

The Application of Total Quality Management Techniques to a Winemaking Program With Multiple Growers and Multiple Vineyard Sites

BRADLEY ALDERSON

Robert Mondavi Winery
Woodbridge, California

Total Quality Management is a set of procedures, systems, and management tools that are normally applied in the context of a manufacturing or service process, not in the growing and production of fine wines. The challenges of using these procedures in the production of a natural product that is subject to different climates, annual weather patterns, vineyard sites, and different vineyard managers is discussed. Applied techniques for creating continuous improvements by winegrowers through data collection and communication of stylistic desires are discussed.

Worldwide, winemakers have made advancements in the science of enology. Better cellar equipment, a strong appreciation for hygiene within the winery, an understanding of the traditional techniques, why they work and when to use them, and improved fining, finishing, and bottling procedures are all innovations that have helped modern enologists produce better wines at competitive prices. One critical innovation was the training and education of winery personnel and the involvement of all the staff in the goal of producing increasingly higher and higher quality wines. This concept of team involvement in quality and production goes by many names and for the purposes of this presentation it will be referred to as "Total Quality Management" or TQM.

Viticulture also has seen many advancements in the last twenty years. Mechanization, trellis and canopy management, rootstock and clonal selection, pest management techniques, and irrigation practices are just a few of these advancements. There are many increased choices for the modern viticulturist to make in managing his vineyard. In vineyards owned and managed by a winery, implementing these choices to produce the quality and style of wine desired is controlled by the winemaker. In the case of a winery that relies upon grapes purchased from many winegrowers, the winemaker must communicate his style and winegrape needs to these winegrower. The focus of this presentation is one approach to assuring and improving the quality and style of grapes delivered to the winemaker by the winegrower. This is a classic supplier-to-customer relationship and an appropriate application for TQM. The challenge is to mass produce table wines that rival and exceed the quality and style of the very best handcrafted wines of the world.

The Benchmarks

Time and the taste of man have, over the twenty or thirty centuries, sorted out most of the old world's premium locations for a particular variety and style of winemaking. For the vineyards and appellations of France, Italy, and Germany this has been unquestionably successful. These costly, hand-made, traditional wines are the benchmarks that winemakers throughout the "New World" strive to emulate. The written and oral material, both scientific and anecdotal, on these handcrafted world class wines, is strongly focused on the production of wines from a single vineyard in a single appellation to a single winery or chateau. Fascinating and entertaining, these

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works are perhaps best characterized by the French concept of 'terroir', a term that looks at all the natural and traditional conditions that influence a vineyard. It is comprised of the soil, both the topsoil and the subsoil types and conditions. It is also the typical climate, the sunlight patterns, temperatures, rainfall or water source, and wind. Last, it includes the traditional rootstock, variety and clone selections and vine training, cropping and maturity traditions and the indigenous microflora, the yeasts, the molds, and bacteria. The concept of 'terroir' creates an attitude that denies the input of the winegrower. He is a mere servant of the vine and traditional vineyard practices, and often these viticultural practices are legally defined; thus, all quality ultimately stems from decisions made by 'terroir'.

Winegrowers in California don't have the same limitations of tradition, but all of the world's farmers are conservative; in the last sixty years or three generations, the ways of tending vineyards and traditions have become established. In all winegrowing appellations, the standard of how to grow a particular variety and what the price of the resulting wine can command become 'facts', despite the advantages and new potentials scientific discoveries produce. This is a limitation for the winemaker; he has the control over his cellar workers to get quality training initiated, but the independent winegrower must be persuaded to abandon established and successful procedures. They must bear much of the additional risk involved with quality enhancement. In addition, they have to endure the social pressure from other members of the winegrowing community for being different.

Another difficulty for the winemaker is that, to meet this consumer demand, the wine industry in California has developed in such a way that a significant majority of our high quality wines are now branded or trademarked blends of multiple vineyards and multiple appellations, without a unity of 'terroir', but rather a blend of 'terroirs'. The paradigm to other industries that have made the transition from hand-made products to those of mass economical production is totally relevant.

Figure 1 is the map of the appellations used by Robert Mondavi Winery, Woodbridge, to produce its wines. At least nine appellations and numerous microclimates are involved. Robert Mondavi Winery, Woodbridge, produces in excess of 3,600,000 cases of five varietal wines. Four of the wines, Cabernet Sauvignon, Zinfandel, Sauvignon blanc, and Chardonnay are dry and barrel-aged. The other, a White or Zinfandel Rosé, is a stopped-fermentation, slightly sweet wine. In this presentation, the application of methods of Total Quality Management is described which has helped us to design and produce wines of unique style and quality that compete with, and often exceed, the quality of the finest handcrafted wines as we grew from 900,000 cases in 1982 to 3,600,000 cases today.

Classic Total Quality Management

There is ample literature about the elements of a Total Quality Management program. The most basic element of the program is a common or shared vision of what the desired quality goals are between the winegrower and winemaker. To do this, the winegrower (as the supplier) and the winemaker (as the customer) must form a team. The winemaker, as the customer, must define what his quality needs are in language or a fashion that the supplier can understand. Next comes an empowering step, where the team decides what is within their control and what is random and beyond their control. The team then jointly assesses the current state of quality of the supplies (incoming grapes) and priorities, then formulates an improvement plan and decides what data need to be developed or followed. Last, the supplier and customer must make an agreement to continue the process of planning, doing, checking, and analyzing the results to develop the next year's plan.

Where We Started

In the early 1980s, winegrape quality control in larger California wineries comprised various incentive and penalty systems that focused on the price given to the grower for his grapes. Legally, the only quality parameters that could affect his price were sugar content, total acid, and pH.

Deductions or penalties could also be assessed for mold and material other than grape content (trash). The winemaker's responsibility ended once the grapes were delivered to the winery. Rarely did he know anything about the resulting wine, as few lots of grapes were kept separate, and in the winery, the wine lots were commingled by variety and appellation. Essentially, wine grapes were a commodity. Winemakers or winery grower-relations staff would visit the grower prior to harvest. This inspection visit, or visits, was the only true quality evaluation other than the winery inspection stand. Standardization was the goal of these programs, and the focus was to make all vineyards look the same, despite widely differing vineyard environments. The other supposed attributes of grape quality that were observed during these vineyard visits were often quite subjective not measurable. If you think about this in the context of manufacturing, we were using control limits and demanding uniformity for a process that has a high degree of randomness. Growers could achieve certain sugar standards and still not deliver the quality and style of grapes we desired.

In 1982, we at Woodbridge determined that to improve our quality we would have to keep at least a representative lot of each vineyard block separate so that we could study and follow its contribution to our program. This was the rule in our parent winery in the Napa Valley, but their hand-made wines sold for a substantially higher price per bottle than ours did. The observations and tasting results that were derived by keeping the lots separate were startling. Contiguous vineyards with the same variety, but different winemakers, were radially different. The winemaking and research staff at Woodbridge conducted many trials to see how to take advantage of these observations. The winemaker was shown the results of these experiments, and he was finally able to taste the wines that resulted from his grapes. These grower tastings were conducted in private with winemaker, winery grower-relations manager, and the grower. The winemaker, of course, was curious, proud if we liked his wines, defensive if we did not, and there was low to moderate degree of commitment to improving his quality based upon the field trials and experiments. In fact, the major accomplishment of these programs was to start training the grower to taste wines critically and to realize that different techniques in the vineyard created different tastes or styles of wines. For many of our growers, this was a tremendous revelation . . . that their work in the vineyard could affect the flavor of the resulting wines.

One strong example of this revelation was leaf removal in Sauvignon blanc. This vineyard practice was driven by an intense mildew and botrytis problem in California vineyards in the early 1980s. Leaf removal to expose the fruit to sunlight and air circulation was shown to be very effective in managing this fungal problem. This was a common practice in table grape production, and it was suggested to researchers by growers. Leaf removal and increased sunlight exposure also affected the flavor of the resulting wines. Small-scale trials and subsequent large-scale field trials showed a radical shift in flavor from the vegetative to the grassy floral attributes that we desired for our wine style. In the last ten years, a tremendous amount of work has been done in the area of canopy management and fruit exposure to sunlight, but the idea came from the growers. Vigor in Sauvignon blanc could also be controlled by not watering excessively. This had the same effect on flavor as leaf removal in many cases.

Another example was timing of irrigation in Cabernet Sauvignon. Observation showed that the timing of application, not the amount of water applied, was quite significant in the development of color intensity and flavor profile but had no effect on yield. Observations quickly led to large-scale field trials the following season with the same results. Since these trials demonstrated to the grower that changing to a new irrigation schedule did not affect yield or vineyard costs, they were willing to change their practices in half the blocks. Keeping treatment lots separate confirmed the improvement. University extension studies funded by growers are pursuing the mechanism of the effect, but the quality enhancement is already in our bottles.

The point of these two examples is that ideas come from observation; research only confirms the mechanism of the observation. To observe, you must be able to distinguish differences. You

must also be able to guess at a possible cause and effect. To do this you must be aware of both the vineyard and the subsequent wine. To do all of these, vineyard lots must be kept separate.

For the next eight years, we used this system of keeping lots separate, then conducting individual tastings with growers, and promoting techniques that gave us the style of wine we wanted. We developed a tremendous appreciation for the different characteristics of each variety in each appellation. In retrospect, we were learning the elements of "terroir" in each of the appellations of California. We also found that the appellation is the course tuning of the flavors and viticultural flavor management was the fine tuning mechanism. Finally, we found we could use the synergy of flavors by blending for appellation characteristic. For example, the Lodi appellation Cabernet Sauvignon has a strong wild cherry flavor note, from Mendocino we can get black pepper and blackberry, and from Santa Barbara we can get herbal and bay notes.

The drawback to this program was that in 1982 we were monitoring vineyards, crushing, fermenting, aging, and bottling 900,000 cases, a little over 15,000 tons of grapes. By 1991, we had grown to 2,500,000 cases and over 37,000 tons of grapes, with over 120 growers and hundreds of different vineyard lots. The time devoted to these individual tastings was a tremendous burden on our staff. We have also run out of really new ideas and how to best get what was left implemented. The winemaker, the research staff, and the grower representative had assumed the role of teacher, and once we had run through our syllabus, progress on quality improvements slowed. This is a natural phenomena, and it parallels the experience of other quality improvement programs. Scientific management and education can improve the quality and efficiency of wine production, but once the grower or worker is properly trained and equipped, improvement reaches a plateau. A new approach must be taken to continue the improvement. New ideas and observations must come from the person most able to make the critical observations. In the factory, it is the production worker; in the vineyard, it is the winegrower.

Winegrower Quality Enhancement Teams

The first winegrower quality enhancement teams met in 1992. Initially, two teams were formed, one for the variety Cabernet Sauvignon and the other for Zinfandel. To be effective, we felt we had to limit the number of participants in each group. Winegrowers were selected based upon the importance of their vineyards, how receptive they were to striving for improvement, and the diversity of their vineyard sites. Since they represented a small core group, they decided to report to the rest of the growers in a seminar at least once a year. Rules for conducting the meetings were established by group consensus and a procedure for creating an agenda was established. Group goals and objectives were proposed, discussed, and adopted by consensus. The Cabernet Sauvignon group decided to focus upon determining everything that affected the pH of Cabernet Sauvignon at full maturity. This was determined by interviewing their customer, the winemaker, as to changing what single attribute would most improve the quality of their grapes. The response was a lower pH at the same maturity levels.

The team started by creating an action plan on how best to address this need. They compiled a list of things they could and could not control in the vineyard. A literature survey was conducted as to the impact of the controllable variables. Tastings were requested from the winemaker as to the differences a pH shift made in the quality of the wine. Researchers, private consultants, and university extension agents were speakers were invited to speak and examine the vineyards. If you look at the list of characteristics that the team felt were beyond a grower's control they are similar to the list used to talk about terroir with the exception of rainfall and viticultural techniques or activities.

A second list was developed by the team. It listed what the team felt they could control or affect. Water and the timing of it's use were the first variables; irrigation is possible and needed in California. Bunch count per vine can be controlled by pruning and thinning, bunch size through controlling water. Various vigor or canopy management practices, such as weak shoot removal,

leaf removal, and hedging, and finally the use of cover crops, fertilizers, and pesticides were considered.

They also decided they needed to know more about their own vineyards. One of the first activities was to examine the subsoil and root structure of each vineyard by digging trenches in the vineyards. They all agreed to keep accurate records of the dates of budbreak, bloom, veraison, harvest, any cultural activities. Pruning weights were also gathered. Finally, they all shared the cost and yield data for each of their vineyards with each other.

Tastings were continued, and we focused on trials, competitive benchmarks, and improving their understanding of sensory characteristics. They were exposed to the use of the flavor wheel, but they soon requested a simpler and more focused tool that we called the flavor speedometer. The example of the speedometer we developed for Zinfandel is Figure 2. The characteristic flavors for Zinfandel were ranked from the least desirable to most desirable. This tool is set to clearly focus on what flavors are positive and what flavors are not desired. The group used this standard to evaluate all the 1991, 1992, and 1993 vineyard lots in blind tastings. Despite some discomfort for those growers whose wines were not placed highly, all participants worked toward mutual improvements.

Despite the fact that this is only a progress report, there are already many positive results from the establishment of the Winegrower Quality Enhancement Groups. Communication between the winemaker and winegrower is clear, and both share a common vision of the objectives. Together the team is learning and determining the "terroir" of their vineyards. In the last two harvests, most of our wine grapes were harvested based upon flavor development, not sugar development. Winegrowers and winemakers are actively working together to determine when to pick for the best quality. From this we have had positive flavor shifts, flavor intensity, and increased depths of color. We have determined a number of variables to observe, and we are studying their impact in each particular vineyard. Data collection is active and being done by the winegrower with the analytical aide of the winery. A result of this is that we, as a team, are approaching 100% soil moisture monitoring by neutron probe in all vineyard blocks; this paid for by the winegrower. The winegrowers on the team have initiated and funded numerous research projects. This year they will spend almost \$150,000 dollars supporting extension and university research. They are also actively looking at vineyards around the world to generate new ideas, and they will be going to Australia this winter on a two week study trip at their own expense. We have truly become partners in the success and quality of our wines.

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California Appellations Used For Robert Mondavi Woodbridge

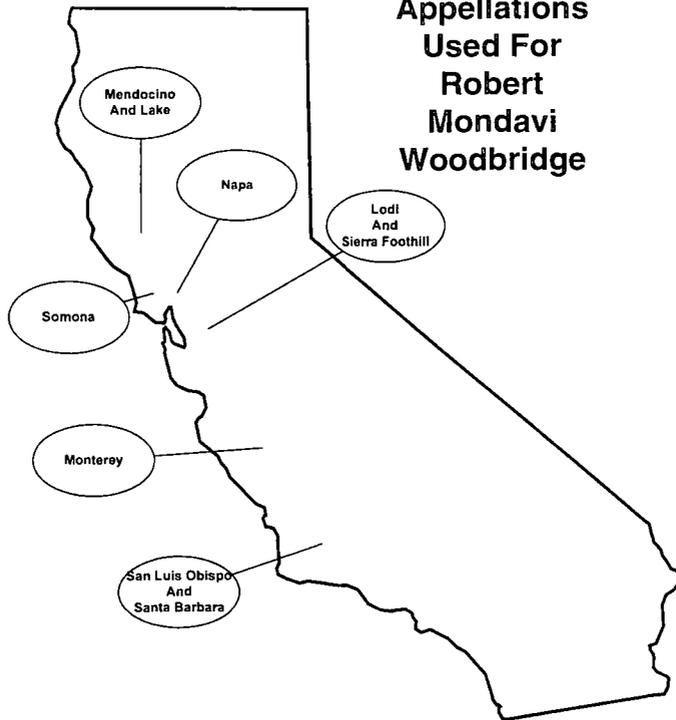


Figure -1-

Robert Mondavi Woodbridge

Zinfandel Flavor
"Speedometer"

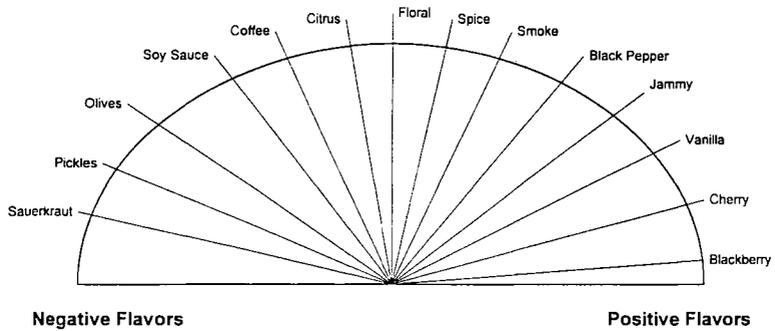


Figure -2-