



# Viticulture, enology and marketing for cold-hardy grapes



## Cold Climate Winegrape Cultivar Trial

University of Vermont Horticulture Research and Education Center  
South Burlington, VT

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**Background and Rationale:** The University of Vermont Vineyard is a research/demonstration site with eight winegrape and eight table grape cultivars planted in 2007. The vineyard is part of a national evaluation of winegrape cultivars associated with the USDA NE1020 Project, the Northern Grapes Project, and an Agricultural Experiment Station Research Project. The Northern Grapes Project utilizes four of the winegrape cultivars.

**Treatments:** We chose two high training systems and one mid-wire training system for comparison. Three training systems and follow up canopy management practices were applied, representing intensive, intermediate, and minimal post-shoot thinning treatments. **Treatments:** Frontenac, La Crescent, Marquette, and St. Croix cultivars are included in the Northern Grapes Project, and Prairie Star and Corot Noir are also included in the NE1020 research vineyard. The winegrape vineyard is planted in a randomized complete block experimental design of six blocks with four - vine plots of each cultivar per block. Table grape cultivars are planted in two - vine plots around the perimeter of the winegrape vineyard.

**Methods:** The vines are trained to a high - wire cordon system. The soil is a well - drained Windsor loamy sand with drip irrigation installed. Shoots are thinned annually to a target range of 24 - 36 shoots per 6 feet of cordon. Canopy combing and leaf pulling is performed as needed throughout the growing season. IPM monitoring is used to optimize pest management decision - making in the vineyard. Harvest date for each cultivar is determined by field testing of juice chemistry, flavor development, and physical condition of berries. Data collected annually: Winter Injury, Pruning Weight, Cordon Length, Live Node Count, Phenology Development, Shoot Count, Harvest yield, Juice chemistry, and Weather.

**Results:** Gradual cooling in fall 2014 prompted good acclimation of vines to winter cold. Winter was prolonged, and cold, with 30 days minimum low below 0°F and a maximum low of -18°F in South Burlington and colder temperatures experienced elsewhere in the state. Spring remained cool through April but temperatures rapidly warmed in April. Weather was hot and dry prior to budburst in early May and throughout the month. Beginning around June 1 and lasting through July, early-mid summer was extremely wet, with 13.7 inches of precipitation measured in those two months. Bloom weather was warm and wet with persistent heavy rain showers. Weather at veraison in August and into harvest in September was dry and occasionally hot. Fall ripening weather was warmer than normal through September, with 2597 degree days (base 50°F) accumulated by October 1 (ten-year average is 2428).

Despite unusually high winter injury, the usual 4-5 buds were retained per cane (retention of extra buds following the 2013-2014 high winter injury led to excessive canopy). Prolific shoot growth on most varieties after budbreak encouraged shoot thinning back to within the target range of 24-36 shoots per 6 feet of cordon. Corot Noir once again suffered heavily from winter injury, resulting in retention of all viable buds and removal of dead wood following budbreak. Several Corot Noir vines and/or cordons collapsed during the season, presumably due to winter injury. Two passes of canopy combing throughout the season resulted in a manageable canopy. Leaf pulling in early July occurred to encourage ripening in lieu of cluster thinning.

Both foliage and clusters of all cultivars were assessed for disease incidence and severity and insect damage and data are currently being analyzed to determine any significant differences among cultivars. Powdery mildew once again appeared to be prevalent this year in all varieties on both foliage and clusters. Downy mildew was also notable on foliage.

Traps for Spotted Wing Drosophila, an invasive pest in Vermont, were set late-July and checked weekly. Adult male SWD were first identified on August 5th in the vineyard. Trapping ceased after first capture was determined. No Brown Marmorated Stinkbug were observed at the vineyard in 2015. Bald-faced hornets and other vespids were also not excessively active this year.

Weight of fruit per vine was lower than average for the vineyard and much less than that of the unusually high volume of the 2013 crop. Cluster weights were actually slightly above average for the vineyard although still smaller than average for the cultivars. The resulting crop was nearly half of average.

The following varieties of wine grapes were driven to Geneva, NY for small-batch vinification and analysis at Cornell University's Vinification & Brewing Laboratory: Frontenac, La Crescent, Marquette, Prairie Star and St. Croix. The post-harvest winemaking is being funded by Anna Katharine Mansfield. Weather data and vine phenology, productivity, and maturity data was sent to Cornell University for analysis. Berry samples at harvest were sent to Iowa State University for fruit chemistry analysis. Harvested fruit was sent to Cornell University for winemaking.

**Table 1:** Key phenology, vine growth, & winter injury for six winegrape cultivars grown at the University of Vermont Horticulture Research Center, South Burlington, VT in 2015.

Cultivar	Budbreak (day of year)	Bloom (DOY)	Veraison (DOY)	Harvest (DOY)	Pruning Weight (kg)	Est. Cordon Length (cm)	Primary Bud Winter Injury (%)
Corot Noir	135	173	240	288	0.34 c	156	65 a
Frontenac	128	159	219	268	0.77 ab	162	10 b
La Crescent	128	163	229	268	0.54 bc	164	16 b
Marquette	128	163	216	268	0.81 ab	160	17 b
Prairie Star	131	163	226	268	0.52 bc	161	55 a
St Croix	131	163	226	261	0.86 a	162	22 b

Values represent mean of six replicates of four vines each. Cultivar means followed by the same or no letter are not different at  $\alpha=0.05$  when adjusted for multiple comparisons using the Tukey method (SAS 9.3).

**Table 2:** Yield and juice quality of six winegrape cultivars in the NE-1020 cold hardy cultivar trial at the University of Vermont Horticulture Research Center, South Burlington, VT, 2015.

Cultivar	Mean Yield per Vine (kg)	Mean Yield (tons/acre) <sup>z</sup>	Mean Cluster Weight (g)	Estimated Ravaz Index	Yield per Meter of Cordon (kg)	Juice soluble solids (°Brix)	Juice pH	Juice TA (g/100ml)
Corot Noir	1.9 c	1.5	168 a	5.4	1.20 bc	18.7 c	3.18 c	0.82 c
Frontenac	4.2 ab	3.4	111 ab	5.6	2.58 a	25.9 a	3.41 b	1.33 ab
La Crescent	1.5 c	1.2	67 b	3.2	0.93 c	20.8 c	3.06 d	1.35 a
Marquette	2.9 abc	2.4	83 b	4.0	2.02 ab	27.0 a	3.23 c	1.23 b
Prairie Star	4.3 a	3.5	92 b	9.0	2.72 a	23.6 b	3.61 a	0.80 c
St Croix	2.5 bc	2.1	92 b	3.0	1.64 bc	19.8 c	3.26 c	0.74 c

Values represent mean of six replicates of four vines each. Cultivar means followed by the same or no letter are not different at  $\alpha=0.05$  when adjusted for multiple comparisons using the Tukey method (SAS 9.3).

<sup>z</sup> Crop yield per acre was calculated from yield per vine based on plant and row spacing and is presented for comparison to other studies and vineyards, and was not analyzed statistically.

Horticultural performance was affected for all cultivars by the cold winter of 2014-2015, which also followed an especially harsh winter in the previous year. Pruning weights were lower for all cultivars than in the previous years 2010-2013. Primary bud injury was lowest for Corot Noir and Prairie Star, and the latter cultivar showed more damage than in any previous year. Cordon length decreased for all cultivars compared to the prior years with warmer winters; the cold weather appears to be taking a toll to some degree on all cultivars. However, Frontenac, La Crescent, Marquette, and St Croix continue to perform acceptably for bud hardiness, even after experiencing two harsh winters.

Crop yield was lower on all cultivars than in previous years. No cultivar attained the target yield of four tons/acre, and Frontenac and Prairie Star had the greatest yields in 2015. Corot Noir again had low yield of 1.5 tons per acre, which was comparable to 1.7 tons in 2014. Juice soluble solids ranged from 18.7° for Corot Noir to 27.0° for Marquette, and rankings were similar to previous years with the exception of Prairie Star which had higher brix than previously observed. Juice pH was within an acceptable range to support fermentation for all cultivars. TA continues to be high for Frontenac, La Crescent, and Marquette, but warm weather during ripening appears to have reduced TA for all cultivars compared to previous years.