

# Industry Roundtable: Micro-oxygenation

**A simple technology that allows more control over the amount of oxygen introduced during winemaking**

**by Lance Cutler**

From left: Jeff Murrell, Michael Havens, Cyril Derreumaux

**I had my first** bottle of Madiran 10 years ago. The wine was so inky that it looked like pouring velvet when it went into the glass, but there was nothing velvety about the finish. The wine was dense, layered with fruit and astringent enough to pucker up French royalty. Bite into an olive freshly picked from a tree and you'll get a sense of what I'm talking about.

Micro-oxygenation may be the latest technological rage in our industry, but it comes from humble beginnings. Micro-ox technology was not developed at some university deep into wine research. It was not developed by one of those brilliant scientists nor was it conceived in some commercial think tank. Micro-oxygenation was invented by a talented French vigneron named **Patrick Ducournau** in the small commune of Madiran, who was trying to smooth out the harsh tannins in his wines.

When it comes to winemaking, I'm no technological wiz. I work really hard to keep up with all of the technological developments, but in my heart of hearts, I like to think that there is something magical about wine. No matter how much we analyze it, there will always be plenty we don't understand, and that unknown quality could be what puts the magic into the bottle.

In the realm of current technology, micro-oxygenation is the hottest thing going. I don't know if micro-ox is magic, but I wanted to find out. Virtually no one wants to talk about it, but a whole lot of people are using it. What it does and how it works was something that intrigued me. It intrigued the editors at *Wine Business Monthly* as well. We decided to do a roundtable on micro-oxygenation and set out to find some experts.

**Jeff Murrell** has a Ph.D. in bio chemistry from **UC Davis**. His wife got him into the wine industry at **V. Sattui Winery**. He moved to director of research at **StaVin**. StaVin does a lot of consulting on micro-ox because it helps their barrel alternatives show better. Jeff also oversees a storage facility that has over 2 million gallons of wine, much of which is on micro-ox regimens.

**Michael Havens** has been a winegrower and winery owner for 25 years. He came to experiment with micro-oxygenation on his own in 1997. He developed his own rudimentary equipment before meeting Patrick Ducournau in Madiran in 1998 where he learned how to use their equipment. He's used micro-ox as a standard tool since then.

**Cyril Derreumaux** is the general manager of **OenoDev**, part of the **Vivelys Group**. He has a business background but has worked with wineries in several countries in Europe as well as Argentina and the United States. OenoDev supplies micro-oxygenation products, French oak chips and computer-controlled digital grape and wine equipment.

*What is micro-ox and what is it supposed to do?*

**Cyril:** I can explain the history. **Patrick Ducournau** was in Madiran making Tannat, which is a very tannic grape. After some experimenting, he discovered that the wines that were in

contact with the most oxygen were softer, rounder and richer. He tried to assess the role of oxygen and manage the *élevage* through the monitoring of five criteria: time, temperature, turbidity, oxygen and wood.

Oxygen was the hardest one to control, and Patrick wanted to have more control of oxygen. So he invented a device that would allow him to add oxygen in a controlled way. He experimented with adding oxygen at different times. That's how he discovered the different phases and different rates of adding oxygen that worked best with the wine.

**Jeff:** Fundamentally, micro-ox is a machine that introduces oxygen into wine. It takes oxygen from a cylinder and doses it into the wine through a sparge stone so that the bubbles are fine and can be more readily dissolved in or react with the wine. That's all it is and that's all it's supposed to do.

**Michael:** I would say that it is the careful, conscious addition of oxygen as opposed to the accidental addition of oxygen to wine to control certain types of development and growth in wine structure. All wine gets oxygen, whether it is accidental or intentional. This is an intentional, careful way of controlling it to achieve our goals.

*Well, this is basically a new technology.*

**Cyril:** That's something I would like to correct. It is not new. We have to change that thinking. The micro-ox system was invented in 1991 by Patrick, used in Europe in 1995 and introduced in the United States in 1998. It's been more than 10 years.

**Jeff:** It's the level of control that is new, and the application of that control is new; but the introduction of oxygen during winemaking has been used throughout history. The modern twist on this is that we are now able to control this down to drastic levels and apply what the winemaker wants more easily than a splash-rack or the more traditional methods of introducing oxygen.

**Michael:** There is no doubt that new research has revealed how important and various is oxygen's role in wine aging. It is not rocket science. The controls are relatively simple. It's a matter of increased consciousness on the part of winemakers and wine researchers to now realize how important this is and then take advantage of this simple technology.

*If it is a simple technology that merely allows us more control over the amount of oxygen coming into the wine, why are most winemakers so reluctant to talk about it?*

**Jeff:** There is a romantic notion of winemaking. People don't want to take a chance of doing something that might be perceived as deviating from those romantic notions. They embrace organically growing grapes and romantically making wine in a non-technological fashion.

**Michael:** The wine industry, and particularly the wine marketing industry, has made it a point to set up two diverse poles in the way we make wine. One is natural, and the other is technological. The idea that some of the choices we make are natural versus others that are technological is highly arbitrary--an unexamined assumption manipulated by marketing people who don't have the first clue about how wine is actually made.

**Cyril:** I'm not sure about that. You don't write on the bottle that you use micro-ox. It's the winemaker who decides whether he uses it or not, whether he feels comfortable with it or not.

**Jeff:** But it is an unknown from a marketing standpoint whether you go out there and say we use micro-ox and we use staves. They don't see it as benefiting their brand or benefiting their sales to talk about it, but they use it because they see it benefiting their wine. There's no upside to talking about it publicly.

**Michael:** Micro-oxygenation is standard operating procedure at all great wine producers in Bordeaux these days. I've seen the equipment in the houses. I know the people who have sold the equipment to them. Certainly in the right bank, it is standard operating procedure. The most famous consultant in the world, **Michel Rolland**, incorporates micro-ox. I mean, it's just oxygen, which is all around us. What are we afraid of here?

**Cyril:** Many winemakers in Argentina use it, and in France alone we sell about 300 units every year. There must already be more than 5,000 units being used in France.

**Michael:** It is much more widely spread than any romantic marketer cares to know about.

*Tell me as a winemaker who has never used micro-ox why I should and what's involved.*

**Jeff:** I would say if you've been a winemaker for many years, and you like the wines you've made, then there is no reason to use micro-ox. But if you are looking for a different way to make wines or for a potentially beneficial tool, then micro-ox can be just that. How you use it depends on what you are trying to accomplish.

**Cyril:** You need a couple of years of training and help on the approach because there are special ways to use it, and different phases--especially the first phase, which we call the "structuration" phase--can seem contra-indicative. In the beginning it doesn't seem to take the wine in the right direction. But in the next phase, the harmonization phase, things resolve themselves.

**Michael:** If you want a wine that has durability in the cellar and in the bottle, then micro-ox early in the wine's life can help you achieve that. This involves the standard continual introduction of small amounts of oxygen over time. It will preserve the wine's freshness and fruitiness as well as shape its structure. Then there is *cliqueur* or punctual oxygenation: that is brief, short-term infusions of oxygen. Even in barrels with wine that you typically racked to bring freshness to the wine or to get rid of sulfides, you can now do that with micro-ox, and you can do it with less work, less wine loss and more control.

**Jeff:** Many of our customers want to get away from barrels. In that case, the way we treat wines in stainless steel doesn't provide the oxygen uptake that it does in barrels. So we use micro-ox to try to mimic that oxygen uptake. Some people want to get wines to market quicker. Those take different strategies, but micro-ox can help. We need to listen to the winemakers to determine what they want to do with the wines. Then we can develop the micro-ox tool depending on their approach.

If they are moving to stainless steel, then that dictates a different approach than if they are dealing with a high tannic grape like Tannat or they want to get a Pinot Noir out in two months. Each of these requires a different application of this tool. It's not just one recipe where we can say, "This is how you use micro-ox." You have to listen first and then apply the strategy after that.

**Cyril:** At **OenoDev**, our point is that micro-ox helps with longevity, but it's not a great tool for rushing wines to the market earlier. The structural changes you get with micro-ox occur

very slowly. Macro-ox might help rush the wines, but micro-ox changes the wine slowly.

**Jeff:** It's really a matter of taste. You taste the wines and you take approaches based on the taste and what the winemaker's sensory profiles are based upon. Micro-ox is somewhat unique in that there is no analytical device that will tell you when you have gone in the right direction other than a winemaker who says, "This is where I want my wine to go."

**Michael:** What you have is what we call "guardrails," decreasing free SO<sub>2</sub> or increasing dissolved oxygen or free acetaldehyde--but those are guardrails. If you run into those, you are already driving too fast. Micro-ox is not a tool that takes the decision making out of the hands of the winemaker. It requires more continued awareness on the part of the winemaker, particularly to the way the wine is developing structurally and aromatically. It allows you to choose which of those potential pathways you'll tread. It takes more attention, not less.

**Cyril:** Winemakers need to assess where their wines are now and where they want to go. Then we can tell them how to use micro-ox to reach those goals. Some wines are more suitable for micro-ox than others. Sometimes there is blending involved. Tasting is crucial to the whole use of micro-ox.

It is also very helpful with stabilization. You've worked all year in your vineyard to develop the best polyphenols. You work with all the winemaking tools to have the best extraction and potential of anthocyanins and tannins, and you want to stabilize those. Micro-ox is very helpful with that.

*Is there a risk of oxidizing the wines?*

**Michael:** There is always the possibility of making a mistake with any technique or tool. I did that once by mis-setting my equipment. What I learned was that the theory of this phenolic interaction works because the wine responded and became young again after seeming like it was overdone.

**Cyril:** I'll come back to the two phases. During the first phase, the reactions are reversible. During the harmonization phase, if you go over, then it is very hard to reverse it.

*Let's be specific. How can micro-ox help with a very tannic wine?*

**Cyril:** First of all you can't just look at tannins. You have to look at the ratio between tannins and anthocyanins because what you are trying to do is create a polymerization between them, so the ratio between one and the other is very important. The best candidate is a wine with high tannins and high anthocyanins. Then you can create those ethyl bridges and make it more color stable and soften the tannins.

**Michael:** And for a very tannic wine you would micro-ox as soon as possible after primary fermentation. If you are using extended maceration, that can be as early as immediately after primary concludes, or if the wine is being pressed off, then as soon as the wine is reasonably clear. Turbidity is a real factor, because lees use up oxygen. But you would ideally apply micro-ox before malolactic. You want to make those green, astringent, front-of-the-palate tannins more supple, round and full. You want to do your work immediately and get that tannic structure moving toward the mid-palate, toward round instead of hard or drying.

**Cyril:** We describe the progression of the tannin as traveling from green to hard to firm to round to soft to melted. Melted would be like a bottle-aged wine. The one you want to avoid is drying.

**Jeff:** My philosophy is a bit different. With hard tannins, it depends on the history. If you have taken these wines and barreled down and over a year and a half they have softened out and you like what they are becoming, then I would only use micro-ox to mimic the barrel. The wine receives oxygen uptake from topping, sampling and racking, which is about 2 ml/liter/month on average over a year's time.

**Michael:** If you include all the intrusions to the barrel, then I'd agree with 2 ml/liter/month; but if you are talking uptake only through the barrel, then we figure 1 ml/liter/month.

**Jeff:** In any case I would try to mimic that usual oxygen uptake as much as possible. If there are problematic tannins and they won't be resolved with normal methods, then I have seen great results with doing a heavier dose earlier on and trying to smooth those out. If they are not so aggressive, then I think just 2 ml/liter/month is perfect: increasing depending on bottling times or decreasing because the wine has achieved the desired results. A lot of it comes down to when you are bottling.

**Michael:** Each wine or style of wine has a different curve for the amount of oxygen required.

*How does micro-ox work when confronted with problems like vegetative character or sulfides?*

**Michael:** You certainly need more oxygen early to address those issues. I need to note that vegetal character and sulfide problems are very hard to completely separate from one another, especially early in the wine's life. In a vegetative wine with high tannin I think the technique would be to give it a burst of oxygen, a very high dose very early in the wine's life. Then you could determine how much oxygen you wanted to use to deal with the structure issues. Most sulfides can also be dealt with if we address them early in the wine's life.

**Jeff:** This is an area where we are in agreement. The best strategy for curing sulfide and veg is: the earlier the better. If you can get the right nutrients in the fermentor and you can get macro-oxygenation in the fermentor, then you are better off than treating it later.

If you still have it pre-malolactic, then I think high doses of oxygen to get rid of veg or sulfide are good. I've seen people who have had sulfide issues a year later, who had success turning up the oxygen then. They use that instead of a splash-rack. One important thing for people to understand is that you have to get rid of the lees first. You can't just turn up the oxygen if the wine is still on lees.

**Cyril:** Sometimes micro-ox can increase the reductive power, but you can re-oxygenate and bring it down.

**Michael:** That matches my experience. If you give a big dose and then immediately stop it, the effect is to have increased the "reductivity" of the wine. By reductivity I mean practically a tendency to create sulfides and to exhibit harder, greener tannins. It's almost like the wine is moving along the path; but when you cut off the oxygen, the wine says, "Oh my God, you sent me down the wrong path. I'm going all the way back down to the beginning." So to me,

just hitting it and then stopping is rarely appropriate.

*What is the timeline for using micro-ox?*

**Cyril:** The idea of micro-ox is giving the amount of oxygen that the wine can consume immediately. You don't want to build dissolved oxygen. You want to control that flow so that it is constant--as low as possible but constant for a long period of time.

**Jeff:** If you don't have an expensive unit, you have to use punctual micro-ox when you have small volumes (like a 60-gallon barrel). You have to do it once a week. You turn it on for maybe eight hours and then turn it off. That mimics racking more than anything else.

**Michael:** In small containers like individual barrels, the volume is too small to allow us to control continual oxygen flow, so we add some oxygen as if we were doing typical cellar techniques, like racking, because it is easier, cheaper and more controlled.

**Cyril:** Micro-ox is like putting gas into a car but just enough to let the car go. It's the same with micro-ox. If you picture the tank and you have micro-ox bubbling in the bottom, the bubbles will never reach the top because they will be consumed by the wine before they can get to the top.

*What is the O<sub>2</sub> doing?*

**Jeff:** I've never seen anything that explains all of the effects that oxygen has. Overall, it adds maturity and aging to the process. This is how wine ages. Oxygen adds complexity to wines, but the exact chemical reactions are so numerous that no one knows exactly what is going on.

**Michael:** It's very complex. It's a cascade of events. Practically speaking, though, it adds what we winemakers would call "wine aging." The wine becomes more complex, less aggressive and more pleasing on the palate. The wine becomes rounder and less harsh.

*When and how are barrel alternatives made a part of this process?*

**Jeff:** We have done numerous side-by-side trials comparing wine in stainless steel with barrel alternatives, with and without micro-ox. People almost always prefer the micro-oxed wine. There's a better integration, a better aging, a better sense of maturity to the wine when you add oxygen with barrel alternatives. If you are using stainless steel, I think you get better wine if you have some level of micro-ox.

Even people going into barrels will use stainless steel and micro-ox first to enhance that timeline and remediate some of the issues they may have with that wine. But the way we look at it is that you are going away from barrels. If you are using barrel alternatives in stainless steel, then micro-ox is a great tool you need to learn how to use because it will make better wine. Toasted barrel alternatives and micro-ox best approximate aging wine in barrels.

**Michael:** Both untoasted oak and toasted oak have reactions with the polyphenols of wine. Untoasted oak seems to have a more structural reactivity with the tannins in the wine. Toasted oak adds aromatic elements that can be very complementary to the wine, but they are less reactive with the wine.

**Cyril:** But the oxygen can help integrate them both.

**Michael:** What with stainless steel tanks, silicone bungs and inert gas technology, we make wine now in a more anaerobic way than we did, say, 50 to 60 years ago. We shouldn't be surprised that we are making different styles of wine. Previously, oxygen was a bigger component of winemaking, but it was accidental. What we are trying to do with micro-ox, in a way, is to become more traditional. We want to bring oxygen, as an element, back to the wine that has seen it robbed by modern equipment.

**Cyril:** And in a controlled manner, where the winemaker gets to decide whether he wants more or less oxygen based on his artistic notions.

*Micro-ox has often been linked to more modest wines. Is there a place for micro-ox in the production of the finest wines?*

**Cyril:** I have people using untoasted oak for wine that is going to barrel. During the structuration phase, right after fermentation, micro-ox is working on the wine itself. It helps develop the wines for extended aging. It is not used only for low-cost wines. Many people use micro-ox for their high-end wines as well. That is certainly true in France, especially in Bordeaux; and it is true here in California as well.

**Michael:** I think it is an important question. That is, can we pursue the highest quality using this technique? And I think the answer is unequivocally, "Yes." Smart winemakers know that oxygen plays a key role in the development of their wine. That's why winemakers are adapting the use of oxygen to their stylistic goals. I started very timidly with my lowest-priced wines. I very quickly learned that that was a mistake. Micro-ox did more with the wine that had the most potential because it had more phenolic material and more depth of fruit.

*How does micro-ox affect the ability of wine to age in a bottle?*

**Jeff:** I've seen a huge amount of commercial wine that has been micro-oxed during its lifetime and still has that ageability. The amount of oxygen most people are using is still on the low end, and people stop before over-oxygenating their wine. So the probability of those wines aging is good.

**Michael:** Ten years ago I did experiments side by side to test exactly this. The last time these paired wines were tasted, the micro-ox wine was more youthful, had more fruit, had a rounder, brighter structure and it was more mouth-filling, especially in the sense of perceived acidity than the more traditionally racked wine. That traditionally processed wine had started to dry out and become more linear. That's just one experiment. I think if micro-ox is used appropriately for this goal of aging, then it can actually produce more age-worthy wines.

**Cyril:** One of our points is that micro-ox helps with longevity, but the structural changes you get with micro-ox occur very slowly.

**Brad Webb**, one of California's most eminent winemakers, once told me, "I can't understand why you should not operate knowing what you are doing, especially if it's something you can quantify. It's silly when you can control some variable, not to control it." I get the sense that Brad would have been all over micro-ox. On the other hand, **Randall Graham**, one of the early proponents of micro-ox, has been reported to have said, "Giving

oxygen to winemakers is like giving razor blades to monkeys."

It certainly seems obvious that oxygen plays a critical role in wine development. If you are a winemaker, I think you have to give micro-oxygenation technology a hard look. Whether you decide to use micro-ox to control the amounts of oxygen going into your wine, or whether you prefer to oxygenate your wine "accidentally" with rackings, topping and such is up to you. In any case, most of us will agree that the denser the wine, the more tannin and the more anthocyanins, then the more oxygen the wine can use.

Tannat is one hell of a tannic monster. It's one of the things I like about the variety. The French know how to cook around their wines. They have figured out that Madiran goes wonderfully with foie gras and cassoulet. That sounds like a perfect three-hour winter lunch to me. **wbm**