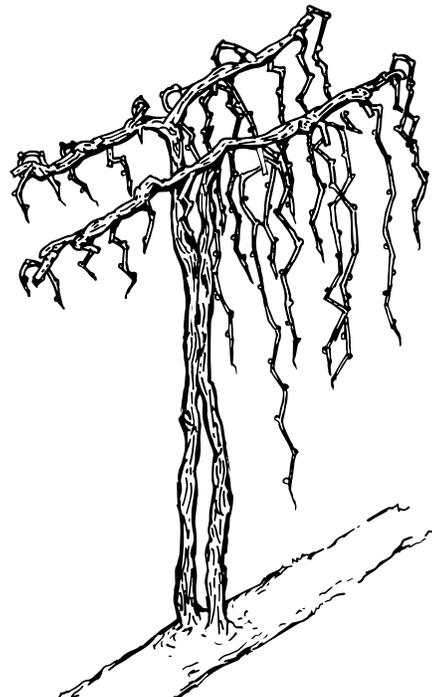
**FIGURE 1.** High wire cordon (HWC) is a downward spur-pruned training system. Trunks may be trained to 5–6.5 feet, as spring frost damage tends to decrease with increased trunk height. The vine is shown before pruning on the left arm and after pruning on the right arm.

## Choosing a training system

The choice of an adequate training system will be influenced by the following factors.

### Cultivar growth habit

Cold climate hybrids have a broad range of growth habits from procumbent (or downwards) to upright, and the choice of training system should adapt to the growth characteristic of the cultivar. Cold climate hybrid cultivars with procumbent growth adapt well to training systems that have downward shoot orientation such as **high wire cordon** (HWC) (figure 1) or **Geneva double curtain** (GDC) (figure 2).

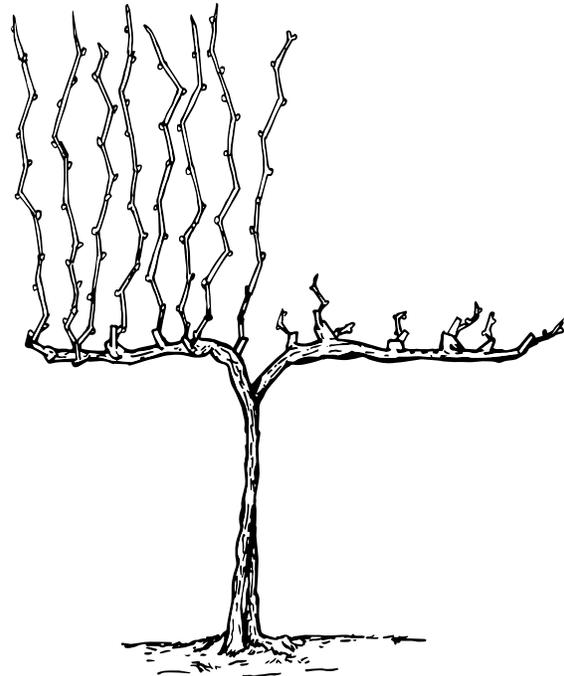


**FIGURE 2.** Geneva double curtain (GDC) trained with two parallel, top-wire trained cordons (5–6 feet high). This split canopy system is designed for highly vigorous, downward-growing grapevines. The vine is shown after pruning on the left cordons and before pruning on the right cordons.

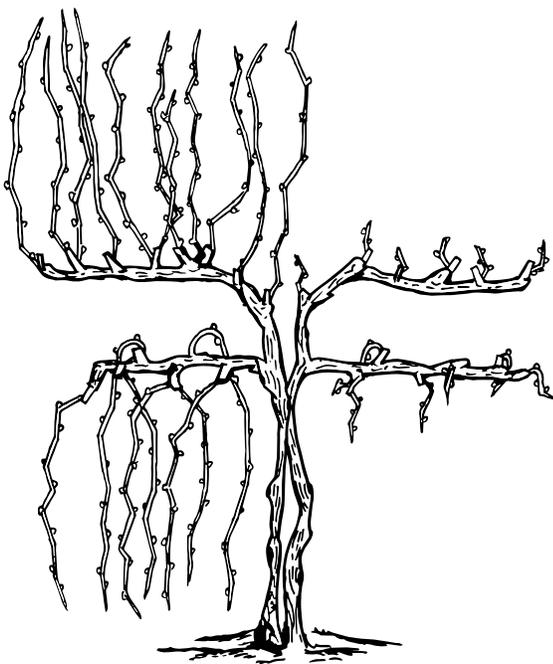
Alternatively, cultivars similar to *Vitis vinifera* with upright growth adapt well to systems with upward shoot positioning such as mid- or low-wire **vertical shoot positioning** (VSP) (figure 3). Cultivars with an upright or semi-upright growth habit can adapt to downward training systems. For example, the ‘Marquette’ cultivar can successfully be trained in HWC and VSP systems. However, cultivars with a procumbent growth habit such as ‘Brianna’ do not adapt well to VSP training systems.

**Vine vigor**

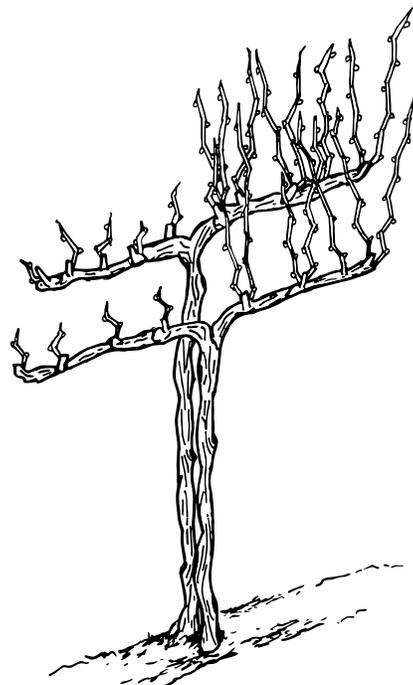
Cold climate hybrid cultivars possess higher vegetative vigor compared to *Vitis vinifera* cultivars, and this characteristic can be intensified when vines are grown in very fertile soil. Divided canopy systems with two or more layers of canopies such as GDC, **Scott Henry** (SH) (figure 4), or **lyre** (figure 5), can be used to control vine vigor, as they increase the number of shoots and clusters per unit of row length compared to those grown on single canopy systems. Cold climate hybrids trained on divided canopy systems can achieve higher yields, reduce canopy shading, and improve fruit composition for some cultivars, compared to single canopy systems. Shoot growth direction can also affect vine vigor. Shoots growing downward have shorter internodes, fewer lateral shoots, and are overall less vigorous than upward-positioned shoots, which could help control shoot growth in vigorous cultivars such as ‘Marquette’ or ‘La Crescent’.



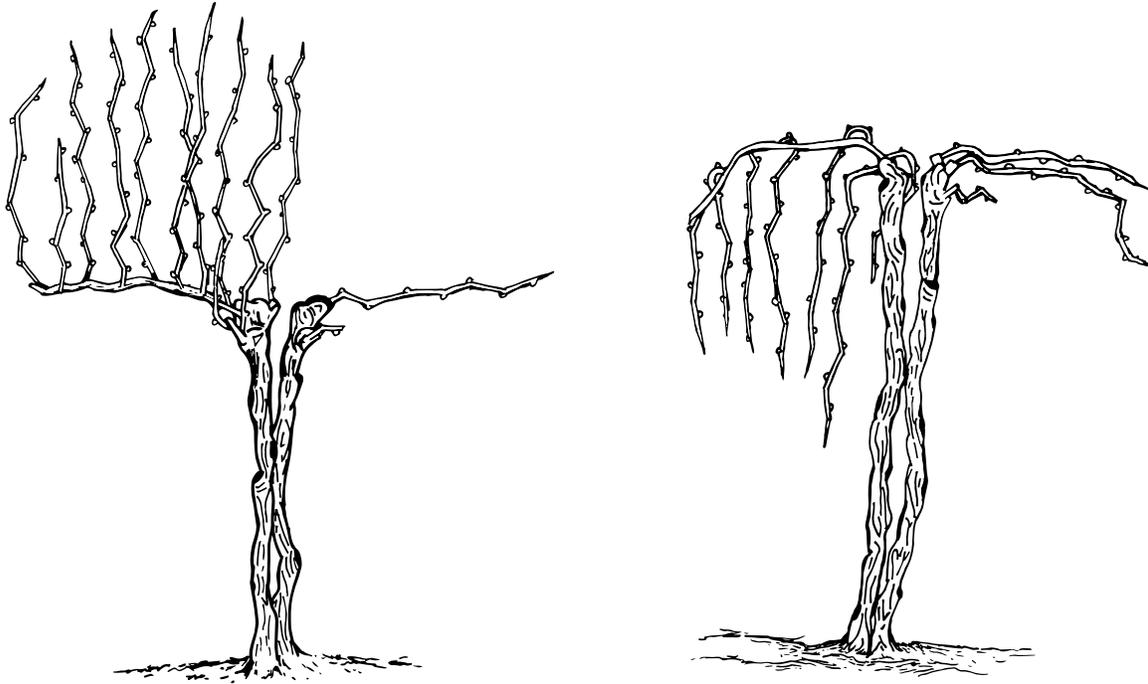
**FIGURE 3. Vertical shoot positioning (VSP).** Traditionally used for European (*Vitis vinifera*) cultivars, VSP is an upward spur-pruned system that can be adapted to cold climate hybrid grapes cultivars that possess a semi-upright to upright growing habit such as ‘Marquette’. The vine is shown before pruning on the left arm and after pruning on the right.



**FIGURE 4. Scott Henry (SH)** is a two-dimensional training system that utilizes both upward and downward canopies. This can help reduce vegetative vigor and maintain a smaller vine in vigorous cold climate hybrid grape cultivars. The vine is shown before pruning on the left arms and after pruning on the right.



**FIGURE 5. Lyre** is a three-dimensional divided canopy training system to control vigorous vines that possess upright growing habits. Vines are trained with two parallel, mid-wire trained cordons. The vine is shown after pruning on the left arms and before pruning on the right, anterior arms.



**FIGURE 6.** Guyot (left) and umbrella kniffin (right). Two cane-pruned training systems that can be easily retrained after cold damage event. The vines are shown before pruning on the left arm and after pruning on the right.

### Winter hardiness and spring frost susceptibility

Although cold climate hybrid cultivars have superior midwinter cold tolerance, freezing damage to buds can still occur (e.g., in early fall during vines' cold acclimation period, in midwinter during extreme low temperatures, and/or in early spring when vines lose their ability to withstand freezing temperatures). Cane-pruned systems such as **Guyot** or **umbrella kniffin** (figure 6) are easier and faster to retrain after a severe cold damage event than spur-pruned systems with permanent cordons that can accumulate damage over several winters, decreasing yield potential over time. Training systems with spurs or canes positioned closer to the ground (i.e., low or mid-cordon VSP) can experience more damage during spring frost than those with high cordons (i.e., HWC, GDC) due to colder temperatures at these lower heights.

### Trellis cost and labor availability

An important part of the cost of establishing a vineyard is the cost of the trellis. Some trellis systems require more components such as extra wire or additional support structures, like cross arms in the GDC system. These extra components can significantly increase construction costs. In addition to the trellis construction cost, it is important to consider the trellis maintenance cost (e.g., repairing damaged or loose posts and wires). Finally, the time and labor required to train, prune, manage the canopy, and harvest the vines in the respective system also needs to be considered. For example, a training system with multiple canopies such as SH may require more labor to train and prune as compared to a

simpler system like HWC. Also, for cold climate hybrids with higher vigor, low or mid-wire systems like VSP may require substantial canopy management through the growing season to ensure good light interception in the fruiting zone, compared to systems that help control vine vigor.

### Adaptation to mechanization

Vineyards considering mechanization should take into account the compatibility of the trellis system with equipment used to prune and harvest. Most pruning and harvesting equipment has been designed for use in vineyards with low or mid-wire VSP, as these are the most common training systems for *Vitis vinifera* cultivars. Equipment designed for pruning, harvesting, and removing leaves from vines in GDC and HWC are also available, as these systems are extensively used in 'Concord' grape production.

### Training system trials

Training system trials in the midwestern and eastern United States have evaluated yield components, fruit quality, and labor requirements of cold climate hybrid grape cultivars trained in multiple systems. The following bullet points summarize the most relevant finds.

- Divided canopy systems such as GDC and SH produce higher yields and reduce vine vegetative vigor compared to single canopy systems. However, the single canopy HCW system has proven to be a highly productive system for cold climate hybrid grapes, and in some cases has proven comparable to divided canopy systems.

- Training systems requiring upward shoot positioning such as VSP are more labor intensive than downward systems, which require minimal canopy management (no need to tuck shoots, remove leaves, or hedge). Divided canopy systems require more labor for dormant pruning.
- More desirable fruit composition (higher soluble solid concentration and lower acidity) is achieved when clusters are exposed to sunlight. Training systems that reduce vegetative vigor such as divided canopies and downward shoot positioning increase cluster exposure to sunlight.

## Additional resources

Northern Grapes Project

<http://northerngrapesproject.org/>

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**Authors:** Amaya Atucha is an assistant professor in the Department of Horticulture, University of Wisconsin–Madison and University of Wisconsin-Extension, Cooperative Extension. Madeline Wimmer is a research assistant in the Department of Horticulture, University of Wisconsin–Madison. Cooperative Extension publications are subject to peer review.

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