Harvest decisions are a consequence of several factors, some predictable and many not, that are unique to each commercial situation.

Harvest decisions are a consequence of **experience, theoretical knowledge, seasonal vineyard management practices**, and **numerical and sensory-based measurements** that are put into action under the **constraints of site, cultivar, post-veraison weather patterns, labor availability, stylistic winemaking goals, vineyard acreage and winery tank space, and current inventory of wines**. Read that previous sentence again; it is a lot. And, while thorough, it still falls short of exhausting the number of potential factors that may impact harvest decisions. So, what can we predict for sure about harvest decisions and timing in Pennsylvania? With rare exception (site limitation, vintage effect, wine stylistic goal), Chardonnay will be harvested before Petit Verdot. And, most grapes will be harvested between late August and late October. These are the limited number of “predictable outcomes”. “Unpredictable outcomes” may become more predictable with an increase in breadth of knowledge and experience, especially with the same cultivars grown on the same site. I wish there were more objective statements that could be made about ideal harvest decisions and parameters. But, “ideal” is dependent on several factors, including those words/phrases that are emboldened/italicized above.

**Experience:** It may take several years to understand optimal management and harvest of the blocks and cultivars on your site(s). Observant growers may “know” their site after farming the same vines for about seven to 10 years. After that, regrets or victories surface. Regrets may result in replanting with different cultivars and/or on different sites or a result in a change in management practice to optimize the productivity and quality of existing plantings. Victories may result in no changes or an implementation of more of “what worked”. Documentation of harvest dates, fruit and wine chemistry, grape sensory observations, and weather patterns of the vintage is productive as these can be paired with the resultant wine styles and sensory characteristics. In turn, if a similar set of circumstances is encountered in a future vintage, wine styles can be targeted or avoided depending on how the wine quality was perceived by the winemaker and consumers. A grower just shared with me their “anticipated harvest window” spreadsheet. Close to 15 different cultivars were represented on that document. The anticipated harvest window was based on past experiences, the weather patterns of the current vintage, and the approximate number of days (90 to 100) between bloom and harvest. This grower keeps good records and has for several vintages. As a consequence, this grower is prepared and anticipating what will happen when entering the harvest season… a good approach to lessen stress (NOT avoid stress… it is impossible to completely avoid stress during harvest!).

**Theoretical knowledge:** Knowing the theory of how vineyard management practices and weather patterns will impact fruit development and composition will likely aid in making judicious harvest decisions, or at least help anticipate the wine quality potential of the crop. Knowing the connection between primary and secondary grape metabolites and how they may impact the resultant wines will help to harvest each cultivar according to targeted wine styles. For example, if the fruit zone is hidden beneath a dense canopy and the cluster density is high such that clusters are self-shading, it is possible that the fruit will be characterized by low aromatic and color potential and have a low Brix: titratable acidity ratio. Depending on cultivar, the fruit may also have high rot potential. Thus, one may want to harvest this theoretical crop before rot increases, which could mean this crop is best used to produce lighter wine styles, such
as a Vinho Verde-style, sparkling, or rosé, or used for blending to increase acidity. This is a fictional case study to make a point that knowing viticulture and enology theory should pay dividends when making harvest decisions and understanding the limitations for the production of certain wine styles from a crop grown and ripened under a unique set of conditions.

**Seasonal vineyard management practices:** From the dormant period through only days before harvest, vineyard management practices (including pest management) can impact the quality, quantity, and disease level of a crop. Textbook vineyard management practices (pruning, training, canopy and crop load management, integrated pest management, etc.) “set the stage” for a successful harvest, regardless of the combination of site, cultivar, and weather patterns. Good vineyard management will optimize the chances of harvesting clean fruit with desirable sensory characteristics. Sound vineyard management practice will result in a balanced crop load that has potential to be matured to full potential without negatively affecting perennial vine health. Optimal vineyard management strategies may enable flexibility in harvest decision. For example, good seasonal pest management should result in clean fruit and, thus, the potential luxury of allowing an extended hang time, if necessary, such as to withstand and be picked after a late season rain event. I have visited the vineyards of many industry members with a reputation of making good wine. There is a common theme at each location: textbook vineyard management is practiced. Canopy management is not viewed as “optional” at these vineyards. There seems to be no magic to the production of quality wines; just timely and effective management (which is lots of hard work, as many know) to produce a quality crop that will give the winemaker every advantage to produce desirable wines. Vineyard management is key to produce quality grapes which should consequently make harvest decisions less stressful.

**Numerical and sensory-based measurements:** Molly Kelly’s and Gill Giese’s “A Balanced Harvest” webinar generally covered measuring fruit maturity from objective/numerical and sensory standpoints. The review of that webinar can be found here (https://bit.ly/32ohHPR). In general, measurements in commercial situations are limited to primary composition (Brix, pH, titratable acidity). Harvest decisions will be based on the values of those primary metabolites. For example, one may wish to harvest Sauvignon blanc at 21.0 Brix, 3.5 pH, and 7 g/L titratable acidity but may wait to harvest Cabernet franc if measured at the same values (as usual, these decisions are dependent on wine stylistic goals). Sensory-based measurements are helpful and can supplement quantitative chemistry measurements. Aromatic whites can be tasted and varietal character is often evident in the vineyard (think Muscat cultivars as an extreme example). One can observe the color change and development in both white and red cultivars. Seed color can be observed and skins can be tasted. Molly Kelly’s presentation from last week should be referenced for further information regarding berry sensory analysis and approaching sensory evaluation as objectively as possible (see link in the second sentence of this paragraph). In addition to measurements that are predictive of wine quality potential, it is important to get out and scout canopies and fruit zones. It may be time to pick if canopies are full of downy mildew and fruit is rotting, especially if rain is in the weather forecast.

**Potential harvest constraints:**

**Site:** Convex, sloped landforms tend to drain and “shed water” better than those that are concave in nature and are relatively flat in topography. These two, divergent landform types have
implications for harvest. A convex, sloped site will likely aid in crop maturity and limit “dilution effects” of a rainfall event as grapes may not swell as much compared to those grown on a flat site that retains water after a rainfall. A large rainfall event may preclude the ability for tractors and equipment to enter vineyards planted on flat sites for several days; a site that is well drained will permit timely entrance of equipment into the vineyard after a rain event. Harvest flexibility and crop maturity are not the only benefits of planting on convex, sloped landforms that are greater in elevation than surrounding land; vineyards planted on such sites may also experience: less “water logging” (anoxia, or, oxygen starvation) of roots and less potential for cold injury to trunks, reduced spring frost potential in radiation-type frost events, less potential for disease development due to exposure and air movement, less vigorous and more balanced growth between vegetative (canopy) and reproductive (crop) tissues.

In 2012, as a young and aspiring viticulturist (I am still, and hope to always be, very much aspiring and learning…), I learned a valuable lesson while visiting the vineyard and winery operated by a veteran winegrower in a cool climate. Their harvest decisions were shaped by their approach to wine production given their acknowledgement of their site limitations. They were not trying to make something work if it was unrealistic; one may call their approach pragmatic. They knew their climate and growing conditions would give them fruit with low Brix and high acidity every year (and the inverse on rare occasion… and possibly at a cost of unbalanced overall chemistry and crop loss due to rot). Their harvest approach was to pick fruit with low Brix and high acidity to make only sparkling wines. Sparkling wine was their business, and remains so today. Not everyone should only make sparkling wine, for a number of reasons. But this is a good example of acknowledgement of site (and climate) limitations and harvesting accordingly to produce a targeted wine style.

Cultivar: Cultivars vary in: rot tolerance, pH and acid stability, the Brix / acidity levels at which varietal character (whatever makes this up… but is unique to each cultivar and sometimes clones) is achieved, tendency for berry shrivel and “shatter”, Brix attainment, color, tannins, capacity to be made into several wine styles, etc. Each of these traits will warrant unique harvest decisions as dictated by winemaking goal. For example, Pinot noir and Cabernet Franc are popular red wine cultivars; they are also often made into rosé wines. The harvest approach will be different for red and rosé wine production with Pinot noir and Cabernet franc. Petit Verdot often achieves remarkable Brix values; Merlot sometimes only achieves modest Brix values. The harvest approach for these two cultivars will vary, for example by harvesting each based on Brix values that are commonly achieved in that cultivar without negative impacts of rot and increasing pH values.

The number of different cultivars grown, and their “maturation schedules” relative to each other, will also influence harvest decisions as logistics and labor availability will need planned accordingly. For example, if three different, early-maturing white-berried cultivars are all scheduled to be harvested in the same week, what happens if one of those cultivars is left to be harvested later? If all other cultivars grown are late-maturing red-berried cultivars (Cabernet Sauvignon, Petit Verdot), then there may be little compression in harvest schedules. However, if there are two other cultivars that need harvested immediately after those three, early-maturing white-berried cultivars, then schedules may get backed up and harvest decisions need adjusted.
accordingly. Vineyard acreage and tank space will certainly have a bearing on these considerations and these factors will be briefly discussed, below.

**Post-veraison weather patterns:** The contrasting post-veraison periods of 2018 and 2019 likely resulted in unique, and maybe even some similar, approaches to harvest. In 2018, the post-veraison period was relatively cloudy and rainy compared to 2019, the post-veraison period of which was relatively sunny and dry. The similarity in harvest decisions between the two vintages may be that harvest was delayed in some cases; in 2018, in hope of achieving ripeness and maturity (apologies but need to be vague and subjective here as the goal of this post is not to review research findings that define ripeness or maturity); in 2019, to maximize ripeness and maturity. The result may have been similarities (e.g. high pH values), but also differences (e.g. greater Brix values in 2019 than in 2018). However, 2019 provided the opportunity for the grower or winemaker to choose harvest date, as opposed to potentially being "forced" to harvest due to rain and rot development in 2018. But, as we know, Brix values are not the only indicator of maturity. Thus, consumer preferred wines had potential to be produced in 2018 with white cultivars and red cultivars grown on good sites and with good vineyard management - even if relatively greater “winemaking practice intervention” was necessary. In summary, weather throughout harvest has a great bearing on harvest decisions – dry weather often increases flexibility with harvest decisions while extensive rainfall can force harvest decisions due to the development of bunch rots (thus crop loss) and unbalanced chemistry (e.g. high pH).

**Labor availability:** Some enterprises have stable, full-time labor; others rely on part-time labor to assist with harvest activities. Those with several full-time employees may not consider labor to be a limiting factor in harvest decisions. However, those that hire part-time labor would agree that labor availability is an important factor in harvest decisions. There are likely situations where harvest decisions are at least partially a function of labor availability. For example, labor may be available at the same time that two acres of Pinot Noir is almost, but not quite, ready to be picked for the targeted wine style. However, if rain is forecasted for the next five days and the labor needed for harvest is not available again for another seven days, a harvest decision must be made. Labor availability has forced the harvest decision, which may ultimately be based on above variables (past experiences, viticulture practices throughout the season, and current objective and sensory measurements). If the fruit has moderate pH (e.g. 3.5), is rot-free, and the site is convex with 15% slope, then waiting until labor is available again in seven days may be an option. If the fruit is increasing in pH (e.g. 3.8), is already rotting, and experience suggests that rainfall will exacerbate rot severity, then waiting to harvest may not be the best option.

**Stylistic winemaking goals:** Stylistic winemaking goals are a strong determinant of harvest. Chardonnay for still wine production will be harvested on later calendar dates and at different chemistry than Chardonnay for sparkling production. Chambourcin and Merlot for red wine production will be harvested on later calendar dates and at different chemistry than Chambourcin and Chardonnay for rosés production. Sparkling wines and rosés require relatively earlier harvest dates, as fruit with lower Brix and higher acidity is suitable for their production. Some wine styles are easier to achieve in every vintage (see above story about sparkling winegrower from cool climate) in a humid climate. But the industry may be oversupplied with these wine styles if everyone harvested grapes at low Brix and high acidity values. Later harvest dates and higher Brix: acidity ratios generally produce wines that are suitable for still wine production and have
more “roundness” and “weight” on the palate compared to light, crisp wines made from fruit that was harvested relatively earlier and with lower Brix: acidity ratios.

Vineyard acreage and winery tank space. Following the same line of thought (from the end of the "Cultivar" section) that cultivar number and their relative maturation dates will impact harvest decisions, so will the amount of acreage and tank space available. Really, the labor: acreage ratio is a limiting factor for vineyard management and harvest decisions, with higher ratios affording greater flexibility and timeliness with management relative to the inverse. But labor constraints were already discussed. Assuming the same amount of labor, there would be greater flexibility with harvest dates and decisions with relatively smaller block and acreage sizes (I couldn’t begin to objectively define what "small" or "large" acreage is as these are relative terms; but one-half of an acre seems "small" while 4 acres seems "big" by wine grape vineyard size standards in the eastern US). Smaller blocks and acreage will be harvested relatively quicker than larger blocks. "On-the-fly" decisions may result in getting the entire crop into the winery in smaller-acreage situations. Regardless of the number of unique cultivars that are grown and their relative maturation dates, smaller blocks and acreages should permit greater flexibility in rearranging harvest schedules without necessarily further delaying the next scheduled harvest.

Winery tank space and capacity will also influence harvest decisions. If tank space is unlimited and the tonnage that will be processed will not pose tank space issues, then harvest decisions will be free from this constraint. However, in some situations, tank space may be limited. Thus, until tank space is made available, all other harvest considerations (weather forecast, maturity, etc.) are irrelevant. The number of unique cultivars that are grown and unique wine styles that will be made may influence tank number and not necessarily total tank space capacity. In summary, harvest schedules may need to be maintained due to tank space limitations; the result may be that all other factors cannot influence harvest decisions.

Current inventory of wines: If there is a large inventory of a certain style of wine, then harvest decisions could be responsive to that situation. The flow of logic is simple: if you have lots of rosé, then harvesting accordingly to make red wines may be an option; if you have lots of still, white wines, then harvesting earlier to bolster sparkling wine inventory may be an option. These are two, simple scenarios. But the idea is to think about the stock of bottled wines, and consider harvesting to target wine styles that will expand and round out your portfolio of wine offerings, if that is desirable for your enterprise.