Summerland Research & Development Centre
Wine Grape Research

Another Type of Cold Damage

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DAMAGE OBSERVED

Most growers recognize two categories of grapevine cold damage: winter freeze damage to buds or wood (phloem and xylem) tissues; and spring frost damage to green shoots. This spring, many vineyards in the Okanagan and Similkameen valleys appeared to have suffered winter freeze damage, even though over-winter temperatures did not dip to below vine-lethal levels. In mid-April we sampled more than a thousand grapevine buds from throughout the Okanagan for hardiness testing and found no winter damage – all buds were alive. At budbreak, just 2-3 weeks later, it was obvious that many buds were no longer viable. The damage occurred during the process of bud break.

The regional distribution of affected vineyards revealed that damage severity was well correlated with soil texture. Vines growing on silty or clayey soils suffered more damage than did vines on sandy or coarse textured soils. In fact, vineyards on loamy sands in the south Okanagan had little or no damage, whereas many vineyards on silty or clayey soils located on the Naramata Bench, in West Kelowna, and elsewhere in the Okanagan had moderate to severe damage. The damage includes dead vines, as well as vines with few shoots on spurs or canes. Within vineyards, damage was more severe in exposed areas, such as on hill crests, and was less severe in low areas or in basins.

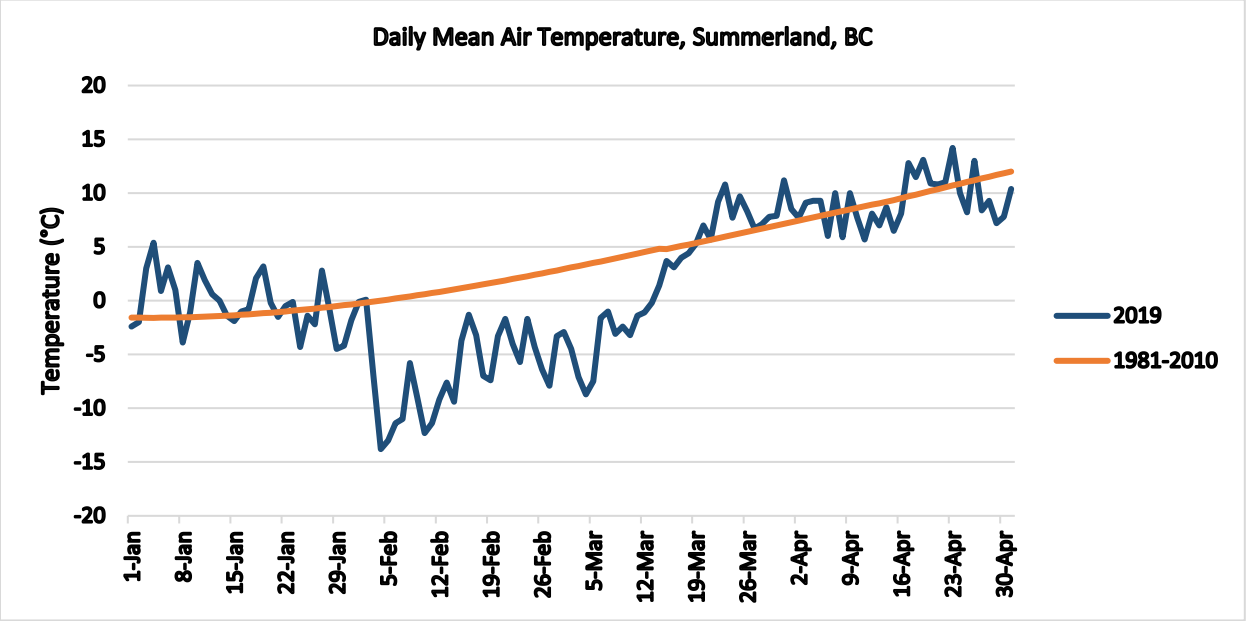
Damaged vines in a Naramata Bench vineyard.

There was a noticeable lack of normal sap bleeding in vineyards that became damaged. Buds examined just after the budbreak period were dehydrated, indicating that insufficient water had been delivered to canes and spurs during budbreak. Many affected vines have since sprouted shoots from the trunk and cordons, and are producing strong suckers from the

vine base. Some growers have observed similar but milder damage in past years, after which the vines eventually recovered.

UNUSUAL WEATHER AFFECTED SOIL TEMPERATURES

Air temperatures were unusually cold for six weeks, from early February to mid-March, averaging 6.6 °C below normal. Vineyard soils cooled to below freezing, which may have caused root damage. Although all regions in the Okanagan Valley experienced abnormally cold air temperatures and soil cooling, only vines on fine textured soils suffered subsequent bud dehydration and death.



Daily mean temperature during Jan-April in Summerland, BC, for 2019 and historically (1981-2010). In 2019, a six-week period of abnormally cold temperatures in February and early March was followed by a warmer period in late March and April. Data source: Environment and Climate Change Canada.

An important difference between fine and coarse textured soils is their water holding capacity. Sandy soils have a field capacity of about 10% moisture by volume, and a pore space filled mostly with air. In comparison, silty and clayey soils hold about twice as much water and contain less air at field capacity. Water requires four times more heat to raise its temperature by 1 °C than does air. We monitored the temperature of a coarse sandy soil before and during the warm period that began in late March. At 30 cm depth, the temperature rose quickly, from 0 to 7 °C in a week. We did not monitor the temperature of a fine textured silty or clayey soil, but these soils likely remained much colder preceding and during budbreak in April.

THE LIKELY CAUSE OF DAMAGE

Water uptake by roots is influenced substantially by temperature (Lv et al. 2013). Little water is taken up by roots at 1 °C, and uptake increases about four-fold as roots warm from 5 °C to 15 °C. It is likely that the roots of many vines in fine textured soils were too cold in April to take up sufficient water to support budbreak. The resulting damage to vines was serious, and tragic because buds were viable in mid-April

but dehydrated and died within the next 2-3 weeks. The weather events leading to the damage were extremely unusual, but recurrence is possible. Growers may be able to respond to prolonged low temperatures in late winter and early spring by applying materials that prevent buds and cane tissues from dehydrating, such as used for dormant root-trimmed nursery plants. Further research is needed to confirm the cause of the damage, and to find effective treatments that will prevent it.

REFERENCE

Lv et al. 2013. Root water uptake model considering soil temperature. J. Hydrologic Engineering https://doi.org/10.1061/(ASCE)HE.1943-5584.0000642

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