Hilling-Up to Prevent Winter Injury in Vineyards

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Winter injury is the single most limiting factor to grape production in the Eastern United States. Although we had experienced limited damage in the last 20 years, many vineyards in the Mid-Atlantic reported winter injury following the harsh winters of 2013-14 and 2014-15. Although it has not been utilized by a significant number of growers in the past, many vineyards that have experienced damage recently should consider “hilling up” (mounding soil over graft unions) for protection against winter damage.

Background

- Extreme low temperatures, widely fluctuating temperatures and late freezes can all cause direct injury to grape buds, trunk and stem tissues.
- Such injury creates opportunities for infection and development of crown gall disease (*Agrobacterium*) on trunks and graft unions which often result in vine decline or death.
- Cold injury and crown gall occurs in all types of varieties, however, *Vitis vinifera* are more susceptible to cold damage compared to hybrids and natives.
- Young, vigorously growing vines are especially vulnerable to cold injury and protective measures should be an especially high priority.
- Also some varieties like (eg. Malbec, Merlot, Sauvignon Blanc, Pinotage) for example, are particularly sensitive to winter trunk injury and may need to be protected even when well established.
- Protect the graft union from extremely low temperatures can be useful to reduce winter vine damage. When a graft union is damaged the vine is usually a complete loss, however if the graft union is protected (Fig. 1), it is possible to replace damaged trunks with regenerated shoots arising at or just above the graft union (Fig. 2).

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Hilling up protects the graft union
• Hilling-up (HU), a practice of covering the graft union using soil, is one of the most effective methods of preventing winter damage.
• Extreme low temps, widely fluctuating temps and late freezes can all cause direct injury to grape buds, trunk and stem tissues.
• Soil hilled up around the vine provides significant thermal mass that holds heat and insulates against heat loss during extreme cold temperature events.
• If the mound is big enough to cover 3 to 4 inches above the graft union, the temperature experienced at the graft union is typically close to subsurface soil temperatures. Studies show that temperatures under the hilled soil can be significantly warmer than air temperatures, protecting the graft union from damage2 (Fig. 3).

Hilling-Up Practices
• The goal for HU is to create a soil mound of 3-4 inches above the graft union. Depending on the soil type, levelness near the base, and soil moisture during hilling-up, two or more passes may be required to effectively cover the majority of the graft.
• HU is recommended during early fall shortly after harvest, however the right time for HU is when the soil is not frozen, neither too dry nor too wet, and easy to work.
• HU can be done manually or mechanically. Tools specific for HU are available, however, existing machinery can also be adapted for this purpose (e.g. vegetable tiller, single plow, disc harrow, etc.).
• For HU, a hoe can be front mounted, tailed, or side mounted. One-sided hoes are easier to operate with higher accuracy compared to two-sided, which require very straight rows.
• Single blade plows or hoes are the simplest and least expensive implements, however, a single pass may not throw sufficient soil to cover the graft union. Normally with two passes, this single notched disc can be as effective as a 2 or 3 disc plow.
• Avoid digging too deep with any tool to avoid damage to the roots of the vine.

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Taking-Down Practices
- Taking down (TD) the hilled up soil requires even more care and often more labor than hilling up.
- Specialized implements with rotary brushes are available for taking down hilled up soil around vines. It can also be done by hand, but this can be a tedious practice.
- TD in the spring is necessary to prevent the scion from rooting into the soil above graft union.

Considerations/Challenges for Hilling-up
- Care must be taken around crooked or bent trunks to avoid damage from the hilling operation. One can easily damage the trunk if the equipment touches the vine and creates wound that may provide a point of infection for, crown gall or exacerbate the potential for cold injury.
- Raise your drip lines before hilling to a sufficient height to avoid damage.
- Obviously damaging the vines during HU or TD can be counter-productive and result in damage to the vine as well as crown gall infection.
- Be sure that the graft union is adequately covered (Fig. 5). It may be necessary to follow up with a shovel to throw sufficient soil to cover the graft union on some of the vines despite good mechanical hilling up practice.
- HU and TD the soil in the fall/winter and spring can also assist in mechanical weed management.
- However if you normally apply a fall pre-emergent herbicide it will be necessary to alter your spray regime since the soil disturbance caused by HI and TD may diminish or eliminate the effectiveness of fall pre-emergent herbicide.

References

Figure 4. Front mounted specialized rotary implement for hilling up grapes with gauge wheel.

Figure 5. Example of poor hilling up. Notice that some graft unions are not covered with soil.