

PROTECTING GRAPEVINES FROM WINTER INJURY

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Winegrape production in the Pacific Northwest has expanded into areas where low winter temperatures periodically cause cane damage or death. In the Walla Walla Valley, for example, minimum temperatures plummeted to below -20°F for several days in 1996 and 2004, killing most exposed canes. Cane temperatures most certainly remained below 0°F during this time.

If vines are grown on their own roots (i.e., not grafted), regrowth and training of new canes from below-ground plant parts is possible. Fruit and wine production is reduced, however, during the time required to retrain the canes. Regrowth of 'Merlot' canes is especially problematic, as new canes tend to be stunted and nonvigorous.

Canes can be protected from freeze damage by burying them or covering them with mulch. This publication describes three systems that may help prevent injury from winter freezes.

Burying canes in a V-trench

In the Walla Walla Valley, growers have developed the following technique.

First growing season (from time of planting)

1. At the time of planting, prune vines to two shoots with two lateral buds each (Figure 1). (If there is only one shoot, prune it to two lateral buds and allow the resulting shoots to grow to 8 inches. Then prune them to two lateral buds each to ensure four shoots.)
2. Protect the four canes within a "grow tube." This also encourages the canes to grow upright during spring and summer (Figure 2).
3. Remove the grow tube in late summer (August) and place the canes on top of the drip wire (about

V-trench system

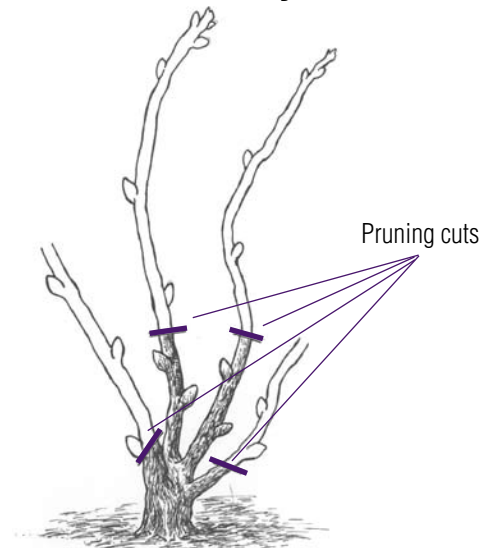


Figure 1. Pruning cuts at planting time.

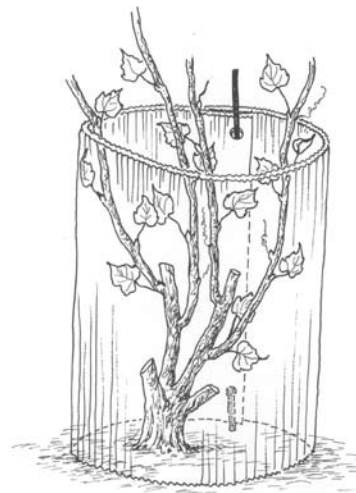


Figure 2. First leaf growth protected by grow-tube.

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1 foot above ground). There is no need to attach the vines to the drip wire.

4. Following leaf drop, cut a V-trench 4 inches deep into the soil, parallel to the trellising. Make the trench as close to the trunks as possible without damaging the trunks.
5. In late fall (before October 31 and before air temperatures drop below 32°F), lay all four canes in the trench and cover the entire vine (trunk and canes) with soil.
6. After the last chance of subzero temperatures has passed (mid-February), lift all four canes. Prune the two strongest canes to two buds and remove the remaining canes (Figure 3).

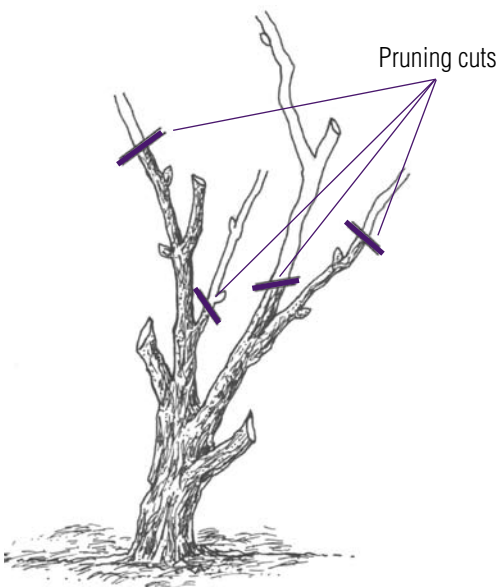


Figure 3. First dormant pruning after canes have been lifted.

Second growing season

1. Train the four canes that grow from the remaining buds in an upright position. Limit nitrogen and water applications to control growth so that internode length does not exceed 6 inches.
2. In late summer, lay all four canes on the drip wire.
3. In fall, bury the canes in a 4-inch-deep V-trench.
4. In mid-February, lift the canes from the soil (Figure 4). Select the two canes with the most intact lateral buds (#1 and #2) to become dual cordons. Train these canes on the cordon wire (Figures 5 and 6). The lateral buds on these canes above the height of the cordon will become fruiting spurs the following year.

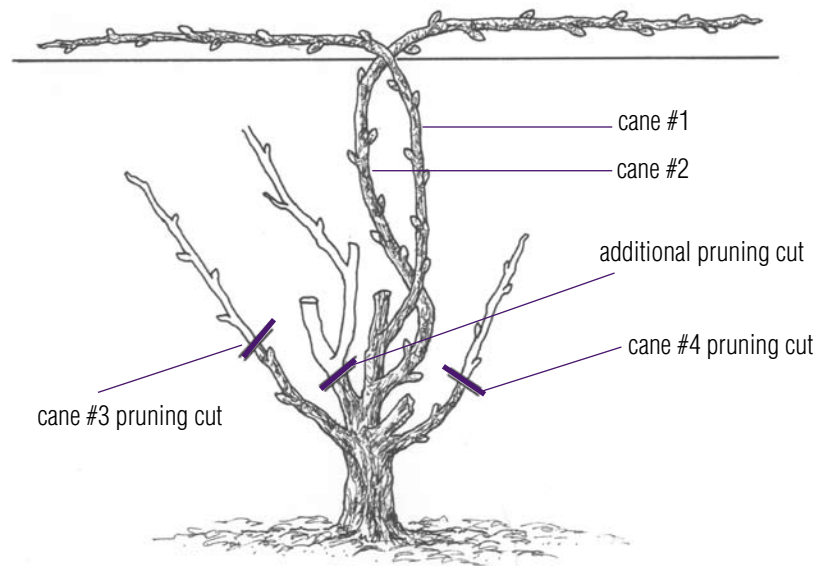


Figure 5. Pruning cuts at second dormant pruning.

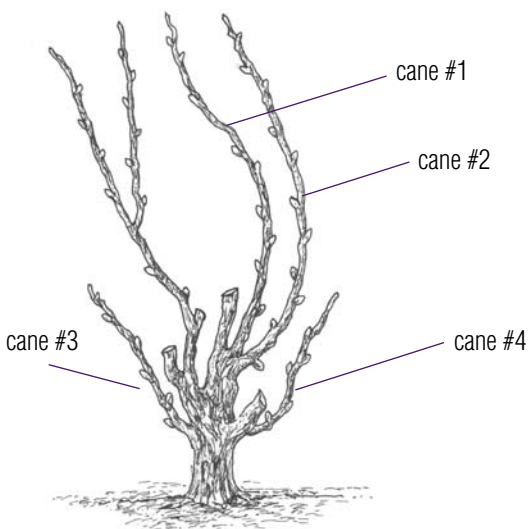


Figure 4. Vine structure before second dormant pruning.



Figure 6. Canes 1 and 2 trained to the trellis wire.



Figure 7. After pruning, canes 1 and 2 remain. Canes 3 and 4 have been cut back to two buds each.

5. Prune the two additional canes (#3 and #4) to two buds each (Figures 5 and 7). These buds will give rise to four new canes. Remove any additional canes at the base.

Third and subsequent growing seasons

Each year, allow four new canes to grow upright from the base of the trunk (Figure 8). Bury these canes in the fall; they will act as replacement canes if the existing dual cordons suffer winter injury. Lift all buried canes in mid-February, regardless of whether they are used to replace the cordons in the event of freeze damage. Otherwise they will root, and water

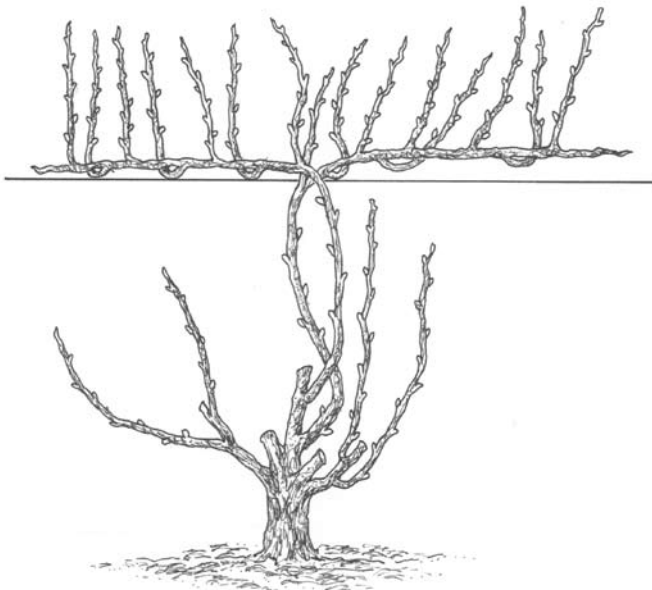


Figure 8. Vine structure at end of third leaf.

shoots arising from these buried canes will create a dense, tangled canopy. Prune two of the canes to two buds each and remove the other two canes.

If winter injury results in complete or partial death of the dual cordons, prune them to a couple of inches above the point where the buried canes emerge. When lifting canes in February, choose the two best canes, with the thickest stems and most intact axillary buds, and use them as replacement canes to recreate the cordon. Prune the other two lifted canes to two buds each. The four shoots that grow from these buds will become the replacement canes to bury the following winter.

Considerations

Although this technique protects plants from freezes, it has several disadvantages.

- Although a tractor can be used to cut the V-trench—using plough blades angled at 70° to the vertical plane (Figure 9)—the vines usually must be placed in the trench by hand. In some instances, it's possible to use plough blades to cover the vines, but on rocky soils this is not always possible. Lifting and pruning the canes is also labor intensive. Costs vary among growers. Vineyards on sandy loam soils with mechanized trenching and burying have the lowest cost, about \$1 per vine.



Figure 9. Plough with angled blades for cutting a 4-inch V-trench.

- Labor usually is in short supply after harvest due to winery crushing operations.
- If grapes are left on the vine longer for flavor development, little time remains before soil temperatures drop below 32°F.
- Fall rains may hinder traffic and make the vineyard floor unworkable, and frozen soils can damage the buds as they are buried.
- If a deep winter freeze kills above-ground parts, bud break occurs at the extremities of the lifted canes well before normal bud break. These early shoots are more susceptible to late spring frosts.

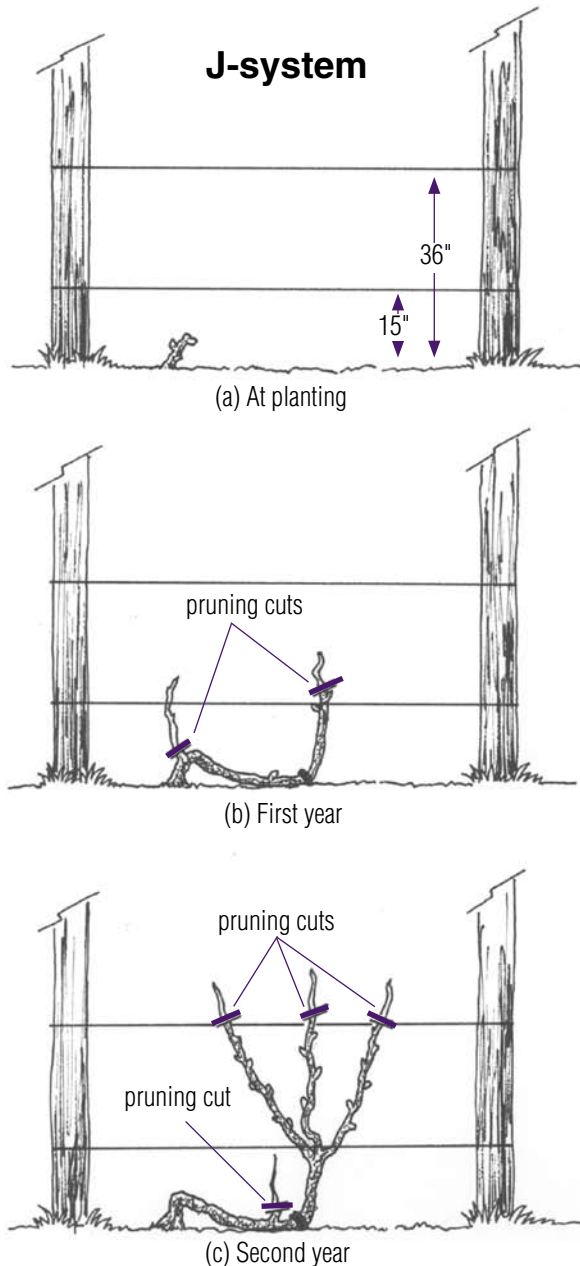


Figure 10. J-system training. (Reproduced with permission from University of Wisconsin Extension, Cooperative Extension article A1656.)

J-system training

Two other training systems have been developed for winter freeze protection in other winegrape-growing regions of the United States, such as Wisconsin, Michigan, and Minnesota. The first of these is the J-system (Figure 10). This system develops low renewal zones that facilitate covering in winter.

The process of burying the dormant vines is more efficient and less damaging to the trunk with this method than with the vertical shoot positioned system, as the vine is better able to withstand the physical movement of the trunk.

First growing season

1. Plant vines at about a 45° angle (Figure 10a). The angled vine will be easier to remove from the trellis in the fall. With grafted vines, make sure the graft union is above the soil surface.
2. Use two trellis wires. Position one at 12 to 18 inches above ground and the other at 36 inches.
3. As canes grow during the first year, train them along the soil surface, using pins to keep them prostrate.
4. Once the canes reach 20 to 24 inches, use a flexible pole or bamboo stake to train them up to the lower trellis wire, leaving 10 to 12 inches of vine along the soil surface (Figure 10b).
5. After the leaves have fallen, choose the strongest cane to act as the trunk and prune back all other canes (Figure 10b).
6. Remove the trunk cane from the lower trellis and bury it in soil or mulch.
 - If using mulch, cover the cane with at least 5 inches of mulch before temperatures fall below 20°F.
 - If burying the trunk cane, do so before the ground freezes. Bury the cane at least 6 inches deep.

Second growing season

1. Lift the trunk cane from the mulch or soil before bud break in the spring.
2. Pin the trunk cane along the ground as before and fasten the tip to the lower trellis wire. The trunk will be fully established during the second growing season.

3. Allow new canes to grow from the head of the trunk cane at the lower trellis wire. Train all canes upwards in a fan design on the upper trellis wire (Figure 10c).
4. Remove any additional canes (shoots) that arise from below the head of the trunk.
5. After the canes have lost their leaves in the fall, prune them to the level of the upper trellis wire.
6. Before the ground freezes, remove the canes and trunk from the trellis and bury them with soil and/or mulch as before.

Third and subsequent growing seasons

1. Lift the trunk and canes from the mulch or soil before bud break in spring.
2. Attach the trunk cane on the lower trellis wire. It should not be necessary to pin the trunk along the soil surface as it should be hardy by this time.
3. Attach the second-season canes in a fan design on the 36-inch trellis wire.
4. Once bud break occurs, you can assess bud damage and make secondary pruning cuts on these canes.
5. Again train all regrowth upward onto the 36-inch trellis wire to complete the fan shape.
6. After leaf drop in the fall, prune vines back to spurs at the “head” of the vine trunk for renewal growth the following season. Before the ground freezes, remove the canes and trunk from the trellises and bury them with soil and/or mulch as before. It should still be possible to bury the trunk, even as it becomes woody and rigid, due to the angle established during years 1 and 2.

Considerations

- This method does not use “grow-tubes,” as the canes produced during the first growing season are trained horizontally before being encouraged to grow vertically on the trellis.
- During the first and second growing seasons, efforts are focused on establishing the trunk. Canes on either the lower or upper trellis wire may be used as the renewal zone for shoot growth, depending on the severity of winter weather.
- If mulch is used, baiting and/or trapping of rodents may be necessary. Keeping the cover crop or vineyard floor mowed will help prevent rodent infestations.

Spur-pruned rose or fan system

Another training system is the spur-pruned rose training or fan system (Figure 11). This system is nearly trunkless, and the renewal zone, or head, is kept very close to the soil surface. The renewal zone is protected by mounding with soil or mulch rather than by burial.

First growing season

1. Plant vines in a vertical position, i.e., not angled.
2. Use three or four trellis wires. Position the lowest wire at 15 inches above ground and the second at 36 inches. Add one or two higher trellis wires to support continued cane (shoot) growth. The number and length of new canes, and hence the number and height of trellis wires, depends on cultivar vigor and vineyard location.

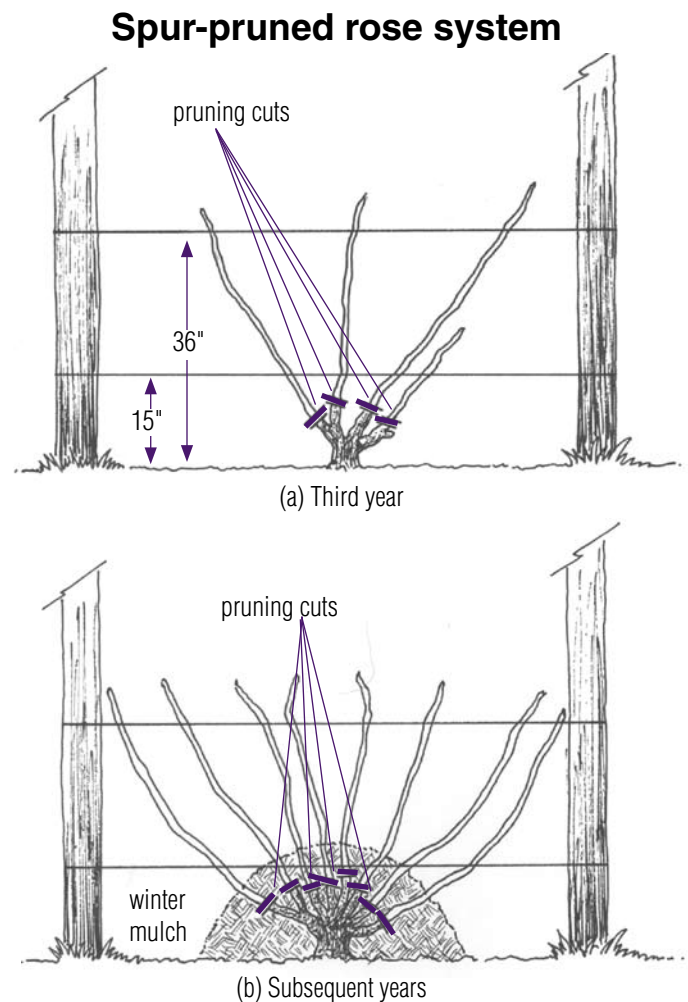


Figure 11. Spur-pruned rose system. (Reproduced with permission from University of Wisconsin Extension, Cooperative Extension article A1656.)

3. Train all canes upward and attach them to the 15-inch and 36-inch trellis wires. No single trunk is formed; a vine head of multiple canes will develop close to the ground (Figure 11a).
4. If using grow-tubes in the spring to protect new cane growth, remove them at the end of summer (mid-August) to enable buds to become winter-hardy in fall.
5. Once the canes have lost their leaves, prune them to spurs with 3 to 4 buds at the head of the vine, within 6 to 10 inches of the soil surface (Figure 11a).
6. Mound soil or mulch around the base of the vine before temperatures fall below 20°F (Figure 11b). The soil or mulch should be thick enough to cover the entire vine head and should be at least 6 inches deep on all sides of the vine head.

Second and subsequent growing seasons

1. Remove soil or mulch mounded around the vine head before bud break.
2. Assess bud viability after bud break and determine whether further pruning of the spurs to two buds is necessary.
3. Train the subsequent regrowth from the spurs upward on the trellis in a fan design (Figure 11b).
4. In fall, once the leaves have fallen, again prune all canes to spurs with three or four buds.
5. Mound soil or mulch around the vine head as described for the first season.

Considerations

- This training system is best suited to own-rooted vines and varieties that are conducive to spur pruning.
- The spur rose training system is low maintenance and easy to prune. However, it is difficult to harvest fruit, as the fruiting zone is close to the ground.
- Depending on the location, this low fruiting zone may become heavily infested with fungal diseases.
- Grow-tubes may be used to train the shoots up to the trellis wire, but are not necessary, as a single

trunk is not the objective. Be sure to remove them in late summer (mid-August) to enable buds to become winter hardy in fall.

- Snow cover can provide additional protection for the low renewal zone.
- If mulch is used, rodent control measures may be necessary.
- If shoots are left protruding from the mound of soil or mulch, winter damage may occur on those areas and may lead to crown gall infection.

Conclusions

Winter freezes pose a severe threat to the successful establishment and maintenance of above-ground fruiting canes in regions subject to deep winter freezes. This is especially true of *Vitis vinifera* L. cultivars.

In these regions, protection for the canes and/or heads is imperative. The technique of burying canes or heads has proven successful in several winegrape-growing regions of the United States. Regardless of the specific method, cane burying is tedious, labor-intensive, and expensive. (Growers estimate the cost at a minimum of \$1 per vine.) However, it is currently the only viable means of ensuring survival of the vines and annual cropping under potential deep freeze conditions.

For more information

Martinson, T., W. Wilsey, M. Goffinet, and M.J. Welser. 2006. Burying canes in the Finger Lakes region: The impact on buds and canes. *Wine East* 34:18–24.

Roper, T.R., D.L. Mahr, P.S. McManus, and B.R. Smith. 2006. *Growing Grapes in Wisconsin*. University of Wisconsin Extension, Cooperative Extension Publishing. Madison, WI. A1656.

For more information on winegrape production, visit the OSU Extension Service educational materials catalog at <http://extension.oregonstate.edu/catalog/> and the Northwest Berry and Grape Information Network at <http://berrygrape.oregonstate.edu/>