Research Report for 2020 to the
Lake Erie Regional Grape Program and NY Wine and Grape Foundation
January 25, 2021

Breeding and evaluation of new wine grape varieties with improved cold tolerance and disease resistance

Principal Investigators	*Organization*
Bruce I. Reisch	Cornell, Geneva (Horticulture Section)
Anna Katharine Mansfield	Cornell, Geneva (Food Sci. and Technology)

Overall Goals:

Viticulture in the eastern United States is limited by climatic conditions conducive to disease development and cold damage. We seek to breed and evaluate new grapevine cultivars that combine cold hardiness, disease resistance, superior wine quality and regional adaptation.

Objective:

1. Provide eastern winegrowers with grape varieties of superior wine quality, which are better adapted to our growing conditions and are sustainable in response to climate change. New selections from the Cornell Grape Breeding Program will be screened for cold response and disease resistance. The field performance of new selections from the Cornell program and accessions from other sources will be recorded. The wine aroma and texture profile of new selections is to be comparable to the quality found among vinifera grapes and/or unique and valued by panelists and the wine consumer. Wine flavor/aroma profiles are to be assessed by producing wine samples and characterizing their chemical and sensory properties.

Progress on new grape variety releases to the industry:

Reports indicate that nursery sales of the 2013 wine grape releases, 'Aromella' and 'Arandell', are going extremely well. In 2014, Goose Watch Winery released the first 'Aromella' varietal wine. In 2017, Arbor Hill released its own 'Aromella' varietal. While 'Arandell' is being used in several red wine blends east of the Rockies, the first varietal 'Arandell' wines were marketed by Vinedo del Alamo winery (Fort Scott, KS); Clermont Vineyards, (Germantown, NY), and (Briedé Family Vineyards, Winchester, VA) beginning with the 2017 harvest. A highly disease-resistant red wine selection (NY06.0514.06) is being propagated for inclusion in regional trials, along with other white wine selections and a red found suitable for rosé wine production. Strong interest in the Riesling hybrid, NY81.0315.17, continues and a large-scale yeast strain trial will soon conclude – with the final set of wine tastings having been postponed by the pandemic.

Wine Sensory Evaluations:

Forty-nine lots of wine (36 white, 13 red) of wine were made from breeding program selections and cultivars in 2019; 28 lots (16 white, 12 red) were made in 2020. Brix, pH, titratable acidity, and yeast assimilable nitrogen (YAN) were analyzed at harvest, and musts were chaptalized to 20˚Brix if necessary. Reds were fermented on the skins with yeast strain GRE, and malolactic fermentation induced with LAB culture VP41. Whites were pressed, settled overnight, racked, and inoculated with yeast strain EC1118. All wines are analyzed for pH, titratable acidity, and organic acids (tartrate, malate, lactate, and acetic) via HPLC, and will be screened by a trained sensory panel.

Sensory evaluation: No wines have been evaluated since the 2018 harvest, due to the ongoing pandemic. As soon as it's safe to organize and conduct tastings again, 2019 and 2020 wines will be evaluated by sensory panels. Wines from the multi-year NY81.0315.17 yeast trial are under evaluation in a cooperative effort with Alina Stelick of the Sensory Evaluation Center, Food Science, Ithaca. An in-home consumer evaluation test has been developed to assess customer impressions of wines in a setting typical of normal wine consumption; data from this study will allow researchers to compare consumer tastes with those of the screening panel, and to provide winemakers with recommendations for yeast selection and production methods.

2020 breeding program analyses of vineyard performance:

Field Data Collection: Observations of vineyard performance in 2020 (including prior years) for program selections and varieties, along with cold hardiness evaluations, disease resistance scores, and wine-related data are summarized in the appendices (Tables 1 to 3)[1].

Comparative vineyard performance data are collected annually (Table 1). Twelve selections and cultivars were evaluated in second test vineyards with a standard hybrid disease control program in 2020 (Table 1), including just two harvested for the first time. Evaluation of a many others was discontinued as we found them to either be unsuitable for commercialization, or we now await results from NE1720 cooperative trials. From the second test vineyard used for the disease resistance program, twenty selections were harvested in 2020 (Table 2), of which ten were harvested for the first time. This reflects the focus on the program in recent years on combining disease resistance with wine quality. Many new selections are now making their way from seedling vineyards into these second test vineyards, so they can be further evaluated for viticultural and enological aspects. Additional data are shown for selections harvested in previous seasons. Selections with low relative rankings (e.g. those with poor wine quality, disease susceptibility, overcropping tendency, susceptibility to cold damage) have been discarded each year. Nearly all harvested selections are tested for degree of mid winter bud hardiness each year, and these data are presented in Tables 1 and 2 as estimates of the temperature at which 50% bud kill is expected.

Please note that where fruit production data have been collected for only 2020, initial lbs/vine numbers are low; these are young vines in their first year of fruit production. Some other seasons have reduced fruit production due to drought, or our effort to convert to high-cordon training. We also have situations where fruit clusters are used in crossing and pollination. So, while we do evaluate vine productivity, we cannot assume that our yields based on a six-vine plot will be representative of fruit production potential on a commercial per acre basis.

Among wine grapes tested under the standard hybrid disease control program (Table 1), there are several of interest, and some more recent hybrids (with vinifera parents) from crosses made in 2008 and 2010 may still hold promise. This latter group descend from vinifera such as Teroldego, Merlot, Tocai Friulano, and Albariño, and testing is still at a relatively early stage. NY02.0101.01 is productive, moderately winter hardy, and disease resistant (under a hybrid spray program), but wine quality has varied.

Summaries of top selections from Geneva – 2nd Test Vineyards:

NY81.0315.17 – Consistently ranks very high for wine quality; descriptor list inccludes muscat notes, intense floral, peach and citrus, tangerine, grapefruit, apple, pear, and honey. In 2017, 2018, and 2019, a replicated yeast trial was conducted using fruit kindly supply by the FLCC-Cooperative Extension teaching vineyard at Anthony Road Winery. Fruit was subdivided and fermented in duplicate using seven difference yeast strains. Wine evaluations will be taking place soon; delayed due to pandemic. Measurements indicate that NY81.0315.17 is 1 to 2 ^{o}F hardier than ‘Riesling’ (according to temperature of 50% bud kill in mid winter). As a bunch rot resistant alternative to ‘Riesling’, it will continue to undergo testing in New York and elsewhere. Own-rooted vines are weak and grafting is required. This selection is available for testing via our two cooperating nurseries, Double A Vineyards (Fredonia) and Grafted Grapevine Nursery (Clifton Springs).

A range of other breeding program selections have been chosen for further trials beyond Cornell AgriTech farms, and available cuttings have been collected for propagation. These include the following:

NY01.0609.01 – This red wine grape produced a very highly ranked and unique wine from vintage 2011, characterized as expressing muscat character with notes of rose and violet. Since 2012, it has been fermented “as a white” to investigate the possibilities of producing a muscat rosé style wine. The color of vintage 2012 was more orange than pink, and some tasters found foxy/cotton candy notes while others described floral, pear, cherry and strawberry notes. The 2013 vintage was also well-liked. Panelists detected some pleasant labrusca notes, along with cherries, cranberry, strawberry, and currants. Only one taster (of eleven) noted muscat character. Vines are very

---

[1] Tabular reporting of this type of long-term research information has its inherent difficulties. Some breeding selections are tested over a long period of time, while others are discarded after only a few years of testing. Also, as newly produced selections start to fruit, data collection begins and these data are included along with data from selections that have already been tested for multiple years. Since every season is different, accurate comparisons among selections are difficult when the years of data collection differ. However, it is still possible to utilize these tables to understand the basic characteristics of each of these selections: productivity, vine size, winter hardiness, disease resistance, and wine quality. These data help to determine which selections show potential for more advanced, replicated trials.

productive (Table 1), with large clusters and have good resistance to powdery and downy mildews under a hybrid spray program. The predicted temperature for 50% bud kill is -13.2 °F.

NY03.0207.06 – This white wine selection produces a good canopy with moderate resistance to foliar powdery and downy mildews. Fruit are mostly rot-resistance but some sour rot has been noted in some years. Wines have been highly ranked by tasting panels, with aromas described as melon, pear, spicy and pineapple, while the palate descriptors included good structure and body; and mentions of citrus, pineapple apple and Riesling-like characters. The predicted temperature for 50% bud kill is -17.4 °F.

NY03.0208.09 – This white wine grape has been described as having citrus, tropical fruit, peach and pear characteristics in both the aroma and palate. It has been very well-liked by tasting panels. Vines have been moderately productive with good resistance to powdery mildew. Bird damage has been a problem and protection (netting) is needed. Due to continuing problems with severe leaf phylloxera as well as rachis necrosis, we are no longer recommending this one for further trials. The predicted temperature for 50% bud kill is -14.9 °F

NY04.0303.02 –This selection produced the top–ranked white wine from vintages 2013 and 2016. However, we have discontinued testing of this selection due to ongoing issues with sour rot, even in 2020 when sour rot was rare.

Disease Resistance Breeding:

The grape breeding program made 15 crosses in 2020, most targeting combinations of disease resistance with high quality. A central focus of the crossing program was the incorporation of disease resistance sources from pollen shared by a cooperator from Germany. We also made a group of crosses to incorporate four downy mildew resistance genes (two newly identified) from *Vitis amurensis* – these genes were recently identified in the "*Vitis*Gen2" project. A total of 5,006 seed were produced in 2020, of which 4,131 seeds were stratified for germination.

DNA marker technology, combined with in-season evaluation of disease resistance in a no-spray nursery, is markedly improving the efficiency of disease resistance breeding. DNA markers can be detected in DNA extracted from each seedling, and we are using this technology with the national *Vitis*Gen USDA-NIFA funded projects to accurately predict which seedlings harbor important genes and gene combinations for disease resistance. The correlation with field-observed disease resistance is extremely high.

From seedlings grown in recent years, most underwent DNA-assisted selection for multiple disease resistance genes coding for both downy and powdery mildew resistance. Approximately 90% of all seedlings were discarded prior to nursery planting between 2015-2018. After one season in the nursery, remaining vines were planted to the permanent vineyard sites. In 2019 and 2020, ca. 50% of seedlings were retained, but labeled according to presence/absence of desirable genes according to DNA testing results. Resistance to disease will be field-assessed each season.

Each year, program selections and seedlings grown under no-spray conditions in both nursery and vineyard plantings are evaluated for symptoms of disease. While we never recommend no-spray conditions in commercial settings, we carry out our evaluations under very stressful conditions along with control (resistant and susceptible) vines in every row. Conditions were less favorable for powdery mildew development between 2017 and 2019, but much more favorable for downy mildew. In 2020, we had only mild/moderate levels of powdery and downy mildew on control vines. We rate both diseases, in addition to anthracnose, phomopsis, bunch rot and black rot, on test selections and controls every year.

Thousands of seedlings are grown each year, but one group has been noteworthy during the past few seasons. In 2006, crosses were made between selections carrying both the *Run1* gene for powdery mildew resistance and the *Rpv1* gene for downy mildew resistance (from the muscadine grape) and other selections harboring powdery mildew resistance from *Vitis cinerea* and *V. rupestris*. In these populations, unexpectedly high percentages of seedlings were saved in the 2007 nursery since they showed minimal amounts of downy and powdery mildew late into the fall. These were planted to a permanent no-spray vineyard in 2008, and most remained nearly disease-free in subsequent years. Some began to fruit in 2009, and several were immediately propagated and recognized as having potentially good fruit quality combined with unusually high disease resistance. Numerous individuals have already been used as parents for further breeding. It's not unusual to find that many of the *Run1* / *Rpv1* seedlings being fermented for the first time do not produce highly ranked wines. However, some show promise with minimal hybrid character. These include the red wine grape NY06.0514.06 and the white wine selection, NY06.0514.09. NY06.0514.06 has been propagated for further trials beyond Geneva, in cooperation with the NE1720 National Cultivar Trial project. It's standard practice in our program to include *Run1* / *Rpv1* in all new disease resistance crosses.

NY06.0514.06 – a highly disease resistant red wine selection. This selection carries the *Run1 / Rpv1* genes, as well as *Ren2* (for powdery mildew resistance) from *V. cinerea*. Also has excellent resistance to bunch rot, and moderate resistance to black rot. The buds are moderately winter hardy, with expected temperature of 50% bud kill in mid-winter measured to be -15 °F. Vines are on the small side and grafting on phylloxera-resistant stocks should be tested. Fruit yields seem low (Table 2) due to the use of many clusters for crossing each year; spurs are not fruitful at the base, as well. Wine descriptors are as follows: fruity with notes of blackberry, plum, cherry; slightly herbaceous, with green pepper noted; good body and medium tannin; also, some have detected chocolate notes.

From crosses made in 2015 and 2016, we now have a range of promising **juice grape** seedlings harboring *Run1 / Rpv1*. These are being propagated already for further trials to better assess juice quality. Some are early-ripening as well.

Technology transfer:
On many occasions we discuss the qualities of new grape varieties with members of the wine industry. We respond to extension phone calls and emails frequently. In many of these communications and at visits to wineries and off-site trials, alternative grape varieties are discussed. While on-site field visits have not been possible during the pandemic, we hope to make up for lost time when we can.

While not directly related to this project, several enology studies assessing tannin retention in red wines have used 2006 release Corot noir as a trial cultivar; results suggest that Corot noir has tannin retention activity more similar to *V. vinifera* standard Cabernet Franc than to other interspecific hybrid red wine cultivars. This series of studies, including the Corot noir data, has been used to illustrate tannin retention methods in extension talks given in New York, Michigan, and Ohio over the past year.

Acknowledgments
Special thanks go to Chris Gerling, Mike Colizzi, Steve Luce, Alexis Pike, and Luann Preston-Wilsey for their technical expertise, enthusiasm, assistance, and thoughtful contributions to this project.

Resistant selections in second-test plantings (all with Run1/Rpv1 genes): (these are mentioned in Tables 2 and 3)



10.0927.02, from a cross made with 'Aromella' in 2010.	12.0107.01 – 2012 cross with a background including vinifera, Frontenac, other hybrids.	12.0118.01 – complex background includes Villaris from Germany; cross made in 2012.

Appendix

Impact Statement:
Two new varieties were released in 2013 (‘Aromella’ and ‘Arandell’), and the first commercial wine of ‘Aromella’ (from Goose Watch) went on sale in 2014, while ‘Arandell’ varietals reached the marketplace ca. 2016. In 2020, the ‘Arandell’ wine made by Briedé Family Vineyards won a Silver Medal at the 2020 International Wine and Spirits Competition – Sommelier Challenge. Three new wine grapes, ‘Noiret’, ‘Corot noir’ and ‘Valvin Muscat’, were released in July 2006, and all are in commercial use. Prior releases such as ‘Cayuga White’ (1972), ‘Chardonel’ (1991), ‘Traminette’ (1996) and ‘Geneva Red’ (2003) have gained widespread acceptance and account for millions of dollars of wine production annually in New York and in other eastern states.

Publications and presentations resulting from this project:

- Presented a lecture on grapevine breeding (2.5 hr) to a section of the viticulture class at Finger Lakes Community College. 2.5 hours x 25 students. Geneva, NY, April 13 and 22, 2020. (Reisch)
- Presented on grapevine breeding and genetics to the Viticulture class at the Univ. of Massachusetts, Amherst. (one hour, 20 students, via Zoom.) February 7, 2020. (Reisch)
- “Wine Grape Breeding and the *Vitis*Gen2 SCRI Project”, annual meeting of the Virginia Vineyards Association, Charlottesville, VA, February 20, 2020. One hour x 200 attendees.
- Podcast, “Developing New Wine Grape Varieties”, < https://www.vineyardteam.org/resources/resource-library/pest-management.php?id=861> July 2, 2020
- Video presentation on Facebook Live: “Hybrid Grapes with Bruce Reisch and Nate Walsh”, hosted by Briedé Family Vineyards, April 2020 https://www.facebook.com/watch/live/?v=234078887699564&ref=watch_permalink
- Recent extension-oriented outputs from “*Vitis*Gen2” include:
- http://www.vitisgen2.org/webinars/
- http://www.vitisgen2.org/home/popular-press/
- Grape Selections from the VitisGen Projects

Our project web sites provides information on cultivars developed at Cornell. See:

http://www.hort.cornell.edu/reisch/grapegenetics/grapeinfo.html

http://www.hort.cornell.edu/reisch/grapegenetics/cultivars.html

http://www.vitisgen2.org

(End of report; See also Appendix Tables 1-3. Detailed data (Tables 1-3) may be obtained by contacting Bruce Reisch <bruce.reisch@cornell.edu>).

Selections	Years of Data	PM	DM	Yield / Vine (lb)	Cluster Wt (lb)	Berry Weight (gm)	50% Bud Kill (°F)	Pruning Wt. (lb.)
Reds								
02.0101.01	10,12-16,18,19	1.83	1.60	18.5	0.24	1.60	-13.5	2.85
08.0702.01	16-20	1.25	1.25	9.8	0.24	1.34	-15.0	3.12
08.0702.02	16-20	1.00	1.25	8.7	0.25	1.03	-11.0	3.76
08.0702.03	17, 19, 20	1.00	1.33	6.0	—	1.15	-10.3	—
08.0710.01	16-20	1.00	1.00	13.1	0.28	1.88	-17.9	2.05
10.0937.05	20	1.00	1.00	3.5	0.20	—	—	—
Chambourcin	97-02,06-20	4.11	1.14	18.8	0.42	2.11	-12.7	2.63
Red Pressed as White								
01.0609.01	09-15,17-19	1.56	1.13	27.9	0.42	2.49	-13.2	3.27
Whites								
03.0207.06	12-20	1.25	2.00	16.0	0.22	1.24	-17.4	2.23
03.0208.03	10-19	1.38	2.29	12.5	0.23	1.68	-15.9	1.86
03.0208.09	11-18	1.57	2.67	12.0	0.18	1.83	-14.9	2.01
04.0303.02	13-17,19	1.00	1.50	13.5	0.18	2.58	-15.9	4.75
04.0303.04	13-16,18,19	1.25	2.00	14.9	0.21	—	-15.7	2.59
05.0403.01	13-19	1.00	1.60	16.9	0.27	1.92	-16.7	2.91
05.0403.03	13,14,17-19	1.00	2.00	11.0	0.26	1.69	-16.0	3.97
05.0403.09	13-19	1.25	1.75	12.0	0.28	1.73	-18.9	3.64
08.0721.02	18-20	1.00	1.00	7.6	—	—	—	—
08.0721.03	15,17-20	1.00	1.50	12.8	0.47	1.31	-9.8	6.62
08.0722.01	17-20	1.25	1.50	6.5	0.32	1.15	-11.0	—
08.0722.02	17, 19	1.00	3.00	2.3	0.19	—	-12.4	—
08.0726.01	20	1.00	1.00	4.7	0.14	—	—	—
Cayuga White	10-15,18-20	2.83	1.88	25.7	0.42	2.74	-11.3	2.63

Key:
Fruit/Vine (lbs.) converts approximately to tons per acre (at 605 vines/acre) by dividing by 3.
Pruning Weight = average pounds per vine.
50% Bud Kill = predicted temperature (ºF) at which 50% of primary buds would die according to freezing tests run on dormant buds in mid-winter.
DM Ave. and PM Ave. = Average ratings of foliar downy and powdery mildew severity during severe test years between 1997 and 2020.
Disease Rating System: 1 = 1-3% foliar infection, 2 = 3-12%, 3 = 12-25%, 4 = 25-50%, 5 = >50%.
Pruning weights and 50% bud kill data are not yet complete for the 2020 crop year.

NOT FOR PUBLICATION

Table 2. Summary of vineyard characteristics of breeding selections grown under fungicide-free conditions.

Selections	Years of Data	PM	DM	Yield / Vine (lb)	Cluster Wt (lb)	Berry Wt (gm)	50% Bud Kill (°F)	Pruning Wt. (lb.)
Reds								
06.0509.01	15,17,18	2.50	1.50	9.4	0.24	0.85	-14.4	1.35
06.0514.06	13-20	1.00	1.29	10.0	0.33	1.58	-15.0	1.27
06.0514.07	18-20	2.00	1.00	13.1	—	—	—	—
07.0608.01	14,17-20	2.00	1.33	8.0	0.37	0.94	-18.1	1.59
08.0709.02	20	1.00	1.00	4.8	0.34	—	—	—
10.0925.01	20	1.00	1.00	4.2	0.42	—	—	—
10.0925.02	19, 20	1.00	1.00	4.8	—	—	—	—
10.0925.03	19, 20	1.00	1.00	21.6	—	—	—	—
12.0108.01	20	1.00	1.00	3.8	0.31	—	—	—
Arandell	05-12,14,15,17	2.86	1.82	9.0	0.17	1.13	-12.0	1.53
Whites								
06.0506.02	13-15,17, 19	1.00	1.00	4.4	—	1.59	-14.5	1.30
06.0508.02	17-20	1.00	1.00	8.7	—	1.15	—	3.41
06.0512.04	15,17, 19, 20	2.00	1.00	17.8	—	2.48	-9.1	1.18
06.0514.09	15, 18, 19	2.00	1.00	12.0	0.27	—	—	—
06.0514.12	15,17, 19	1.00	1.50	10.8	0.21	0.86	-17.1	—
09.0815.01	19, 20	1.00	1.00	10.3	0.23	—	—	—
10.0927.01	20	1.00	1.00	7.1	0.35	—	—	—
10.0927.02	20	1.00	1.00	1.7	0.24	—	—	—
10.0934.01	19, 20	1.00	1.00	7.6	0.24	—	—	—
10.0934.02	19, 20	1.00	1.00	7.0		—	—	—
11.0010.01	20	2.00	1.00	3.3	0.16	—	—	—
12.0107.01	20	1.00	1.00	3.3	0.32	—	—	—
12.0118.01	20	1.00	1.00	3.4	0.35	—	—	—
13.0205.02	20	1.00	1.00	2.5	0.29	—	—	—
13.0206.01	20	1.00	1.00	1.5	0.35	—	—	—

Key:
Fruit/Vine (lbs.) converts approximately to tons per acre (at 605 vines/acre) by dividing by 3.
Pruning Weight = average pounds per vine.
50% Bud Kill = predicted temperature (ºF) at which 50% of primary buds would die according to freezing tests run on dormant buds in mid-winter.
DM Ave. and PM Ave. = Average ratings of foliar downy and powdery mildew severity during severe test years between 2005 and 2020.
Disease Rating System: 1 = 1-3% foliar infection, 2 = 3-12%, 3 = 12-25%, 4 = 25-50%, 5 = >50%.
Pruning weights and 50% bud kill data are not yet complete for the 2020 crop year.

NOT FOR PUBLICATION

Selections	Years of Wine Data	Harv. °Brix	Harv. pH	Harv. T.A. (%)	Wine pH	Wine T.A. (%)	Wine Score*
Reds							
02.0101.01	10,12-16, 18, 19	19.6	3.05	1.00	3.13	0.94	5.02
08.0702.01	16-20	19.4	2.97	1.09	3.19	1.09	5.18
08.0702.02	16-20	20.2	2.75	1.85	2.74	2.01	3.67
08.0702.03	17, 19, 20	21.2	2.79	2.10	3.03	1.65	—
08.0710.01	16-20	22.0	2.94	1.14	3.14	1.09	3.24
10.0937.05	20	23.0	2.88	2.01	3.22	1.50	—
Chambourcin	97-12,14-20	21.0	2.91	1.46	3.02	1.45	—
Red Pressed as White							
01.0609.01	9-15, 17-19	18.5	3.14	0.99	3.23	1.10	5.35
Whites							
03.0207.06	12-20	19.4	2.93	1.28	2.88	1.34	5.09
03.0208.03	10-19	20.4	3.02	1.10	2.97	1.16	4.85
03.0208.09	11-18	20.2	2.91	1.10	2.86	1.26	4.99
04.0303.02	13-17, 19	18.4	3.08	1.25	3.05	1.37	5.75
04.0303.04	13-16, 18, 19	19.8	3.09	0.94	3.17	1.03	5.65
05.0403.01	13-19	20.2	3.01	1.19	2.94	1.14	4.47
05.0403.03	13, 14, 17-19	20.3	3.08	0.95	3.09	1.01	4.43
05.0403.09	13-19	20.5	2.84	1.63	2.70	1.72	3.88
08.0721.02	18-20	18.9	2.98	1.11	3.10	1.24	3.52
08.0721.03	15, 17-20	19.5	2.98	1.42	2.99	1.51	4.96
08.0722.01	17-20	19.8	3.03	1.42	2.99	1.49	—
08.0722.02	17, 19	19.0	3.02	1.10	3.02	1.25	4.88
08.0726.01	20	20.2	2.73	2.00	2.75	2.04	—
Cayuga White	96-20	18.7	2.96	0.99	3.04	1.14	—

Table 3. Summary of wine data collected on breeding selections and varieties under test.

Selections	Years of Wine Data	Harv. °Brix	Harv. pH	Harv. T.A. (%)	Wine pH	Wine T.A. (%)	Wine Score*
Selections from the Disease Resistance Breeding Vineyard							
Reds							
06.0509.01	15, 17, 18	15.7	3.00	1.17	3.14	1.22	4.98
06.0514.06	13-20	20.1	3.11	0.93	3.42	0.87	5.49
06.0514.07	18-20	20.2	2.91	1.27	3.22	1.24	5.00
07.0608.01	14, 17-20	21.4	2.97	1.41	3.29	1.24	5.00
08.0709.02	19, 20	19.9	2.81	1.82	3.05	1.42	—
10.0925.01	20	18.8	2.92	0.96	3.15	1.21	—
10.0925.02	19-20	20.0	2.96	1.03	3.33	1.23	—
10.0925.03	19,20	20.6	2.90	1.13	3.21	1.29	—
12.0108.01	20	19.6	2.97	1.14	3.55	0.96	—
Arandell	05-12,14-17	19.7	3.28	1.08	3.81	0.76	4.82
Whites							
06.0506.02	13-15, 17, 19	19.1	2.99	1.40	2.96	1.08	4.99
06.0508.02	17-20	20.0	3.01	0.99	3.10	0.79	3.73
06.0512.04	15, 17, 19, 20	19.4	2.91	1.13	2.89	1.23	4.14
06.0514.09	15, 18, 19	20.6	3.01	0.97	2.95	0.72	5.17
06.0514.12	15, 17	19.0	2.84	1.54	2.82	1.53	4.43
09.0815.01	19-20	22.3	2.82	1.57	2.86	1.55	—
10.0927.01	20	23.4	2.90	1.25	3.02	1.34	—
10.0927.02	20	21.4	2.80	1.57	—	—	—
10.0934.01	19-20	20.9	2.83	1.41	2.95	1.45	—
10.0934.02	19-20	21.8	3.11	0.95	3.14	1.09	—
11.0010.01	20	23.6	2.80	1.44	2.99	1.50	—
12.0107.01	20	22.0	2.79	1.53	2.78	1.61	—
12.0118.01	20	22.2	2.84	1.13	—	—	—
13.0205.02	20	23.9	2.90	0.94	—	—	—
13.0206.01	20	21.9	2.96	1.04	—	—	—

* NOTE: wine scores available only through vintage of 2018