Why we make crop estimates:

Crop estimation is one of the most critical cultural practices performed at Hogue Cellars. Accurate estimates are necessary to predict the quantity of grapes delivered to the winery to crush or sell. Estimates are also necessary for accomplishing timely crop adjustments to achieve quality objectives. The challenge of successful crop estimation is in delaying the process until yield parameters are expressed sufficiently to make accurate harvest projections while completing it early enough to respond to the forecasts. This becomes increasingly difficult as the number of blocks to be sampled increases.

Techniques:

Techniques for crop estimation include the ‘eyeball’ method; historical yield information (e.g. tons/acre), seat of pants and the more rigorous measurement of individual yield parameters. Those of us involved in crop estimation have utilized all these methods and at times have failed miserably. The only way to make accurate and reproducible crop estimates is through a rigorous protocol that measures all yield parameters for each block. Following the yield estimate, the number of clusters per vine to be thinned must be calculated, thinning recommendations communicated and thinning completed, all usually by veraison.

Parameters:

To achieve accurate yield estimates, the following parameters must be known or calculated each year: block size, vine density, percent vine stand, average clusters/vine, average cluster weight and harvest cluster weight. Before GPS tools were available, block size was a frequent source of error. Too small of sample size is often a source of error. Vine density can be a source of error if the block was mechanically planted. Vine stand is usually estimated by visual inspection of the block, but it too can be a source of error if the block is highly variable. Although clusters per vine are typically measured by non-destructive counting of flower clusters, this technique under-estimates the actual number of clusters. Destructive sampling of fruit clusters is far more accurate and a necessity for making harvest cluster weight projections. Although each of these yield parameters can have potential sources of error, their measurement is fairly mechanical and straightforward. The real challenge is in predicting a reasonably accurate average harvest cluster weight for each block.

In the early 1990’s Dr. Steve Price at Oregon State University took advantage of the grape berry’s double sigmoid growth pattern to estimate harvest cluster weights in July when berry growth reached Lag Phase. Lag Phase is the period in berry development between the two sigmoid growth phases when growth temporarily slows or stops. It is characterized by seed coat hardening and embryo development. Previous research had shown that for most varieties, Lag Phase occurs at approximately half of final berry weight. Dr. Price determined that for Pinot noir in the Willamette Valley, Lag Phase occurred approximately 50 to 55 days after bloom. By weighing clusters at this time and doubling their weight, he found he could make a reasonably accurate estimate of their harvest cluster weights. This gave sufficient time for each grower to make crop adjustments before veraison.
In 1998, Hogue Cellars under the leadership of Dr. Wade Wolf adopted Dr. Price’s Lag Phase cluster weight approach to improve crop estimations. We continue to use this system to this day, as it has worked quite well for our program.

**Crop Estimation Procedures at Hogue:**

Mature reference blocks are sampled each year in the Yakima Valley for Cabernet Sauvignon, Merlot, Chardonnay, Riesling and Sauvignon blanc. These blocks are on typical sites and soils for the Valley, trained to bilateral cordons and maintained using standard cultural practices. Each week following berry 50 clusters from each reference block are randomly sampled. After measuring total cluster weight, five berries are randomly removed from each cluster and 250 berries weighed. Sampling is discontinued in mid September after berries reach full size. Base 50 degree Heat Units for the sampling dates are obtained from a nearby weather station operated by Washington State University. Average cluster and berry weights and heat units were plotted weekly against sampling dates. At the end of the sampling season, cluster and berry ratios are calculated. Ratios are calculated by dividing the final sample weight into each sampling date weight. Lag Phase can be determined either by the mid season slowing in cluster or berry growth or when the ratio curves reached a value of two (see graphs below).

Crop estimation sampling begins each year the first week of July and is completed by July 23. Four teams of two people each sample, harvesting vines and recording the data. Sampling would begin with warmer sites and conclude with the coolest sites. For each block sampled, vines were selected on a grid to be harvested. If the selected vine was atypical, a more typical adjacent vine is harvested. A minimum of six vines is harvested from blocks smaller than five acres. Sample size increases with block size. Blocks over 25 acres are divided and subsampled. Highly variable blocks are sampled more intensely. All clusters from each sample vine are removed, counted, weighed together and recorded. Secondary clusters from lateral shoots are not included.

Using vine density, percent vine stand, average clusters per vine, average cluster weight and a cluster weight ‘growth factor’, yield was calculated for each block. The cluster ‘growth factor’ is estimated for each block by comparing to current and past reference block data for that sample date and refined by comparing the estimated final cluster weight to historical cluster weights from that block. Heat Units for the sample date are also compared to previous years’. If the samples are collected during Lag Phase, the ‘growth factor’ is two. If collected before Lag Phase, the factors are between two and four. If collected after Lag Phase, the factors are between two and one.

Each block is assigned a target yield depending on age, variety and product quality. If the estimated yield exceeds the target yield, the number of clusters to be removed from an average vine to achieve the target yield is calculated and communicated to the vineyard manager. The expectation is that thinning will be completed before veraison and confirmed by Hogue’s viticultural staff.

Field data is recorded on Palm Pilots and downloaded into a computer daily. A database then calculates average clusters and cluster weight per vine and calculates the yield. If the estimate exceeds the target yield, the database automatically calculates the number of clusters to be removed and generates a report with that information.
The graphs below show weekly cluster and berry weights for 5 varieties sampled from reference blocks through the 1999 season. Measurements started at pea size. Lag phase is circled where the growth slows or stops for all five varieties – typically the last of July through the 1st week of August.
Growth ratios for each variety are calculated by dividing the final berry or cluster weight by the individual weights measured throughout the season. This is equivalent to saying that the final weight has a growth factor of one. The graphs below show the cluster ratios for all five varieties and individually for Chardonnay. This demonstrates that Lag Phase occurs when the cluster weights are approximately half of the final weight, or at a ratio of 2.
The graphs below summarize the results of Hogue Cellars’ crop estimation program in 2000 using the procedures described above.