Using Grapevine Bud Dissection to Assess Yields

by Stephen Vasquez and Matthew Fidelibus

The last few years we have received calls regarding grapevine bud dissection and its use for estimating next season’s crop. Farmers typically have two questions: What information can they garner from such a process and secondly, when can they expect the results if samples are brought to a UC Cooperative Extension office.

The answer to the second question is an easy one since UC Cooperative Extension does not offer a bud dissection service. The reasons for not offering such a service will be easily understood after considering the following discussion. To answer the first question, we need to discuss the process and how to interpret the results. In short, bud dissection analysis can provide two types of information. First, it can produce data that may be used to estimate cluster counts for a given block. Second, it gives growers some insight on bud health in specific blocks and whether bud mortality is affecting yields. Together, this information can be used to help predict future yields and to make decisions on how to adjust bud loading for next season.

Understanding Bud Architecture

To understand the merits and deficiencies of bud dissection data, one must become familiar with the characteristics of dormant buds. At each node along a cane a dormant bud develops between the leaf petiole and lateral bud or shoot (Fig. 1). In fact, each of these are truly compound buds consisting of a primary and two secondary buds, which together are surrounded by scales (bracts) that protect them during dormancy (Fig. 2). Each compound bud may also be referred to as a latent bud. Figure 3 shows a transverse section of the latent bud showing the primary (arrow) and two secondary buds protected by the bud scales. Under normal conditions, the primary bud emerges in the spring bearing one or several flower clusters. If, by chance, the shoot arising from the primary bud is damaged (i.e. knocked off or killed by frost or insects), one or both of the two remaining buds may begin to grow in its place. Although this “backup” approach by Mother Nature will allow continued foliar growth within a season, it does not assure an equivalent replacement crop. This is because the two remaining buds are not normally as fruitful as the primary bud. This is especially true for Thompson Seedless (TS), TS-like cultivars (i.e. Selma Pete) and other fresh market grapes (i.e. Flame Seedless). Many wine grape cultivars on the other hand, tend to be more fruitful at secondary buds should the primary bud become damaged, but may not compare in size and quality to the fruit from the primary bud.

Process of Dissecting Buds

The process of dissecting a grapevine bud and identifying its potential fruitfulness can be exciting and frustrating, simultaneously. The procedure is laborious, time consuming, and thus costly. Hence, the main reason UC Cooperative Extension does not offer bud dissection analysis as a service. But, in order to garner any useful information, it will take many buds meticulously dissected to reveal their potential fruitfulness or lack thereof.

The following tools will be needed to dissect grapevine buds:
- Razors (double-sided work best)
- Stereo microscope (id. dissecting microscope) with a good light source
- Notebook and pencil for documentation

Once obtained, the tools should be setup in a location that has good lighting and can be used for the duration of the job.

Plant material should be collected from throughout a uniform vineyard or block containing the same cultivar. When considering which canes to collect, they should be healthy, fully mature, round and of medium size and internode length. Canes that have grown on the outside of the canopy (sun canes), which are often kept at pruning, make good candidates for bud dissection analysis. The minimum amount of buds to be dissected should be 100 representing no more than 40 acres. For example, 40 canes collected from a Thompson Seedless vineyard would allow for two buds to be selected from each cane, roughly representing each acre. Canes should be marked with some type of identifier relating to the vineyard. For example, R10V20E would represent row (R) 10, vine (V) 20, from the east (E) side of the vineyard and can be marked directly on the cane with a permanent marker. The buds selected for dissection should also be identified at this time and should remain consistent for each cane collected. For example, because Thompson Seedless is not fruitful at nodes 1-4, buds found at nodes 6 and 9 for each cane should be marked and used for the analysis.

Once samples are collected and marked they can be systematically dissected. Buds should be dissected by slicing through them starting at the top to reveal the interior of the compound bud. Two to three slices may be needed. Determining fruitfulness involves counting the flower cluster primordia from the primary bud only. At first it may be difficult to properly identify flower cluster primordia but it becomes easier as more samples are processed. The cluster primordia will be next to the shoot apex and surrounded by leaf primordia.
Primary Bud Necrosis

Primary bud necrosis (PBN) is a physiological disorder that affects the primary bud within the compound bud; the secondary buds if not affected, may grow. Although flower clusters can be seen, fruit bore on secondary buds are usually of lower yield and reduced quality. In severe cases, the entire compound bud will die and will be brown to black in color with little or no healthy green tissue (Fig. 5).

PBN is not completely understood but it is most commonly associated with the following situations: high vigor with large cane diameter, excessive irrigation, low carbohydrate reserves, shading of canes, and phytohormone imbalances. The lack of direct association with one of the previously mentioned situations could be a result of cultivar and regional interactions.

PBN is normally observed approximately 20-days after bloom and on through dormancy. Depending on the cultivar it can affect both basal and distal buds on a cane or spur. Bud dissections can be useful in determining if and when buds are aborting. Sampling for PBN can begin in early fall when next seasons canes or spurs are mature and continue through dormancy.

Assessing Yields

After dissecting bud samples and documenting information for respective blocks it can be difficult to understand what the numbers mean. Data collected in the first year might not reveal much about potential yields for the following year, but as data accumulate over the years, a relationship between bud dissection data and vineyard yields should become apparent. Bud dissection data is further enhanced when actual flower clusters (inflorescence) counts are taken each year from the same vineyards. These data should also be compared to actual yields at the end of the season. Doing so for the first three years will give you historical data and allow you to make informed decisions on pruning. Generally, Thompson Seedless and TS-like cultivars are not very fruitful at basal nodes 1-4, hence the reason they are cane pruned with 12-15-nodes/cane. If bud dissection data concludes that potential yields are low, additional canes may need to be retained. Cultivars that are traditionally spur pruned, such as Cabernet Sauvignon, may also require cane pruning to produce adequate yields in years when bud fruitfulness is predicted to be low.

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Finding a Lab that Offers Bud Dissection Service

It can be difficult to find a lab in California that offers bud dissection services. Labs that offer other services (i.e. nutritional analysis) might also perform bud dissections, so it is worth asking them first. If you cannot find a lab offering the service it might be worth having your existing staff trained. This would allow you to monitor your own vineyards systematically, developing historical data that can then be compared year after year and help make decisions on bud retention. Alternately, some packers and wineries have someone on staff that surveys their growers’ vineyards and may be willing to add your vineyard to their list.

In conclusion, when considering bud dissection analysis for estimating yields, there is no substitute for data collected from a particular vineyard or block over seasons.