Evaluating the Effects of Cropping levels on Bud Hardiness to Mitigate Risk in Lake Erie Grape Production for *Vitis Labrusca, Vitis Vinifera,* and Hybrid Cultivars

Progress Report for the Lake Erie Regional Grape Research & Extension and the New York Wine and Grape Foundation

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Research and Extension project
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Objectives:

1) In commercial vineyards, determine the relationship of bud hardiness to cropping levels that have been identified using sensor technology and mapping tools, and adjusted using mechanical practices (fruit thinned and shoot thinned).
2) In research vineyard, determine the relationship of bud hardiness to specific cropping levels in native Concord, hybrid Vignoles, and vinifera Riesling varieties.
3) Develop dormant season bud hardiness profile that encompasses acclimation, maximum hardiness and deacclimation of the effect of different canopy treatment on them and the bud hardiness inherent to Concord, Vignoles, and Riesling varieties in the Lake Erie region.
4) Determine bud hardiness in response to environmental events where temperatures drop quickly or unseasonably low.

Winter low temperatures that fall below a critical value can damage grapevine buds. The critical temperature for bud injury varies over the dormant season and responds to daily changes in temperature. We can measure this critical temperature through a procedure called differential thermal analysis, which involves controlled freezing of a sample of buds collected from vineyards. With funding from the New York Wine and Grape Foundation, we are monitoring bud hardiness in Concords (native), Vignoles (hybrid), and Riesling (vinifera) at different cropping levels to see if there is an effect on cold hardiness. We monitor samples every two weeks from November through March in the research vineyards at the Cornell Lake Erie Research and Extension Laboratory in Portland, NY.

Bud hardiness is a process that changes throughout dormancy and is determined by genetics and the environment. Seasonal differences, high cropping levels and late harvest can affect bud hardiness and vine health. These factors contribute to the risks of growing grapes in cool climates. To be sustainable in the sense that producing an annual crop at economically viable levels each year, the bulk juice grape growers must produce high yields and quality while reacting to climate related obstacles and wine grape growers' sustainability looking for ways of implementing mechanization to accommodate recent labor issues. We were funded to test and compare different crop load management effects on bud hardiness in three different grapevine species, American native *vitis labrusca* Concord, French native *vitis vinifera* Riesling, and French- American hybrid Vignoles.

Crop load can impact vine health and bud hardiness. Overcropping a vine will decrease vine size over time. Does overcropping really decrease bud cold hardiness of the buds you retain after pruning? Does the timing of crop adjustment decrease bud cold hardiness? Current practices and technologies have focused on crop adjustment to maximize yields and increase quality. These advancements have added to the reliability of return crop and contributed to an increase in vine size. This project hopes to provide insight on the risks and benefits of cropping levels, crop adjustment, and crop adjustment timing as well as identifying the relationship between cropping level and bud hardiness among native Concords, hybrid Vignoles, and vinifera Riesling varieties.

Bud hardiness data was collected from four grape cultivars in the Lake Erie Grape Region to develop dormant season bud hardiness profiles in collaboration with Tim Martinson in past years. Adding the level of differential crop load management effects on bud hardiness for V. labrusca, V. vinifera, and Inter-specific hybrid cultivars in the Lake Erie Grape Region from November – April would give growers the information needed to maximize yields and respond to climatic events. Armed with this information, growers could accurately identify when vines begin the deacclimation process allowing them to know when they should address risk management strategies such as delayed pruning.

There is constant potential of bud and vine injury as a result of sudden low temperatures. Bud hardiness profiles from ongoing research is used to educate area grape growers and adjust their pruning levels. Adding a data layer of potential detrimental effects on bud hardiness due to crop load management decisions for American, French, and French-American hybrid cultivars would widen the scope of information and potential impact on sustainability.

The treatments for the native portion of this research are Concord High Crop and Concord Low Crop. This data was gathered using Dr. Terry Bates's Big C research on our farm that is a variable rate within a variable rate trial. We utilized ground based NDVI sensors to adjust mechanical practices in our Concord grapes to achieve the research cropping levels of High and Low.

The Vignoles (V) and Riesling (R) crop load trial with differential cluster drop timing treatments are three cropping levels or High (H) leave all fruit, Medium (M) leave 5 shoots per foot/one cluster per shoot, and Low (L) leave 4 shoots per foot/one cluster per shoot in Riesling. In Vignoles, we left all fruit for the High crop level, removed half of the fruit for Medium, and left one quarter of the fruit in the Low cropping level. The crop was adjusted by dropping clusters at three different times within those treatments: Early at fruit set (E), Mid-season around 30 days post bloom (M), and Late at veraison (L). Therefore, when looking at the table provided, if you wanted to find the Lethal Temperature 50 for Riesling, Medium Crop, where the clusters were dropped around 30 days after bloom, you would look for RMM.

There was also a spur pruned vs. cane pruned trial in Riesling added to the study, where vines were pruned to total 30 buds on each vine in three different management strategies: two 15 bud canes, six 5 bud spurs and 15 two bud spurs.

Throughout the growing season, sensor technology and mapping tools were used to determine the relationship of growth to cropping levels. Final average berry weights and juice soluble sugars for each treat of the cropping level trial were recorded and pruning weights are planned to collect.

Table 1. Riesling Cropping Level Trial Average Berry Weight and Brix per Treatment

Riesling	100 Berry Wt (g)	Ave Berry Wt (g)	°Brix
Control	173	1.73	19.3
HE	172	1.72	19.9
HM	156	1.56	19.5
HL	168	1.68	19.1
ME	175	1.75	20.4
MM	165	1.65	20.5
ML	165	1.65	20.3
LE	170	1.7	19.9
LM	164	1.64	20.1
LL	138	1.38	20.2

Table 2. Riesling Cane vs Spur Pruning Trial Average Cluster Weight and Average Brix per Treatment

Riesling Cane vs. Spur				
Node #	**Cluster #**	**Weight (g)**	**Brix**	**wt/cl(g)**
2	99.0	6991.6	20.6	71.1
5	111.7	7061.1	20.5	64.2
15	81.2	5738.6	21.1	71.0

This report contains the data collection to date and the LT50 data is published on our website for our grower stakeholders to reference along with articles published to explain the research and information collect for this

season. The research will be analyzed and presented at a later date. Below is the table of our results for this past week:

Table 3. Lethal Temperature 50 in Fahrenheit for Bud Hardiness and Cropping Levels for the week of January 25, 2021

Date	Variety	Cropping Level	Crop Adjustment Timing	LTE 50 (°F)
1/25/21	Concord	High		-12.14
	Concord	Low		-16.85
	Riesling	2 cane 15 bud		-11.20
		6 spur 5 bud		-10.62
		15 spur 2 bud		-8.03
	Riesling	High	Early	-8.46
			Mid-season	-9.67
			Late	-11.49
		Medium	Early	-10.61
			Mid-season	-10.64
			Late	-13.49
		Low	Early	-6.74
			Mid-season	-11.25
			Late	-9.87
	Vignoles	High	Early	-14.96
			Mid-season	-15.95
			Late	-4.04
		Medium	Early	-10.79
			Mid-season	-13.22
			Late	-3.62
		Low	Early	-13.99
			Mid-season	-5.67
			Late	-6.52