

The Vineyard of the Future?



Blurring the lines between what happens at the crushpad and what happens in the vineyard

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Phyllis Gillis

THIS YEAR MAY BE remembered as a near-perfect one for winegrapes: perfect fruit, a huge crop, a perfect growing cycle and an optimistic return to pre-recession retail wine prices. This year will also be marked as the beginning of a new era as sophisticated, technology-driven equipment integrated into the operational practices of California's premium wine-producing regions has enhanced quality, increased efficiencies and reduced costs with no discernible negative impact to the vines and grapes themselves.

These technology advances have also caused the line between what happens at the winery versus what happens in the vineyard to blur—for example, destemming, sorting and cleaning grapes taking place on-site in the vineyard during harvests rather than at the crushpad. The means greater efficiencies in labor and hours, streamlined harvests and allowing for re-configuration of always in-demand cellar space or re-utilization of production space for expansion of areas, such as tasting rooms.

By the end of the 2012 harvest cycle, this new generation of equipment, including multi-function tractors, harvesters, mobile digital optical sorters, hand-held electric pruning shears, electric tying guns and wireless data information systems, has proved to be a game changer for the wine industry.

Brian Shepard, co-owner of **Walsh Vineyards Management Inc.**, one of the largest viticulture management businesses in Napa Valley and Sonoma County, invited me to follow the Walsh team over the course of the 2012 growing cycle. Walsh owns and operates more machinery and equipment than nearly any other vineyard management company in any wine region of the United States. These were not staged walk-throughs but real-time, on-site work days (often beginning at dawn), with regular crews performing

their assigned duties. As the year unfolded, I felt like I was witnessing the emergence of the vineyard of the future, and by the time harvest concluded, I had seen the future of the wine industry.

Shaping the Future of Vineyard and Winery Operations

Walsh was not immune from the events that affected much of the California wine industry for the last three vintages, including the recession of 2008-2009 and consumer resistance to wine prices, the near catastrophic weather events of 2010-2011 and an increasingly unstable labor pool. Beginning with a deconstruction of every component of their services, Walsh co-owners **Brian Shepard** and **Tim Rodgers**, along with an internal team, reviewed vineyard practices and winemaking processes as they considered each operation.

“There were so many factors at play that it was difficult to prescribe one solution or another,” said Shepard. “It was not as simple as before. Everyone wanted harvests at the lowest possible price, but it was not possible to suggest that a myriad of problems would be solved by just cutting crews or replacing one piece of equipment over another.”

Soon they realized that the wine industry was not just in the middle of a recessionary meltdown but on the cusp of a huge leap forward in disruptive technologies, specifically innovations that could change the industry. The rapid acceleration of advanced technologies built into sophisticated



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equipment, with cost savings of up to 50 percent for both harvest and hand vine tasks, such as pruning, tying and leafing, was likely to shape the vineyard of the future, challenge conventional winemaking processes, impact long held business models and change the business of growing, making and selling wine.

Facing the thorny question of whether their clients would be receptive to replacing operations previously performed by hand with machines, the team took a leap of faith forward, concluding that:

- An integrated system, combining versatile equipment and technologies, needed to be useful for all clients, no matter the size or vineyard conditions;
- Any major equipment, such as tractors, had to be utilized for multiple operations;
- Every decision had to be based on maximum benefit of client efficiencies and competitiveness, no matter the size or whether the focus was vineyard or winery.

Walsh began to build a base for change from the bottom up, first with the development of a rich data information management system, accompanied by research, field tests and client trials of the new generation of precision technologies, machinery and equipment entering the marketplace.

“The Walsh people are very sophisticated and advanced,” said **Hal Huffsmith**, vice president of vineyard operations, **Trinchero Family Estates**. “Walsh’s attention to detail and concern about wine quality fosters a long-term perspective for addressing the wave of changes reverberating through

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the U.S. wine industry as a whole—labor, efficient use of information management, cost controls, re-training of staff and burgeoning liquid fuel costs. They have worked hard to study the integration of equipment and operations, and they offer a model to help in understanding both the challenges and opportunities for us as an industry.”

In this article, I focus primarily on the Napa Valley and Sonoma County, the home of Walsh and their diverse clients. We focused on three major technologies that offer substantial cost savings, specifically wireless data information systems, hand-held electric pruning shears and electric tying guns, and harvest equipment, including digital optical sorters.

Wireless Data Information Management

The first wave of wireless, hand-held, data-based information management devices and cloud computing paralleled the arrival of new machinery and equipment prototypes from 2006 to 2008. This convergence sparked a change in how and which data was collected, providing greater understanding of the intersection between equipment and operations with business decisions.

“Once these game-changing technologies, long used in other industries, finally reached agriculture and vineyard management and winemaking, we had the ability to collect data outside,” said Rodgers. “A huge amount of paper has always flowed through vineyards. It was simply no longer enough to ‘eyeball the vines’ and collect vast data by pencil and paper.”

Many versions of data management software soon appeared, including **Meristem**, **AgCode**, **SureHarvest** and **CropTrak**, most of which were programmable for specific needs and were fairly close in price. Meristem is specific to the wine industry; AgCode is strong on the data and business side, less so on the viticulture side. SureHarvest and CropTrak are used for other agricultural industries in addition to wine.

“The technology was here,” added Shepard. “We asked ourselves why an agricultural business wouldn’t want to be as competitive as any other business. Virtually every one of our field workers had a personal cell phone. It was a short jump to hand-held devices, collecting data that allowed for management of the vineyards in a real-time mode.” Walsh has 45 cellular devices that workers use to collect critical viticulture data, and information is sent directly from the field to the Walsh web portal for user access.

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Each spring, a plan for every Walsh client is developed using the Meristem GPS system that maps every block, layout, vine spacing, irrigation set, pump and wind machine. Information is collected by field workers that input specific data, including phenology, irrigation information, fertilizer levels and monitoring of disease or pests. This is repeated during the various stages of the growth cycle—bud break, bloom, veraison and harvest. Workers also input their own hours that sync with accounting systems, providing real-time analysis of time spent on specific viticulture tasks, including the two major labor expenses—hand vine work and harvest.

Steve Sangiacomo of **Sangiacomo Family Vineyards** converted to Meristem a year ago.

“We have over 100 blocks within 1,000-plus acres allocated to growing grapes for more than 60 wineries. There are different varieties, different soil types, weather conditions, water management and farm plans specific to each winery,” he said. “We are now able to collect information about virtually each vine on an hour-by-hour, day-by-day basis and synch it through a wireless network to our database. The database can be accessed at any time, allowing us to make decisions in the fields on a real-time basis year-round.”

Richie Allen, winemaker at **Rombauer Vineyards**, uses the **iPhone** and **iPad** to stay connected through **TankNET**, **Wine Tank Temperature Control** and **The Winemakers Database**, wine production software. Allen, an Australian, has years of experience with machine harvests. He arrived in the U.S. eight years ago from a position in New Zealand where 95 percent of the Sauvignon Blanc crop is machine-harvested.

“We are remotely connected to everything. We make over 100 lots from a variety of vineyards. I don’t know how we would manage our business without a data information system,” he said.

Hand-Held Electric Pruning Shears and Tying Guns

An early vineyard visit provided an introduction to a large crew of men and women wearing battery packs and using electric shears to prune and tie vines. The motion of the men, pruning the large, overgrown canes, and the women, tying down canes to the wires, projected a measured diligence as they moved efficiently from vine to vine.

Hand vine work, along with harvest, has always been one of the industry’s largest costs and comes as no surprise since pruning has always been labor-intensive. The skill carries great respect for the field workers that excel. Hand-held electric shears, manufactured by **Pellenc**, **Felco** and **Infaco**, first appeared in Europe about 15 years ago, but costs, resistance among workers over safety concerns, including the potential loss of a finger, and inconsistent productivity comparisons have hindered adaptation in the U.S.

“Many of our pruners can prune as fast as the electric shears,” Rodgers said. “Speed is not an issue. The issue is the time value of the equipment and the huge labor and



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Hand-held electric pruning shears

technological advantages that result in substantial cost savings through improved working conditions and an increased level in physical comfort. The smaller hands of our women crews tend to be more adaptive to the tying guns.” Walsh has 40 hand-helds, 20 shears and 20 tie guns and is seeing receptivity among field crews. Rodgers admitted that the capital investment is substantial, averaging \$2,700 per unit, including the battery pack.

“Changes in technology have increased safety features. Increased health concerns over Repetitive Motion Injuries (RMI) have contributed to a tool that provides better working conditions, including less injuries and a happier work-

force,” he said. “This translates into a more sustainable work environment.”

Shepard cautioned that vineyards must be able to accommodate the hand-held electric shears and noted that the best results come from cordons vertically positioned or within a lyre-type trellis. Trellises need to be in good physical shape, with tight wires.



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Portable battery packs for electric hand-held shears and tying guns

Mechanical Harvesting and Optical Sorting

The entry of prototype, technology-based equipment for harvesting and sorting grapes began to surface in the U.S. between 2006 and 2008. Two years later, production began, led by French manufacturers **Pellenc SA** and **Bucher Vaslin**, followed closely by **Braud-New Holland Agriculture**, with sophisticated wine-specific machinery and equipment shipped to the U.S. Other future-forward producers, including **Grégoire**, **OxBow International**’s **Korvan Mornish** and **AgRight Harvest**, had been in the global marketplace for some time but lacked digital optic sorting capabilities and on-board functionalities, focusing largely on high production regions with flatter terrains.

“At that time, the general consensus among wine industry professionals was that machine harvesting would never have a place among the elite California wineries,” said Walsh’s general manager **Towle Merritt**. “Emulating France’s Bordeaux region in its winemaking heritage and philosophy, Napa Valley grape growers and winemakers long rejected the practice of mechanical harvests, yet 50 to 75 percent of all Bordeaux fruit had consistently been harvested by machine. The 2012 harvest broke through that barrier, validating assertions that the speed, fruit quality and cost reductions attained through mechanical harvesting and sorting for premium grapes was not only possible, but desirable.”

Five years ago, roughly 10 percent of traditional harvesters were used for picking within large production regions. In 2011, with new and better digital technology driving sophisticated equipment, about 45 percent of clients’ harvests were mechanized. In 2012, over 50 percent of Walsh’s clients,



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Marc Paisnel, CEO, Pellenc America SA,
with the 8590 multi-function tractor

including **Silverado Vineyards, BV, Domaine Chandon** and **Cuvaison**, harvested and sorted either completely or partially by machine. Other wineries outside of Walsh's client base, such as **Dominus, Opus One** and **Clos Du Val**, used all or some combination of mechanized equipment.

For large producers, there are concerns over the "fit" between machinery and existing sites, vineyard layouts and trellis configurations, grape varieties, yield and, often, whether cost savings will be wiped out by the process of moving grapes from vineyards located a distance away from the winery or crush facility. Winemakers whose reputations and brands have been built on hand-crafted methods are concerned over how costs align with benefits, and if consumers will accept a shift in the way artisan wines are produced.

As to whether the new business models of premium, high-end wineries at the forefront of this technology revolution fit the business model of others, there may be a middle ground—using elements of the new equipment to attain efficiencies in some aspects of their operations and maintaining existing processes in others.

Right now the harvester and the digital optical sorter are the "wow" machines of the industry. I heard a lot of "wows" from speechless vineyard managers and winemakers, watching grapes fly through the sorter and come out virtually flawless. The buzz over the avalanche of recent technology-based equipment, and the "either/or" discourse over hand versus machine harvesting, has obscured the real issue: leveraging options to impact innovation. The question of whether these operational vineyard advances will lead to bottom line decisions over how wines will actually be made is equally important.

A comprehensive review of the optical eye sorting technology ("New Technology for Sorting Grapes Used in High-end Wine" in the February 2011 issue of *WBM*) serves as an excellent introduction to its value in speed, accuracy and labor savings. Two manufacturers, Pellenc SA and Bucher Vaslin, offer similar machines. Since the article first ran, both began offering expanded capabilities, as does Braud.

"Mechanization brings adaptability to large vineyards, but it also enables a small vineyard to be nimble," explained Shepard. "Winemakers can pick

precisely when they prefer to without having to fear that crews will not be available. If weather events intervene, machines can sort out berries that are unusable.

"Old harvesters of the '80s decimated vines," he continued. "Today's harvester technology bears no resemblance to the machine of the past. Perhaps those older models are still used: but if you actually see how the fruit is picked and sorted today, the end result is often better than by hand, yielding efficiencies in labor, quality, clean fruit and cost savings up to 50 percent."

Shepard also noted that machine harvests cost-out through a fixed rate per acre, compared to hand-harvesting paid by a piece rate per ton. Both methods depend on yield. Whether you are a grower selling grapes to a winery, or a winery growing grapes for its own wine, the cost savings and quality are considerable.

"Linkage cost-savings are most evident during harvest," explained Rodgers. "When you add the on-board capabilities now available through the multi-function tractor, combined with mobile, on-site use of the optic sorter in the vineyard, real opportunities arise for maximizing efficiencies in time and labor that can substantially impact a business's bottom line

The Impact of Multi-function Tractors

The multi-function tractor is a mammoth workhorse, 12 feet high and the base for maximizing year-round productivity. Multi-function tractors contain on-board software, visual monitors, row tracking systems, mobile communications, digital cameras and LCD light systems. Independent hydraulic sensors on each wheel control height and leveling and allow for tight row-end turns and double-row picks. It is now possible for two to four people to do a harvest. Tonnage achieved depends on crop load. At 5 tons per acre crop, you could harvest 25 tons in five hours. If you had 2 tons per acre, you would only get 10 tons as the speed remains fairly constant; thus the larger the crop, the more money you save.



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Leafing with on-board tractor implement

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Outside of harvest, the multi-function tractor can be configured with a variety of optional implements designed for floor management, including pre-pruners, under-vine tillers, leafers, trimmers and sprayers. The average cost for the Pellenc multi-function tractor, with specifications designed for a range of models that fit specific vineyard layout and row spacing, run anywhere from \$176,000 to \$230,000 without implements. Picking heads range from \$105,000 to \$150,000. With the picking head and implements, such as sprayers and pre-pruners or leaf pullers, the starting price sits at around \$385,000.

The other top-tier, all-year Braud multi-functional tractor, produced by **New Holland**, is similar to the Pellenc line in cost and capabilities, including on-board sorting. The Grégoire line, according to Merritt, is probably the best priced, but does not include on-board berry sorting. These tractors have constraints in some vineyard layouts, however. A Pellenc 8590, the most widely sold multi-function tractor, can operate within a 5.5 foot row, with a tolerance of 25 percent up or down slope and a 17-foot minimum headland space for turning. Its Selectiv' Process picking head with on-board sorting can handle up to an 18-inch cross-arm used for catch wire purposes (no quadrilateral-trained vineyards).

Training drivers to use a multi-function trailer is one critical issue that is often overlooked. Even an outstanding driver cannot be expected to easily morph from a conventional tractor user into a master of this machine. Walsh has been growing its tractor team for about 10 years, promoting drivers as they master the skills required to handle this new breed of workhorse, including software and video monitor expertise, joy stick agility and the ability to operate multiple levers simultaneously.

Trincher's Huffsmith commented on the difference between equipment used for the Sacramento/Upper San Joaquin Valley, where much of its acreage is located.

"We have harvested grapes mechanically since 1991," he said. "We have very different conditions than those encountered in the North Coast. We are a large production vineyard operation. Our per-acre tonnage is higher, and we require different mechanical picking strategies, specifically, over the row harvesters with unique shaker head and bow rod configurations." His winery looked at the new equipment, including the Selectiv' Process and optical sorter. "The cleanliness of both picking in the vineyards and sorting at the winery is impressive. However, our logistics are different, and that has to be taken into consideration when making an investment in this type of equipment."

An insight into the future came from an unexpected source.

"The single-most important issue a vineyard manager or winemaker should address about machinery and equipment is the site," said **Marc Paisnel**, CEO

Pellenc America SA. "The one question I would like to hear more often is, 'Will you come and see my site?' The site drives every decision. A buyer needs to be sure that the right equipment, no matter how technologically sophisticated, will fit with the right site."

Lighting the Night

One harvest technology often overlooked is the use of night lights. Night harvests have been around for some time and have become the norm in Northern California.

"People tend to under-estimate the effect of power booms on changing harvests from day to night," said Rodgers. "Beginning at around 11 p.m. light booms hanging off trailers allow crews to pick over four rows, effecting huge shifts in labor management, with delivery to the winery around 7 a.m. The lights also allow the digital optical sorter to operate as a mobile unit in the vineyard, with grapes processed directly from the field to the winery and



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Checking clean fruit from a Gimbres trailer

clean fruit often delivered straight into fermentation tanks."

Rodgers explained that the cooler nights are better for the grapes and also provide better working conditions for crews. After working a shift, workers can go home and sleep while their children and families are at school or work. The family is able to have dinner together and the worker returns refreshed.

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Step by Step

Rombauer has two optical sorters on-site, a Pellenc Selectiv' Process Vision and the Bucher Vaslin Delta Vistalys. Both machines work similarly for hand-harvested fruit, according to Allen, with the Pellenc easier to program and more difficult to clean. Both were first used during the 2011 harvest, a high-pressure, high-mold year.

"It was a challenging year, but the Vistalys selected the color of the mold we wanted to reject on the berries. The berries sorted out at a slower rate than with clean fruit," Allen said. "Hand sorting can only do about 2 tons an hour under excellent conditions compared to machine sorting at up to 10 tons an hour. A second set with molding and shatter, even with on-board sorting, is still going to require a second pass by hand in the picking zone. As a piece of technology, the optical sorter is absolutely remarkable.

"When you look at it as a vehicle for making conditions more efficient and what it does to budgets, including factors such as insurance and compliance issues, the savings are astonishing, particularly when competing against global competition," he added. "We have no resistance to optical sorting. Machine harvesting is not going anywhere. The labor pool is decreasing, and we need to consider alternatives to staying competitive."

Steve Rogstad, winemaker at 50,000-case **Cuvaision**, agreed. "In 2009 we did a trial hand versus machine run with our Chardonnay: four rows on, hand-picked; four runs off, machine-picked; one batch cluster-pressed, another berry pressed. There was no difference at all in the quality of the wines." He has always had an artisan approach to winemaking.

Rogstad added, "2010 was the watershed year. It was a cool year; and as the season limped along, we went through vineyard after vineyard, removing leaves to expose the fruit for greater heat. Shortly after veraison, the heat spiked at 102 degrees. Virtually every cluster of the reds had sunburn. We decided to berry-sort with the digital optical sorter. I was concerned how the fruit would press out without stems. The berries came out intact, looking like a bin of fresh blueberries with no unwanted material. Four to 5 percent of that crop was sorted out; but if I had to do this by hand, we might not have had a crop at all.

"A year later, 2011, we started harvest on Sept. 27, with rain forecasted the first week of October. We hand-picked all our Pinot Noir and sorted optically then used the mechanical harvester and optical sorter to capture two-thirds of our Chardonnay. Walsh brought in all the equipment. We were able to harvest everything above 21° Brix. There was some pressure against Botrytis, but with the optical sorter, we were able to triage and eliminate the berries that were gone."

Mix and Match for Flexibility

Managing costs in an environment, readjusting after three difficult seasons, is difficult. What then is the right road toward the vineyard of tomorrow? Perhaps flexibility.

From the point that the grapes leave the vines—by hand or machine—the decision-making process over sorting and winery reception appears to be shifting to one of mix and match. Under the conventional process, grapes are picked by hand and sent to the winery for conventional de-stemming and table sorting by a crew and then on to the winemaking team for processing. Labor dominates costs.

Under the "all mechanical option," grapes are detached from vines by an on-board harvester, with picking heads adjusted for the precise fruit zone in selected rows using a high-frequency linear grape separator. Clusters are destemmed on-board, waste separated, and berries are preselected and run

A Surprise Visit

As I was wrapping up this piece, Walsh received a visit from two men from Quantum Technologies, showcasing their newest technology—a pilot plug-in electric vehicle (Quantum PHEV F150). It looked like a stainless steel pick-up truck. With Rodgers at the wheel, the engineer and executive in back, and myself riding shotgun, we took a spin. The battery charge function and smooth, quiet drive elicited a "wow" from Rodgers, given Walsh's recent conversion of its office and terminal roof to solar panels. The vehicle is easily charged using a 110 V or 220 V outlet. Rodger's "wow" was upgraded to a "very cool" when the engineer told us he had 6,000 miles on the truck and had filled up only once.



According to **David M. Mazaika**, executive director of strategic development at **Quantum Technologies**, the Quantum PHEV is designed for rugged fleet users and will drive the first 35 miles completely on electric power, switching to a conventional hybrid as a car does to a combination of electric power and gas. The PHEV battery requires recharging at 600 miles. The truck is intended for customers who typically drive an average of 75 miles/day, who can take advantage of the 35-mile EV range, while providing the capability to drive for extended durations. It can operate in two- or four-wheel drive modes and matches the performance of a standard F150 pickup truck. The base chassis is a Ford F150 which Quantum then integrates with its F-Drive, plug-in hybrid system. Production is scheduled for June 2013.

through the on-board sorter. Clean fruit is off-loaded into bins or gondolas to be sent directly to fermentation; or if using the new **Gimbre** false-bottomed trailer, the free-run juice is captured from the pick, draining juice away from skin contact and reducing phenolic extraction (phenolics increase the oxidative potential of wine). In other words, less "skin contact" time equals less potential for oxidation. Liquid and grapes are then reunited before moving to fermentation.

But what of the winemaker? If a machine can do all this, can the wine-making process be mechanized as well? Pellenc is said to be coming out soon with the Spectron, an "in the field" maturity monitor that will test Brix, pH levels and more.

"I'm a traditionalist. We hand-harvest and hand-prune," said **Barbara Neyers**, owner of **Neyers Vineyards**, who offered a reasoned assessment of the either/or quandary. "We are also certified organic. Weed control is critical around the base of our vines as we cannot use chemicals to control the growth. Walsh does all our farming. I'm all for new technology. If it's

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cost-effective, all the better, but largely we have a business model that works for us, and I don't foresee changing that in the future."

"We like our clients to be educated about what is possible," offered Shepard. "Oftentimes a client will call for help with a particular need, for instance, leafing. Soon curiosity builds as neighbors talk about larger equipment. There is no 'best' choice. It depends on the client and the client's needs."

The Challenge of Change

As the 2012 harvest came to a close, the good year and the huge crop were front and center. Building a different future in the vineyards, the wineries and the business of wine are now left for next season.

"It doesn't take much of an imagination to appreciate the potential impact of all these technologies," said Rodgers. "New alternatives to liquid fuel technologies, vineyard information management from the ground up, using optical sorting technologies instead of fitting people onto sorting lines, re-training field workers to operate data-driven systems and equipment, are part of the new way of doing business. As the line increasingly blurs between what happens at the winery to the source of the grapes, financial decisions will inevitably shift toward a systemic, big picture model.

"We have to use our imaginations to change our businesses and work within the environment that exists rather than fit people into an environment that is nearly obsolete," concluded Rodgers. "The cost of these new technologies is substantial; but as businesses become more sustainable, we believe the costs will balance out rather than add to the challenge of change." **WBM**

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