

Site and Soil Considerations for Northern Grape Production

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The most fundamental and irreversible decision in the life of a vineyard is the choice of site. Growers invest anywhere from \$12 to 16,000 /acre to establish a vineyard – and site characteristics can determine the overall productivity and profitability over the life of the vineyard.

Cold-hardy ‘Northern Grape’ cultivars have expanded the range of sites suitable for grape production to those with winter low temperatures down to -20 to -30 °F. But surviving winter low temperatures is only one facet of site suitability. In all other respects, Northern, cold-hardy cultivars require the same things other grape varieties require to thrive in the vineyard.

What is Required of a Vineyard Site?

Grapevines need:

- A **growing season** of sufficient length The growing season is by the number of days between the last 28°F in spring and the first fall occurrence. The season at a particular site must be long enough to allow both the fruit and the vegetative parts of the vine to mature. It must provide enough heat energy to ripen the fruit and vegetation.
- There must be adequate **sunlight hours** to ensure a sufficient supply of carbohydrates are produced by photosynthesis to mature the fruit and vine and to maintain future productive potential.
- The supply and the availability of essential **mineral elements** in the rooting zone must neither be inadequate nor excessive. Mineral elements which are not essential may also be problematic if they are toxic to grapevines or consumers.
- There must be a steady and sufficient **supply of water** to allow the vine to function properly. However, soil water must not be in excess or grapevine roots will suffer. Often in cool or cold climate production regions the vines are not irrigated. In that case the soil must retain enough water in the root zone to provide vine needs between rains.
- The site should neither **receive nor retain excessive moisture**, and it **should allow cold, dense air to drain away** from the vineyard. Otherwise cold injury or water logging may occur. However, surface water and air drainage should not be obtained at the cost of increased **soil erosion** or limitations on the ability to **operate machinery safely**.

Climate: Climate sets the limit on how specific grapevine varieties perform, on two levels:

- **Macro climate:** Regional climate sets overall limits on what grapevines will survive and be productive. In a cool climate with cold winters, winter low temperatures (Table 1) are a prime determinant of what varieties will survive the winter with minimal bud and trunk injury. Frost-free dates (which determine the length of the growing season) and heat unit accumulations are also important macroclimate considerations.

Table 1. Mid-winter Low Temperature Risks for Grapevines

If low temperature is higher than	Injury hazard is	Suitable Varieties
0°F	very low	almost any
-5°F	low	most northern vinifera
-10°F	moderate	hardy vinifera/moderately hardy hybrids
-15°F	high	hardy hybrids/most American
<-15°F	very high	hardy American varieties
<-18°F	Extreme	Cold-climate (Minnesota & Swenson) hybrids

- Mesoclimate:** Local climate within a region is modified by elevation, slope, aspect (slope direction) and presence of barriers to air flow. **Sites with poor air drainage have significantly lower temperatures during radiation frosts, which greatly increases the risk of spring and fall frost injury, and sometimes mid-winter injury.** Spring frost can particularly affect cold-hardy ‘Minnesota’ and ‘Swenson’ varieties, which tend to have significantly earlier budburst than classic *vinifera* or other standard hybrid varieties.

Figure 1 illustrates 3 relevant measures, based on Min/Max temperature readings: 1) Frost-free days: Number of days between last spring and first fall temperature below 29° F. 2) Growing degree-days: Summation of daily average temperature above 50° F, and 3) Winter low temperatures.

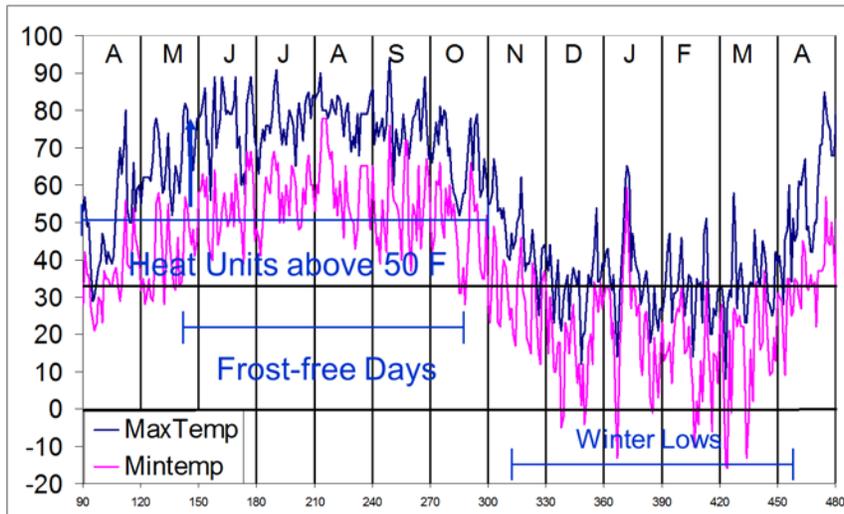


Figure 1: Minimum maximum temperatures and climate parameters.

Climate and mesoclimate are the most important site characteristics to consider in choosing a site. Choose a site with good air and water drainage, a southerly (or SW to SE) aspect, and at an appropriate elevation (mid-slope in hilly regions).

Soils: Grapes are adaptable to many types of soils, but the best vineyard soils tend to be light-medium textured, (e.g. gravelly loams, silty loams, sandy silt-loams) with excellent internal soil drainage, and a lack of hardpans that limit soil rooting depth. Northern grapes prefer moderately acidic (6.0-6.5) soil pH.

Soil characteristics can be modified prior to planting to dramatically improve vine performance. Thousands of acres of *vinifera* grapes are grown on heavy clay soils in Canada's Niagara peninsula, with the installation of dense (every row) drainage tile lines. Soil preparation preplant can adjust the supply and balance of mineral nutrients, and soil pH. Preplant cover crops can add organic matter to deficient soils, and some are reported to suppress plant pathogenic nematodes.

Complete references on soils, climate, and site selection considerations are available online and in production guides. I recommend:

Wolf et al. 2011. [Wine Grape Production Guide for Eastern North America](#), NRAES 145, PALS Publishing, Cornell University Ithaca NY.

Online: http://palspublishing.cals.cornell.edu/nra_winegrapecontent.html

Lakso A. and T. Martinson, 2010. The basics of site evaluation and selection. Posted at: www.nyvineyardsite.org

Sforza and Wolf 2014. [Eastern U.S. Web-Based GIS Tool](#) for vineyard site evaluation. Map-based web tool for site specific climate and soils information. Posted at: <http://www.arec.vaes.vt.edu/alson-h-smith/grapes/viticulture/research/scri-index.html>

Economics: Choosing the best possible site has long-term consequences. Over the 25 year expected lifespan of a vineyard, raising average production by each 0.1 Ton per acre adds \$900 net present value at planting time. In other words, you can afford to pay \$900 per acre more for a vineyard site if you expect only 0.1 T /acre per year extra over the life of the vineyard. It also follows that any pre-plant investment (deep ripping, tiling, soil pH) you make prior to planting that raises productivity of the site is likely to pay off in a more profitable vineyard.

The takehome message is this: Pay now or pay later. You can pay up front for superior sites and improvements or you will pay later in poor growth, lower production, and poor vine performance.