

Refining the craft of winemaking through automated analysis

King Estate Winery: A success story of sustainable growth rooted in quality control

Celebrating a period of huge growth, King Estate Winery in Oregon, US, invested in the Thermo Scientific™ Gallery™ Discrete Analyzer to automate quality control processes and support the much-increased production capacity. Time-consuming, error-prone and manual analysis processes were eliminated, resulting in many benefits, including:

- Increased efficiencies and reduced spoilage rates delivered through complete monitoring of the entire end-to-end winemaking process
- Analysis tasks reduced from days to hours, greatly expanding the laboratory's capacity for sample processing
- Even subtle shifts in maturation are now identified, quantified and remedied through interrogation of the winemaking process



King Estate Winery is a sight to behold. Set in over 1,000 acres amid the mountains and hills of the beautiful Willamette Valley, near Eugene, Oregon, King Estate Winery is the largest Biodynamic® certified vineyard in North America. With 470 organic acres under vine, it is famous for its Pinot Gris and Pinot Noir varieties, mostly grown on-site, and for its wide range of distinctive and expertly crafted white, red and rosé wines. Established in 1991 by the King family, King Estate Winery is a thriving family business, rooted in sustainable practices and producing over 300,000 cases each year.

“Our methods are bespoke, they reflect the unique character of our wine and our quality control procedures need to support that. The Thermo Fisher Scientific team worked with our technicians to design specific methods that integrated with our existing equipment and testing procedures.”

– Leah Lyon, Manager of the Quality Control Program, King Estate Winery

Crafting premium wines requires robust quality control and King Estate Winery, renowned for its quality, needs to run a wide range of analysis at multiple stages throughout the production and bottling process. However, traditional methods of analysis were proving challenging, requiring highly skilled technicians to run laborious, manual and time-consuming tests on multiple parameters. Recent business growth meant that these methods became unsustainable; causing a bottleneck that was starting to slow production.

In 2012, the King Estate Winery Quality Control team, headed by Brent Stone, now the Chief Operating Officer (COO), collaborated with Thermo Fisher Scientific™ to find a solution that would enable automated, accurate and reproducible analysis of a wide range of quality control metrics throughout the winemaking process. The result of this collaboration was the purchase, implementation and ongoing support of an automated analysis solution, powered by the Gallery discrete analyzer.

The perplexing complexity of manual monitoring

To maintain King Estate Winery’s position as one of Oregon’s biggest and best producers, sustainable growth is critical to long-term business success. The business expanded quickly to reach 4,000 tons of grape intake in 2012 and the high quality that customers had come to expect from the Estate had to continue, albeit at a larger scale. Since manual methods of quality control were no longer viable, automated methods needed to be created. This meant that the previous manual spectrophotometry methods, used to measure key quality indicators, such as malic acid, acetic acid and glucose and fructose levels, were no longer viable.

“Spectrophotometric methods, although effective, meant day-long assays on every sample of grapes,” explains Leah Lyon, Manager of the Quality Control Program, King Estate Winery. “Technicians would manually prepare cuvettes and pipette samples, processing and analyzing the results and recording data on paper-based forms. These processes were naturally prone to error. The slightest distraction could



make you lose your place and either skew the results or mean expensive and time-consuming reruns. Day-long processes simply aren’t viable in this fast-paced industry. Winemakers need to know whether a batch of grapes is ready to go into fermentation within hours because there is a batch right behind it. The quality control department was causing a bottleneck and this was particularly evident during harvest-time.”

To have complete control of the winemaking process, the end-to-end journey from grape to bottle and beyond needs to be carefully monitored. Samples need to be taken and evaluated at every stage of the manufacturing process from harvesting and juice extraction through to fermentation, aging, filtration and bottling. With manual processes, only random and sporadic sampling is possible which can result in large volumes of wastage if potential spoilage is not detected early on. King Estate Winery needs to have complete control and insight into the whole manufacturing process, not only for quality control but also to meet the stringent regulatory requirements that come with producing wine. Alcohol content, acetic acid levels and total sulfur amounts must all be measured and certified within limits to ensure that wine products fall within safety, quality and taxable limits.

“The system literally watches the winemaking process, a silent overseer that spots problems before they become expensive issues. We can intervene and protect our quality standards in a way that we never could with manual processes.”

– Brent Stone, Chief Operating Officer, King Estate Winery

Supporting a growing business through automation

As production increased and the business grew, it became clear that manual processes needed to be replaced with more efficient, automated methods. The laboratory manager at the time, Brent Stone, now COO, contacted Thermo Fisher Scientific for support. Together, the team identified quality control metrics that needed to be automated and which were highly indicative of quality, spoilage and the stage of wine progression, including malic and acetic acid, glucose and fructose and both total and volatile acidity levels. The Gallery discrete analyzer was chosen as the ideal solution thanks to its high throughput, automation and ability to analyze up to 20 different parameters in one sample.

Each parameter was assessed and calibrated to ensure that the Gallery discrete analyzer provided the sensitivity needed—for analytes such as acetic acid, very low levels needed to be detected as an early indicator of spoilage. Across the production cycle, hundreds of tests like this were required each day.

“The Gallery discrete analyzer meets both the immediate sampling needs at each part of the wine-making process but also manages a big part of our more strategic quality control program,” explains Stone.

The Gallery discrete analyzer was installed at the same time as vintrace wine production software and integrated with the platform to fully realize the traceability benefits. Barcodes now track the wine as it passes from harvest to bottling and quality control procedures are fully linked to the individual bottle.

The Gallery discrete analyzer was brought in to fulfill a particular role in the quality control process but it soon delivered further unexpected benefits and, as the suite of testing parameters continues to grow, so do the benefits that the system brings to the testing laboratory and the wider business.

Analysis at every stage of the winemaking process

The Gallery discrete analyzer is a high-throughput photometric analyzer that provides a full suite of testing parameters for every stage of the winemaking process. The single analyzer combines both photometric (enzymatic and colorimetric) and electrochemical (pH and conductivity) detection in one multi-functional system.

With ready to use reagent kits, every test is accurate, carefully controlled and fully traceable, all tracked through barcodes. Automated sample addition, calibration and dilution mean that manual errors are removed and multiple parameters can be calculated from one sample. Reagent and sample volumes are reduced to just microliters per test, creating only milliliters of waste which, in turn, reduces the cost per analysis.

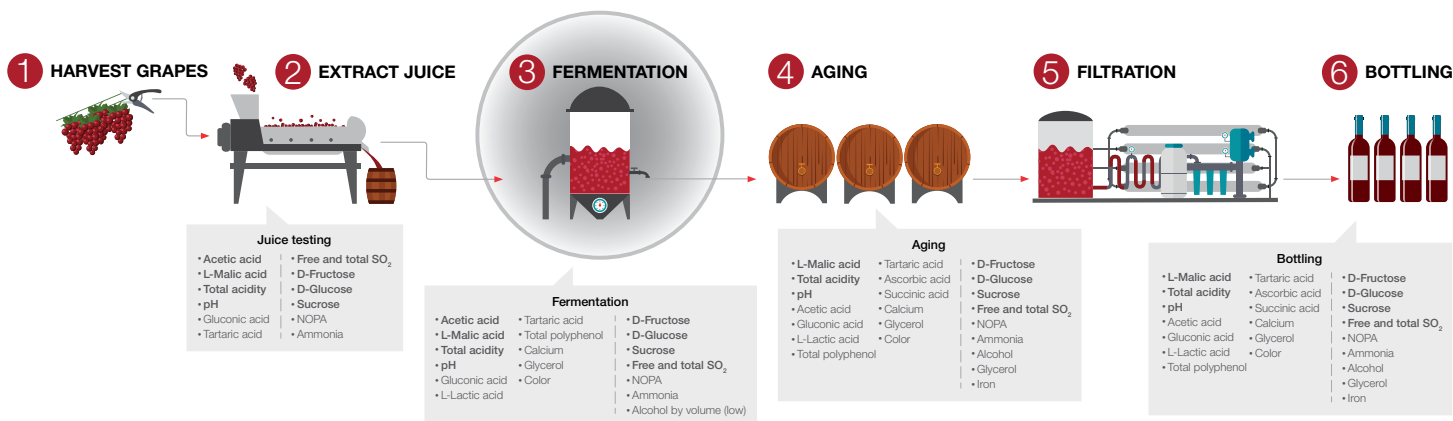
The highly automated testing and analysis methods mean that the technicians can simply load samples and reagents and import methods from a laboratory information management system (LIMS) before walking away to complete other value-added quality control tasks. The rapid workflows mean that up to 350 tests can be completed each hour, with up to 20 parameters analyzed at once from just one sample.

Specific wine analysis kits are available to provide the full suite of testing parameters from harvesting and juice extraction through to fermentation, aging, filtration and bottling. Importantly, the key wine spoilage indicators are included within this standard suite, including pH, volatile and total acidity, free and total sulfur dioxide, residual sugar, residual L-malic acid and acetic acid.



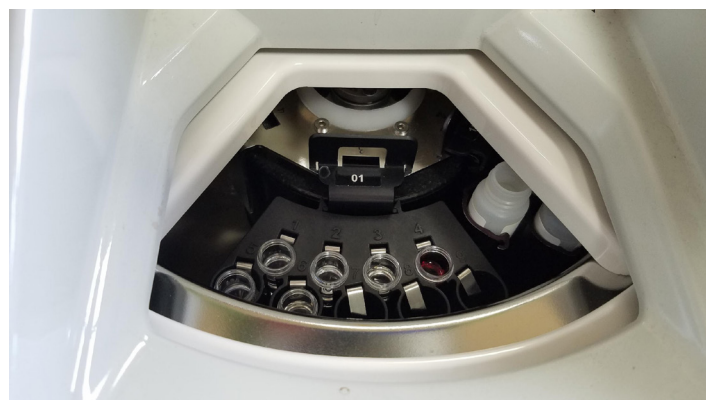
“The Gallery discrete analyzer evolves with our business and, together with the Thermo Fisher Scientific team, we have already added many more parameters to our analysis, expanding the initial benefit we achieved when we installed the system back in 2012.”

– Leah Lyon



A solution packed with potential

After a brief installation and commissioning period, King Estate Winery was soon running over 300 tests per hour across a broad range of quality control parameters. The Gallery discrete analyzer is now an integral part of the quality control team, ‘watching’ the wine as it matures and providing insight into every part of the wine production and maturation process. Even small changes in the fermentation process are captured as the wine matures, indicating the small shifts that can lead to large-scale spoilage if left unchecked.



“Malic and acetic acids are powerful indicators for how a wine changes over time,” explains Lyon. “Even small changes can indicate subtle taste discrepancies and stability problems. We monitor bottles for two years after bottling and we test every month at this stage. That’s a lot of analysis and it would be simply impossible to do this work through our traditional, manual methods.”

All enzymatic analysis now takes place in-house with a team of just three scientists providing the immediate status of a lot at any given moment in time, along with the full overview needed for robust quality control processes.

Unexpected benefits also emerged from this transition to automated analysis. The assays are now being used to detect incorrect or incomplete procedures within the winemaking process. Tank mixing processes and sugar additions can be checked through glucose, fructose and sucrose analysis, helping winemakers to refine their processes, maximize production efficiencies and further increase quality standards. Volatile acidity measurements indicate potential microbial contaminants or wild yeast populations, enabling production to act quickly and isolate batches should any issues occur.

“Other wineries and even breweries, ask us how we manage to so carefully monitor the quality of our wines and how we manage to generate so much insight and exert so much control over our processes. We have had several businesses visit to observe the Gallery discrete analyzer at work and we are always happy to share our successes with others in the industry. The Gallery discrete analyzer evolves with our business and, together with the Thermo Fisher Scientific team, we have already added many more parameters to our analysis, expanding the initial benefit we achieved when we installed the system back in 2012.”

Find out more at thermofisher.com/discreteanalysis

For Research Use Only. Not for use in diagnostic procedures. © 2021 Thermo Fisher Scientific Inc. All rights reserved. Biodynamic is a registered trademark of Demeter Association, Inc. All other trademarks are the property of Thermo Fisher Scientific and its subsidiaries unless otherwise specified. **CS74102-EN 0621M**