Virginia Cooperative Extension
Virginia Tech • Virginia State University
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Viticulture Notes

..... Vol. 35 No. 5, December 2020

Beth Chang, Enology Extension Specialist, Food Science and Technology (eabc@vt.edu)
vtenology.com
Tony K. Wolf, Viticulture Extension Specialist, AHS Jr. AREC (vitis@vt.edu)
Tremain Hatch, Extension Viticulture Associate, AHS Jr. AREC (thatch@vt.edu)
https://www.arec.vaes.vt.edu/arec/alson-h-smith.html

THE 2020 SEASON IN REVIEW:

Beth Chang, Tremain Hatch and Tony Wolf, Virginia Tech

2020 has been a remarkable year. No discussion of the 2020 season would be complete without mention of the widespread spring frosts that occurred and which ultimately impacted the final harvest tonnage for the year (TBD). The traditional growing months of April – October were book-ended by unusually warm March and November temperatures. Depending on your location, March was possibly the 4th warmest on record while November was mentioned as the 5th warmest in the northern Virginia area. The latter had no real downsides, but the warm March was instrumental in hastening the end of ecodormancy in our vines and predisposing them to spring frost injury with the advent of green tissues. Had temperatures remained warm, we might have fared better, but April through mid-May were unusually cold, and punctuated by sub-freezing conditions on 15, 17 and 19 April, and 9 and 10 May ("Mother of all frosts") with pockets on 13 May for good measure. The frosts of April missed some late-budding cultivars such as Cabernet Sauvignon, only to have those escapees get hit with the subsequent May frosts. Damage was most severe and widespread in the southern and central piedmont, and well into the northern piedmont, particularly at vineyard elevations under about 850' asl. Most of the damage occurred under radiational cooling events. Some success in avoiding complete crop loss was achieved with inputs of wind, heat, as well as double-pruning, but the repeated nature of the freeze events, and in particular the duration of the 10 May event, still led to significant injury even with those frost mitigation efforts. What many feared would be an oversupply of fruit in a market depressed by the coronavirus pandemic, turned into a much leaner and more sought-after crop.

It's not easy to pin down what exactly an "normal season" looks like here in Virginia. This past growing season was unique according to a couple different meteorological indexes.

The weather data used for this summary of the season was measured at NEWA weather stations around the state, and fruit chemistry data was acquired via the piloting of a Sentinel Vineyards project (details below). Growing degree days (GDD) is a means to show accumulation of warmth over time. We accumulated less heat in 2020 than we did in the previous two years (Table 1, Figure 1). However, it was not cooler for the entire growing season. We got hotter than average in July (Table 2). Richmond and Washington DC had 20+ day streaks of 90+°F. Then September and October were cool again (Figure 2).

Table 1: Heat accumulation in 2020, 2019 and 2018 (Growing degree days base 50°F)

Total Heat	Crozet (Albemarle Co.)	Paeonian Springs (Loudoun Co.)	Winchester	Floyd
GDD, 1 April - 31 October 2020	3762	3564	3442	2909
GDD, 1 April - 31 October 2019	4494	4014	3946	3547
GDD, 1 April - 31 October 2018	4188	3872	3812	3337

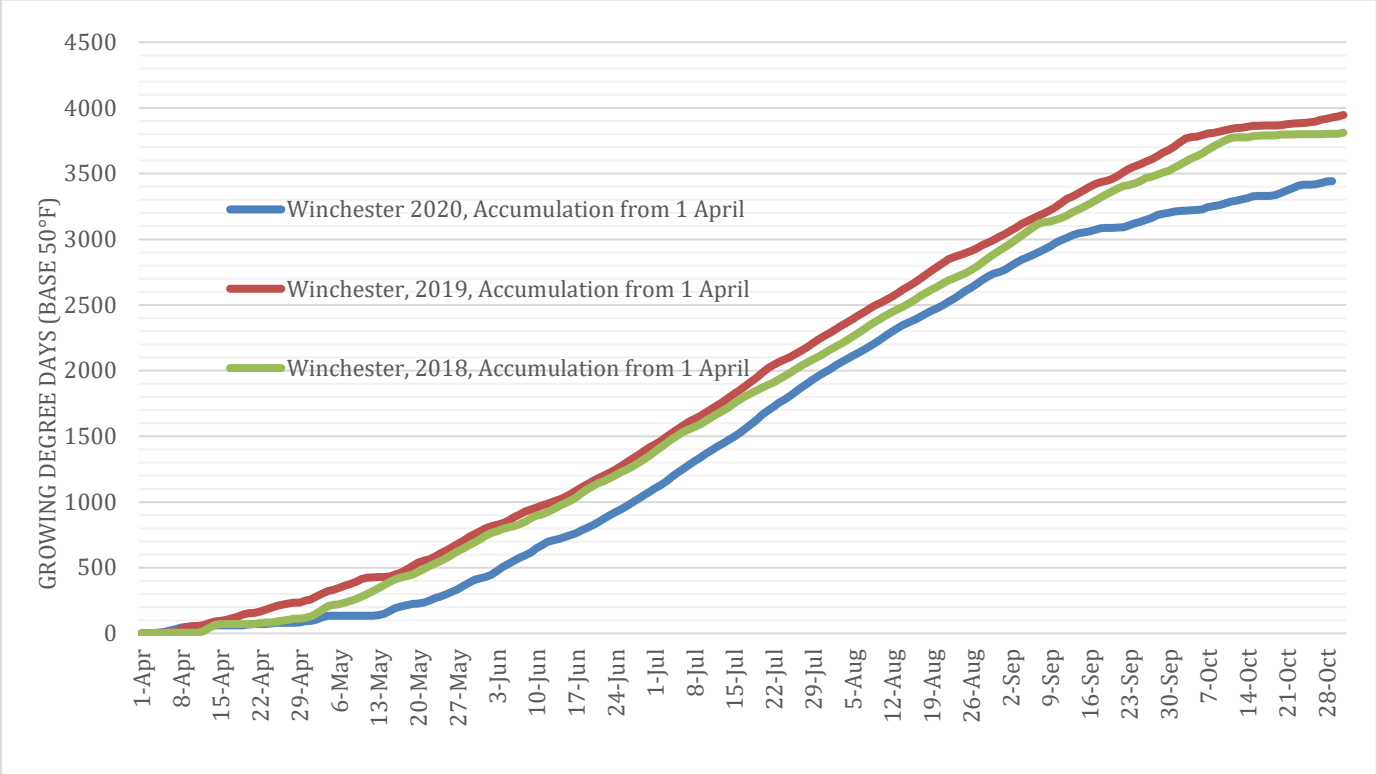

Figure 1: Growing Season Heat Accumulation in Winchester VA *(see Appendix Figures 10-12 for GDD in Northern, Central and Southwest Virginia).*

Table 2:Heat Accumulation in month of July 2018, 2019, 2020 at Winchester AREC

Year	Degree Days Accumulated in July
2020	907
2019	848
2018	778

In previous years, September shows clear heat accumulation with a flattening out and modest gains in October. In September 2020, we started will less heat and we had modest heat accumulation from mid-September on.

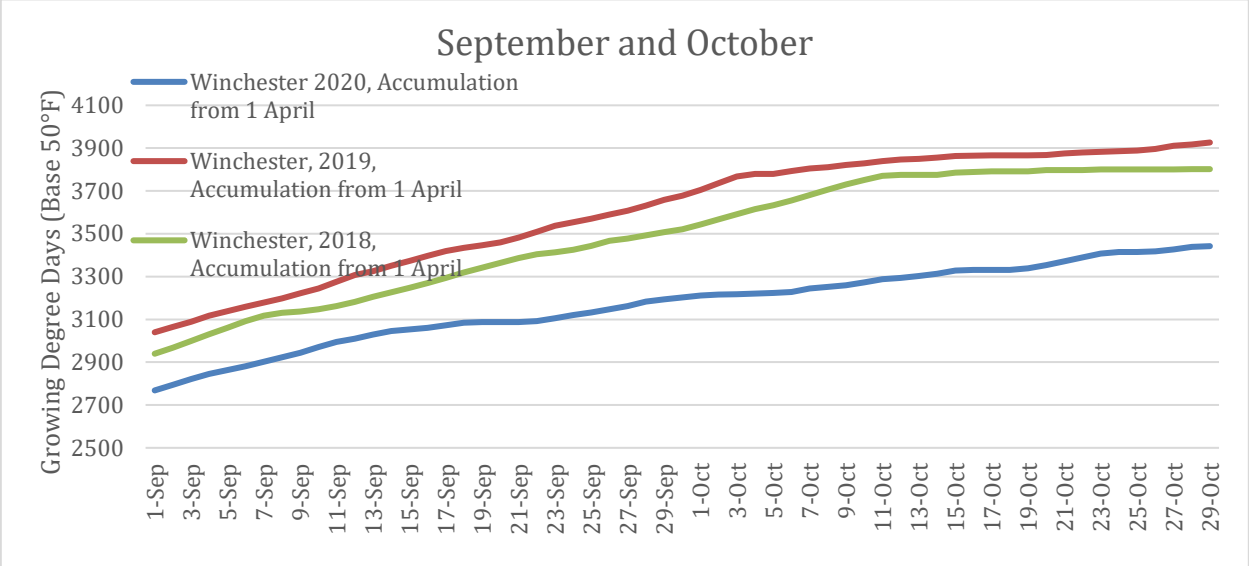

Figure 2: Heat Accumulation in September and October 2018, 2019, and 2020

We had inconsistent rainfall for most of the season. Some areas of the state got downright droughty in July, and the rain picked back up in August. In fact, some areas got more than enough rain in August. Rainfall totals in August varied across the state; Richmond and areas east had the most rainfall (Table 3). The frequent rainfall in August made downy mildew control very tricky this year. See more about downy mildew control here: http://grapepathology.blogspot.com/. A number of vineyards in Central Virginia reported over a foot of rainfall in August.

From what we saw in vineyards across the state, insect pests seemed about average this year. We are getting more reports of Pierces Disease (PD) in the eastern part of the state. Recall that problems with PD go in tandem with mild winter temperatures. Winter '19-20 was pretty mild, so this uptick is not unexpected. We saw a smattering of vines showing symptoms west of I-95. Red vinifera grapevines shows PD symptom expression in Figure 3. The 2020 Pest Management Guide does list control measures for PD.

Table 3: Rainfall in month of August recorded at weather stations around Virginia (NEWA and Airport weather stations)

LOCATION	TOTAL RAINFALL IN AUGUST (INCHES)
RICHMOND	15.27
NEWPORT NEWS	11.25
LYNCHBURG	10.96
CROZET	10.91
ESMONT	10.71
QUANTICO	8.43
DULLES AIRPORT	7.64
CHARLOTTESVILLE AIRPORT	7.55
WINCHESTER AREC	3.21
FLOYD	2.95

Figure 3: Symptomatic PD vine (center) unaffected vines down the row (Louisa Co. 21 Oct. 2020)

At our research vineyard in Winchester, we had a pretty good season. We made it through the frosts unscathed. We installed two new research vineyards this spring. It got dry enough in July that we irrigated our newly planted vines weekly. Tony stayed on top of fungal diseases and insect pests with a 11 spray program (see Table 6 in appendix for contents of each spray). Our vines entered September with a clean canopy. We enjoyed lovely stretches of high-pressure conditions from mid-September on that were punctuated by remnants of hurricanes/tropical depressions that each dropped more than an inch of rain (Figure 4). We held the fruit through a couple rains but then picked Petit Manseng and Cabernet Sauvignon on 9 October before the remnants of hurricane Delta pushed through our area. Botrytis is a perennial problem at our AREC site. The fruit had a modest amount of botrytis (single berries) at the time of picking. However, we felt that it would not fare well though another rain. In hindsight, had we pulled more leaves in our fruit zone and added a specific botrytis material and insecticide for fruit flies after veraison, we may have been able to hang the fruit a little longer. Our September-October ripening period was reasonably good from the standpoint of weather and pests/diseases.

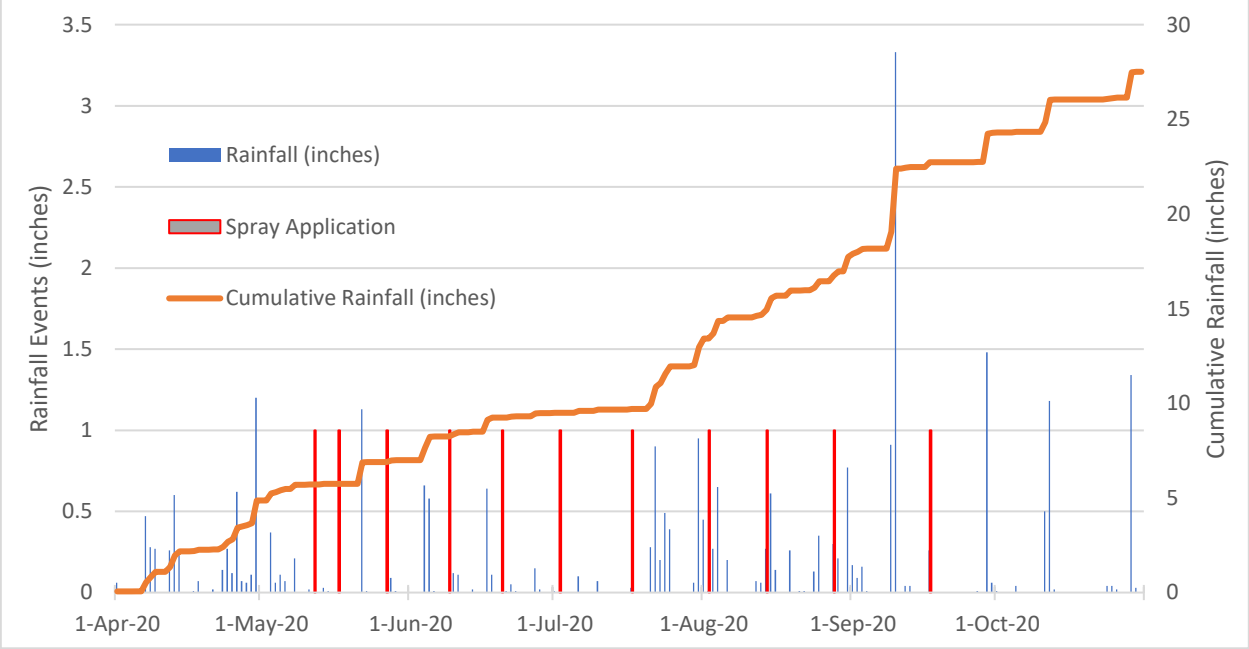

Figure 4: Seasonal rainfall, rain accumulation and spray applications at Winchester AREC vineyard (see Appendix Table 6 for spray applications summary).

With support from industry partners and funding from the Virginia Wine Board, we piloted a Sentinel Vineyards project this season. Updates from veraison to harvest were shared through VT Enology Extension's blog (view reports at articles.vtenology.com). Here is a summary of last sample date and Total Soluble Solids (TSS) or Brix from the seminal sentinel vineyards this season (Figure 5). We assume that last sample dates approximately correspond with harvest.

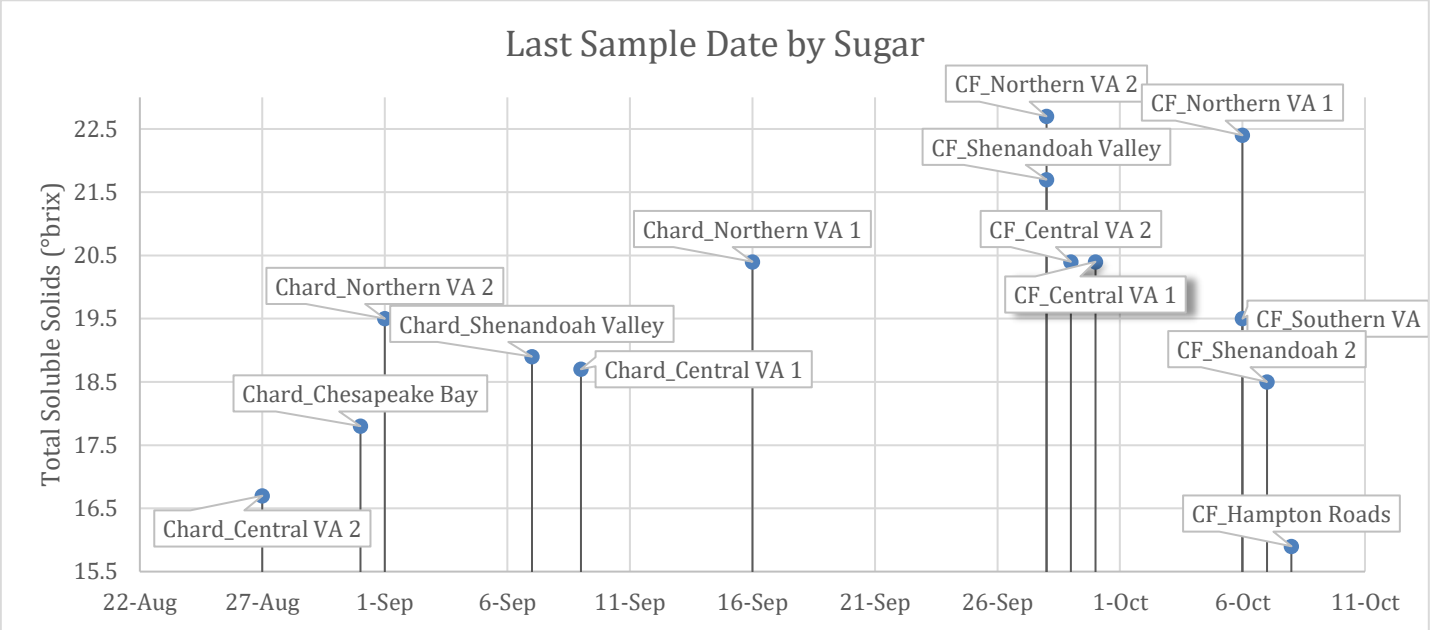

Figure 5: Last Sample Date for vineyard blocks for the Sentinel vineyard project.

As things calmed down after the harvest, we took some time to reflect on the primary fruit chemistry data accumulated throughout the season via the Sentinel Vineyards project. As shown in Figure 6, sugar load increased in a relatively linear fashion in Chardonnay for both Central and Northern Virginia, with average sugar load between 0.3 – 0.4 g TSS/berry at harvest. A similar ripening pattern was seen in the Cabernet Franc sampled in Northern VA and Shenandoah Valley, and both regions reached ~0.35 g TSS/berry. Cabernet Franc from Central VA trended similarly through week 5, but dipped at the end of the season, possibly due to the aforementioned rain events. Southern VA and Hampton Roads seemed to experience slower sugar loading this season. However, we launched the fruit chemistry sampling at the end of August, and may not have accurately captured the full berry ripening trajectory (lesson for this enology extension specialist for next year!).

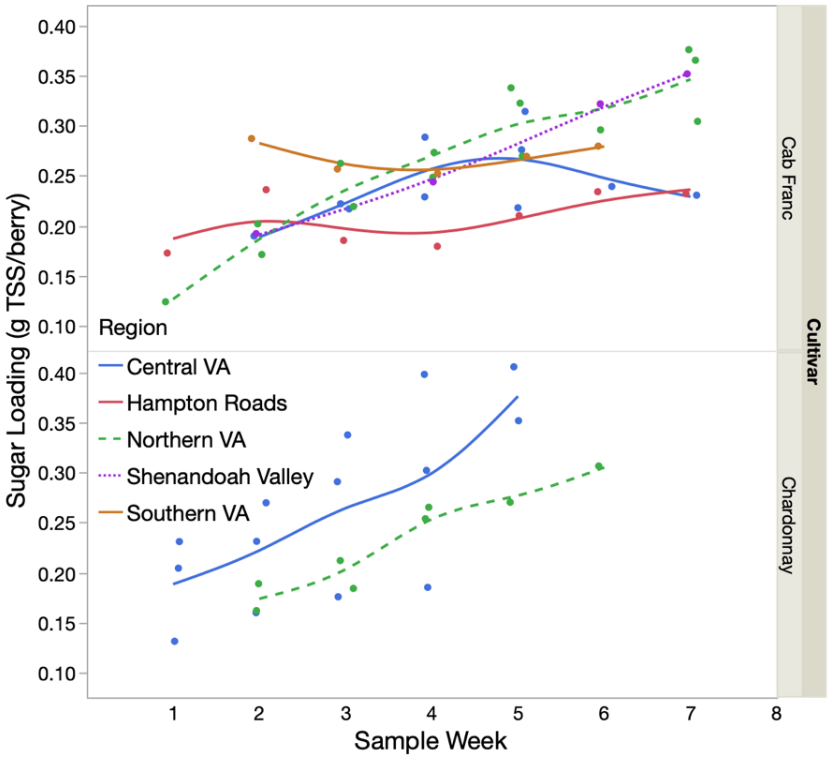

Figure 6: Sugar loading (g TSS/berry) by sample week. Note: sample week is per cultivar, i.e. sample week 1 for Chardonnay was a different calendar date than sample week 1 for Cabernet Franc.

The most universal practice for chemically assessing fruit ripening is TSS (°Brix), and pH is also often monitored as it is an easy secondary tool for assessing berry condition. Therefore, these metrics for the 2020 season are shown in both table (Table 4) and figure (Figure 7) form. In Table 4, the average values for post-veraison (i.e. first sampling) and harvest (i.e. last sampling) for each region are shown. The average across sampled regions (i.e. "statewide" average, given data to date) is also listed. We are reminded that sample collection began around 14 °Brix for both Chardonnay and Cabernet Franc, and both varieties were harvested at ~20 °Brix. Figure 7 (top) displays these sugar accumulation values as a percent change by industry partner (Table 4 is by region). While a particular Northern VA Cabernet Franc site more than doubled its berry sugar across the season, overall analysis showed a 37% increase in TSS. That Northern VA Cabernet Franc did indeed achieve the highest sugar accumulation of our samplings, however other sites may have seen larger percent increases in sugar accumulation if sampling started earlier (again, lesson to yours truly).

Table 4: Comparison of average post-veraison versus harvest TSS (left) and pH (right) values by region. n = number of sites.

CHARDONNAY TSS (°Brix)	Post-veraison average	Harvest average
Central VA (n=3)	13.67	18.23
Northern VA (n=2)	14.20	20.10
Overall average	13.93	19.17

CHARDONNAY pH	Post-veraison average	Harvest average
Central VA (n=3)	3.36	3.71
Northern VA (n=2)	3.31	3.67
Overall average	3.33	3.69

CABERNET FRANC TSS (°Brix)	Post-veraison average	Harvest average
Central VA (n=2)	17.50	20.60
Northern VA (n=2)	13.85	22.40
Shenandoah (n=1)	14.90	21.70
Hampton Roads (n=1)	11.60	15.60
Southern VA (n=1)	18.40	20.40
Overall average	15.25	20.14

CABERNET FRANC pH	Post-veraison average	Harvest average
Central VA (n=2)	3.45	3.77
Northern VA (n=2)	3.12	3.63
Shenandoah (n=1)	3.10	3.58
Hampton Roads (n=1)	3.52	3.66
Southern VA (n=1)	3.69	3.71
Overall average	3.37	3.67

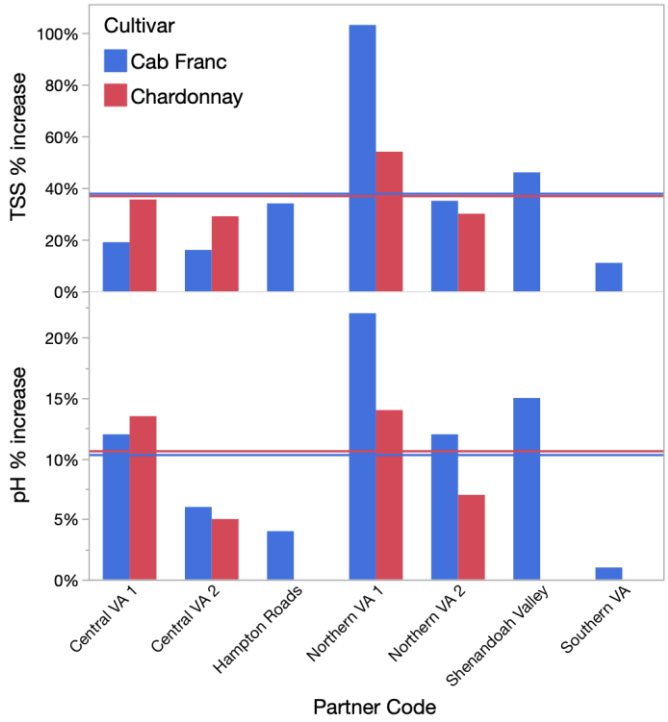

Figure 7: Percent increase in TSS (top) and pH (bottom) from post-veraison (i.e. 1st sampling) to harvest (i.e. last sampling) by cultivar. Note different y-axes (TSS max. value = 103%; pH max. value = 22%). Horizontal lines delineate average values: 37% for TSS (top) and 11% for pH (bottom).

Examining average Chardonnay pH values, we see reasonable consistency between Central and Northern VA samplings. Both regions had average starting values of ~3.3, and increased to ~3.7 by harvest – an 11% increase (Table 4). In contrast, the Cabernet Franc pH data is challenging to generalize. Northern VA and Shenandoah had the most similar pH values throughout the season. Overall, pH increased by ~10% across the state, for an average of 3.67. Of the fruit chemistry metrics examined this year, pH is the parameter from which we are most reluctant to draw conclusions, and most excited to obtain repeat measurements in future years. It is interesting to observe the lack of congruity between sugar accumulation and rise in pH. For example, Central VA 1 and 2 Cabernet Franc samplings increased in TSS by 19% and 16% respectively, while their pHs increased by 12% and 6% (Figure 7). Data points such as these open a portal into the fascinating interplay of berry chemistry factors, and serve as a gentle reminder to check both when assessing harvest parameters.

Continuing in the vein of fruit acid metrics, Figures 8 and 9 show titratable acidity (TA; g/L) and malic acid (g/L) as a function of TSS (°Brix) by region. As evident by the narrow confidence intervals (i.e. shaded areas around each line), we did not observe much variation within each region. Likewise, rates of degradation of both TA and malic acid appeared fairly consistent across regions. At harvest, TA values were ~6.5 g/L for Chardonnay and between 4-5 g/L for Cabernet Franc (Figure 8). Malic acid decreased to 3-5 g/L in the majority of Chardonnay samplings and 1 – 2 g/L in Cabernet Franc (Figure 9). Higher than usual malic acid levels were reported by some operations, particularly for other cultivars like Petit Verdot. This probably related to the cooler conditions this season.

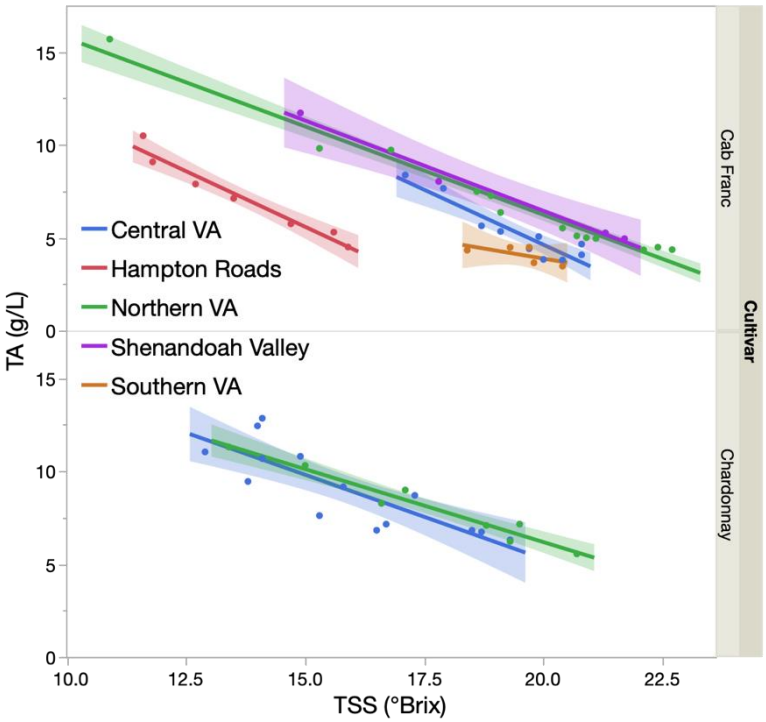

Figure 8: Titratable acidity (TA; g/L) as a function of TSS by cultivar.

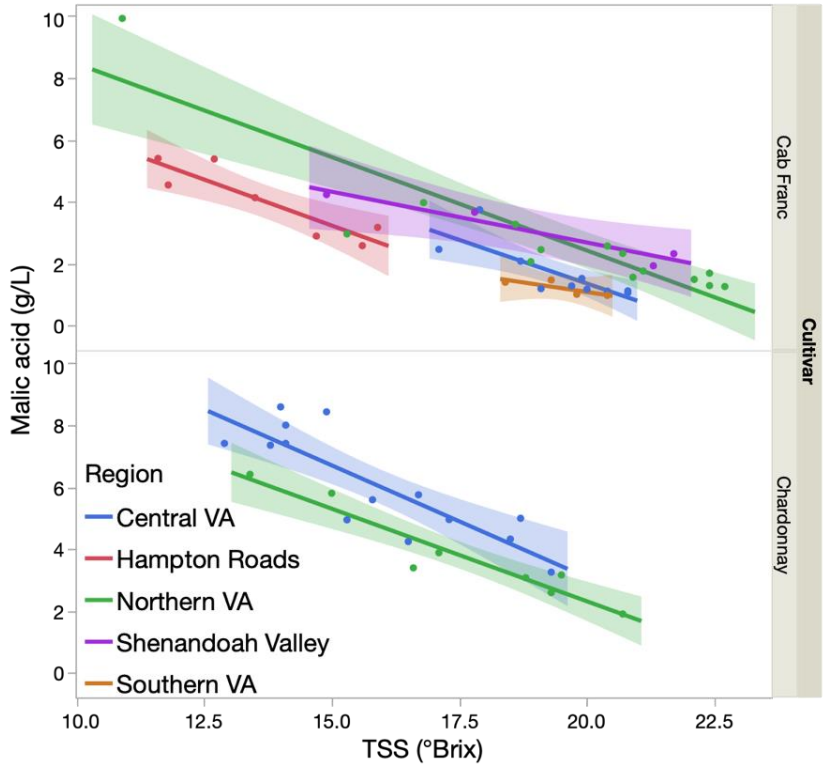

Figure 9: Malic acid (g/L) as a function of TSS by cultivar.

As detailed in Report 7 (see articles.vtenology.com), YAN values were fairly constant throughout the season. No significant trends in YAN by cultivar or region were observed, though significant differences between sites can be seen in Table 5.

Table 5: Average YAN (mg/L N) by sampling site. Average obtained from multiple samplings (n = 4 – 7) across the season.

Cultivar:	Site Code:	Average YAN (mg/L N):
Chardonnay	Central VA 1	333
Chardonnay	Central VA 2	273
Chardonnay	Central VA 3	323
Chardonnay	Northern VA 1	198
Chardonnay	Northern VA 2	157
Cab Franc	Central VA 4	314
Cab Franc	Central VA 5	115
Cab Franc	Northern VA 3	91
Cab Franc	Northern VA 4	54
Cab Franc	Shenandoah	97
Cab Franc	Hampton Roads	313
Cab Franc	Southern VA	185
Average Chard		257
Average Cab Franc		143

Throughout harvest, “The Gambler” by Kenny Rogers plays in repeat in our heads. We hope that you knew when to hold ‘em and when to fold ‘em this season, and that these “state of the grape in the state” reports helped along the way. We welcome feedback on how to make the Sentinel Vineyards project more useful and robust in future years, and once again thank the Virginia Wine Board for their funding, the Virginia Tech Analytical Services Lab for processing the fruit chemistry samples, and most of all, our industry partners for their enthusiasm, dedication and effort during the busiest time of the year.

Appendix

Figs. 10-12 Growing Degree Day Accumulations at other weather stations across the state

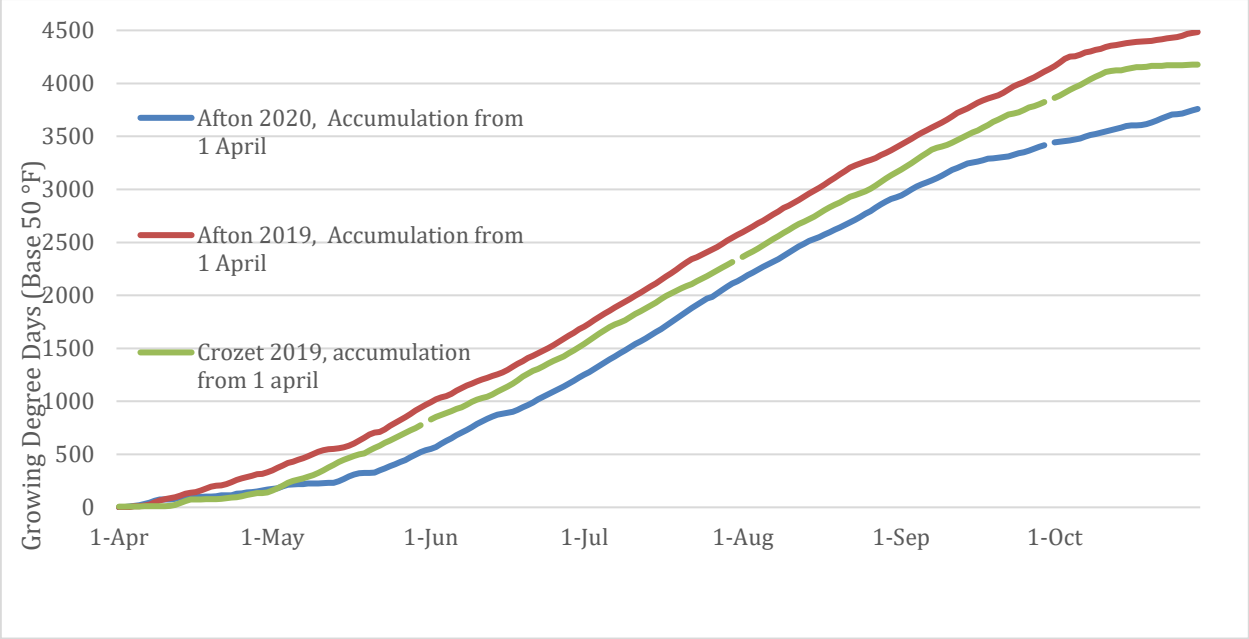

Figure 10: Growing Season Heat Accumulation in Afton/Crozet VA

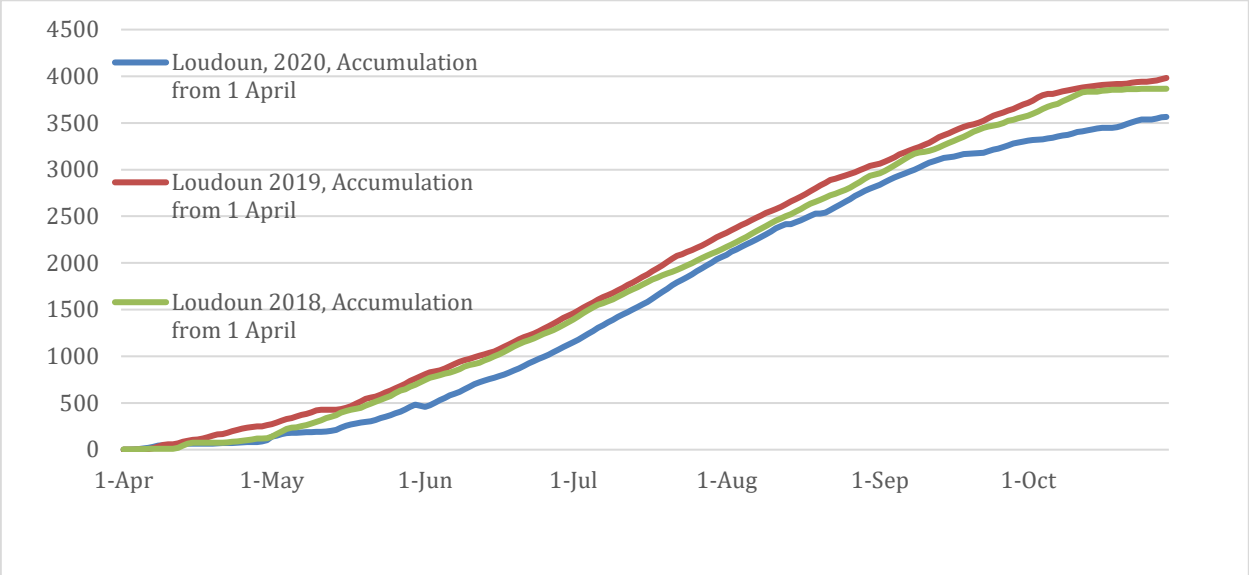

Figure 11: Growing Season Heat Accumulation in Loudoun Co. VA

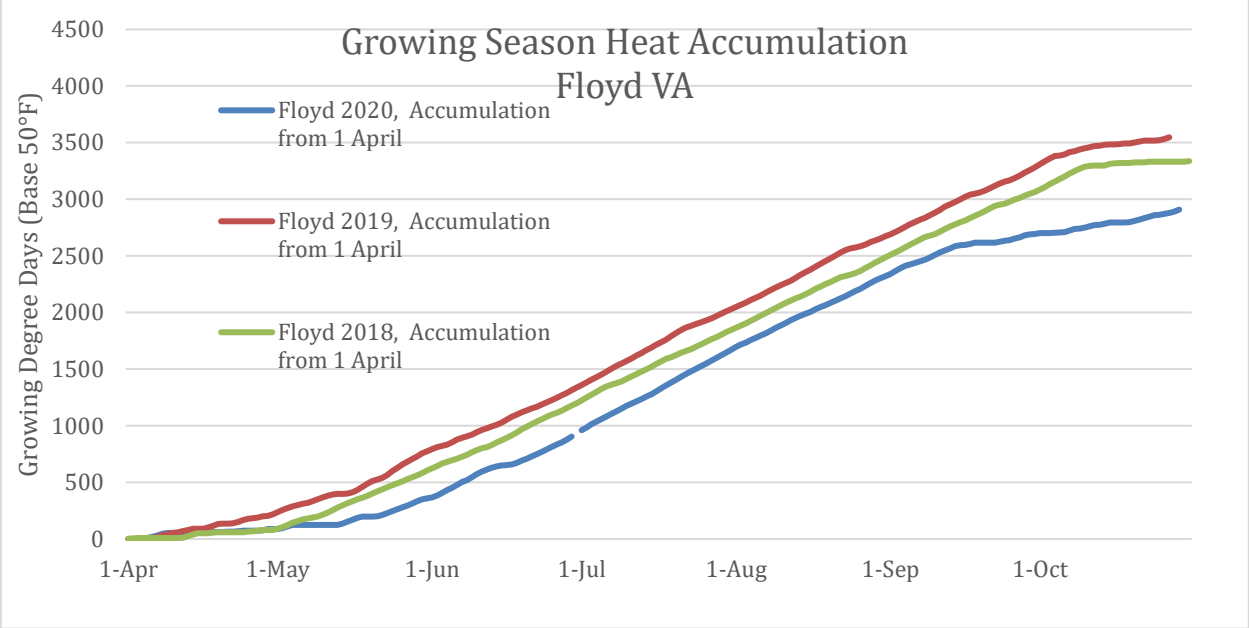

Figure 12: Growing Season Heat Accumulation in Floyd VA

Table 6: Spray program for 2020 growing season at AREC research vineyard (Petit Manseng and Cabernet Sauvignon). *Shown as an example, not a recommendation*.

Date	Spray Application	Material
5/12/2020	1	Ziram
5/17/2020	2	Mancozeb, Sulfur
5/27/2020	3	Mancozeb, Sulfur
6/9/2020	4	Mancozeb, Sulfur, Rally
6/20/2020	5	Mancozeb, Sulfur, Ridomil, Rally, Intrepid
7/2/2020	6	Inspire Super, Ranman, Carbaryl, Sulfur
7/17/2020	7	Vivando, Ranman, Phos. Acid, Carbaryl, Sulfur
8/2/2020	8	Sulfur, Captan, Phos. Acid, Carbaryl, Quintec
8/14/2020	9	Sulfur, Vivando, Phos. Acid, Ranman
8/28/2020	10	Vivando, Luna Experience, Zampro
9/17/2020	11	Zampro, Phos. Acid

Upcoming Meetings

VT Enology & the Winemakers Research Exchange are co-hosting a virtual **Wine Sensory Workshop** that will focus on evaluating wine flavor in a methodical manner – a useful tool from tank sampling to tasting rooms! Tune in next **Thursday, December 10th** from 2-3:30PM for the foundational webinar, then join one of two virtual sensory sessions (**12/17/20** or **01/21/21**) to dive deeper into hands-on training and practical applications. See events.vtenology.com for more information and (required) registration links!

The **Winter Technical Meeting** will be held virtually this year. The dates are **February 25-26, 2021**. Watch for details from the Virginia Vineyards Association to come out in the new year.

Online Interactive Pruning Seminar with Marco Tessari

Marco provided a workshop on conservative pruning before the 2019 VVA winter technical meeting. Marco will be delivering sessions for growers in the mid-Atlantic. There will be a fee for these workshops. Keep posted for scheduling details.

Student seeking winemaking internship:

Isabella (Izzy) Elliott is seeking an internship winery position in spring 2021. Expected graduation in May 2021, Virginia Tech, BS chemistry major and viticulture minor, 3.06 overall GPA. In her words: My goal is to use my chemistry knowledge in winemaking. I believe that my next step is an internship. I want to learn the laboratory techniques and decisions made to create a beautiful wine with the help of an established winemaker. In addition, I want to know more about vineyard operations. Contact (and full resume): Phone: (757) 575-0187 Email: ilelliott@vt.edu
Interested persons may also contact Tony Wolf as a reference (vitis@vt.edu); Izzy is in my viticulture course this semester.