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The Evolution of California Clones

Plus ~

The Promise and Challenges of Alternative Packaging for Premium Wine
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"I think the cans that are really resonating with our consumers we'll continue to carry, but the category is shrinking and kind of leveling out, which I think is probably healthy to be honest. "It's pretty challenging to make canned wine and do it the right way."

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founder, Two Shepherds Wine, "The Promise and Challenge for Premium Wine in Alternative Packaging," page 54

"We use labels to do very creative things that are all part of our lives. This is an important part if you want to sell to Millennials and Gen Z; authenticity is huge. They see through the bullshit."

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president and owner, Summit Wine and Spirits, "From 'Lip to Glass' to Virtual Tastings," page 62

"Stores see a lift in sales of brands that have been demoed for weeks after the tasting ended, so it's not just the bottles that we sell at the demos that matter—it's the repeat sales from new customers who will be loyal to the brand for a long time."

Erica Crawford

winemaker, Loveblock TEE, "Natural Alternatives to Sulfur," page 22

"The TTB desk thought green tea was poured from a teapot into the tank. We then had to explain the process and supply documentation. Every time the response landed on a different desk, so we spun around for a while but eventually succeeded."

The World of Clones, Then and Now

An Interview with John Caldwell and Deborah Passin

Lucie Morton

Lucie Morton is an independent viticulturist based in Virginia. She is an internationally recognized author, ampelographer, lecturer, consultant, research collaborator and, most recently, film producer (*www.bonvoyagevitis.com*). Her higher education took place in Europe while her practical education began as a vineyard manager on the family farm in Virginia, along the banks of the Potomac River.

Vitis Vinifera Have Grown for millennia in Eurasia to provide grapes, whether fresh, dried or fermented. At each node, there is the latent possibility to root and sprout a new shoot that will be identical to the mother vine. Over time, there can be subtle genetic changes, which lead to variations called clones. This species is easy to propagate vegetatively from cuttings and, consequently, can easily spread with human migration. All *vinifera* varieties and their clones are Eurasian and, over time, have become associated with specific countries and regions within countries.[1]

In the January 2023 issue of *Wine Business Monthly*, my article "Are Your Grapevine Clones 'True-To-Type?'" went into detail about how clones of a single variety can differ from each other and why it matters. In this article, I would like to take the lens off of the vines and instead look at the human and transitionary aspects of clonal distribution within the wine industry over the past 50 years.

In this context, where "history" begins circa 1970, I will look at "California clones", whose true ancestry was an ocean away. Today, grape growers look for where the selection was made of a given varietal clone, not where it came from. By designating a variety or hybrid by its species, one can trace back to where it originated versus where it was selected.

As a student in the Cours Superiéur International de Viticulture in the early 1970s, I got a first-hand look at early clonal trials in Europe. When one surveyed the vineyard landscape from a distance, the clonal plots stood out for their uniformity of color compared to adjacent blocks of older vines that were populated with those selected from several mother vines over many years. Playing into the homogeneous green color also was the fact that the clonal vines had gone through virus elimination and therein lost some of those picturesque primary colors of yellow and red.

As a self-employed, non-institutionally affiliated viticulturist based in Virginia, I was far from a place to lecture on issues I thought would be of interest in California. Fortunately, fellow Virginian and microbiologist Lisa Van de Water provided me with a forum at her Wine Lab in Napa.

At a Wine Lab seminar on rootstocks in 1987, I met John Caldwell and blind-tasted two Cabernet Sauvignon wines that forever changed my perception of winegrape clones. At the time, comparing Bordeaux and Napa wines, which had been ignited by the 1976 Judgment of Paris, was a common feature of wine tastings. These were times when I saw quite a bit of varietal confusion masked as "clonal" differences, where Merlot was, in fact, Cabernet Franc, and Gamay Beaujolais was a mix of Pinot Noir and Valdiguie.

Therefore, when John presented me with two Cabernet Sauvignons that day, I immediately identified one as French and the other as Californian. It was hard to believe that they had both been grown in his vineyard in Coombsville, Ca., just east of Napa, and that the difference was due only to the clones used in each lot.

Interview with John Caldwell

Recently I asked John to tell me about those game-changing Cabs.

When did you become convinced that French clones would be a positive addition to your vineyard?

Caldwell: It was my first harvest in 1986 during fermentation. John McKay was my winemaker at that time, great winemaker and guy. He started talking about the aroma differences between French CS337 and CS15 versus CS clone 7 and the CS See "clone" during fermentation in the tank and during pump-overs. After racking and sulfuring in '87, we sat down for tasting. It became obvious to all that the clones I had smuggled in had something big time to add to the quality of Napa Valley wines. That was the wine you tasted at Lisa's lab.

This was a time when illegal "suitcase" importations from Europe were unfortunately rampant. Knowing you did not want to

French stock from Canada.

Caldwell: Yes. I wanted the new clones to be certified virus-free and had to be certified true-to-type. Only plants from the ENTAV-INRA program in France were certified. There was no way to do it legally, except for going through the U.S. certification program that took seven years to complete. I did not have the option to wait seven years. Fortunately, I found a nurseryman in Canada who was working with ENTAV-INRA and had about 6,000 wonderful one-year-old vines already grafted: two clones of Cabernet Sauvignon, two clones of Cabernet Franc and two clones of Merlot. I bought every one he had available.

What happened when you got caught at the border with the plants?

Caldwell: When I got caught, I had 1,400 vines in my rental car trunk. Of course, they confiscated all of them. But I had already gotten 4,400 vines across the Niagara Falls border before and had already sent 10 boxes of them to my shoe store in Yountville, using United Parcel air freight. When sending by UPS,

they always gave you a yellow carbon copy of your freight bill. Stupidly, I had those 10 carbon copies with me in my briefcase.

When the officer decided to trace those 10 boxes, I had to make an executive decision. So I ate them! That caused a bit of a stir with a body search and all, but the receipts were gone into my stomach. The office now was going to send me to the Buffalo City Jail. Not good! I asked if I could make a phone call, and I called a friend who lived in a small community close to Niagara Falls for help.

Luckily, my friend was an attorney, and he assured me that he could help. Within 5 to 10 minutes, the officer's phone rang. With a strange look on his face, the officer says to me, "I don't know who you know, but that call was from my boss: he wants me to release you. So get your stuff and get the hell out of here." I drove back to my friend's house, and sitting in his living room, I asked, "Richard, what happened today?" He said, "My boy, you were lucky today. Back in law school, my best friend is now head of customs for New York State. I gave him a call, and he got you out of a pretty tight situation!"

I seem to remember that at first you thought you had all 337 in Block 9, but then noticed one was different and eventually found a tag that said 15. In fact, the 15 had larger clusters and did not have Leafroll 2 (LR2), so people wanted that one. Didn't they call it the Caldwell clone or something?

Caldwell: The Caldwell 337 and Caldwell 15 were "imported from Canada in February 1984" and planted (in) July in Block 9, the block in 1990 where you and Pierre Galet found the true SO4 sucker. The block still exists and is still about 60% original, with approximately 1,000 vines of CL337 and 1,000 vines CL15. I planted a row of 337, then 15, then 337, etc. On the day of planting, some of the CL15 bundles were used to complete certain rows when we ran out of 337. That is why we have a mix.

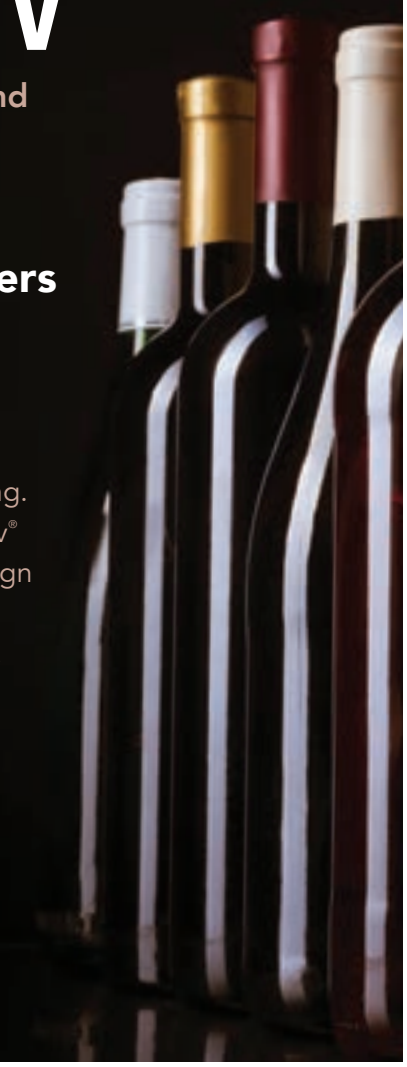
Forty years ago, I had no idea these two CS clones were going to give me such an increase in wine quality. Had I known, I would have paid more attention to keeping the purity. The certified clonal wood was sent to Canada from a nursery in Carpentras, France. I met the owner in 1983. It makes me smile that I ended up with 337 F1. Anyway, both were good; and after 40 years on French 3309 and SO4, Leafroll 2 still shows no symptoms on the 337 or 15.

Your next move was to bring over material legally through USDA after quarantine became part of a licensing system with the French government. Why did you bring the material in through Robert Goodwin in Missouri?

Caldwell: I brought the material through Missouri State because Goodman charged me one-sixth the price per plant that Davis and Cornell were charging. And Robert was delightful to work with.

I believe I recommended that you also bring in rootstocks, both for health and trueness to type. How did you choose which ones?

Caldwell: I brought in clonal rootstocks because I wanted only French clonal material in my vineyard. I learned from you to choose the varieties the French were using around that time. I also learned to check my soil first, then decide on the rootstock that best matched my soil type. Your research on the affinity of rootstock varieties provided me the necessary information to match them to my soil type. You kept me away from AxR1, although AxR1 rootstock was still the only one recommended. You and the French influenced me away from that disaster. I think the French rootstocks are superior to Foundation Plant Services rootstocks, and I have 25 acres planted on French rootstocks that are now over 40 years old.



John, you had your own nursery for a brief couple of years before selling it to Sun Ridge. Those plants which you and Tom Nemcik produced were terrific. The vines on the French rootstocks were not California-certified, and you said I was the only person who wanted, in fact insisted on them, in 2003 and 2004 when a number of my Mid-Atlantic clients were getting established. I have reported on how well these vines did years later, vis-a-vis red blotch, and all of them are successfully going into their third decade of production. What rootstocks have you found best for your site in Napa?

Caldwell: In Coombsville, my three best rootstocks are 3309, 5BB and Riparia Gloire. I would plant more 5BB. I still love Lyre, with 30"x10' vine spacing. Today more 1130P and 110R should be planted. I never planted them, but they are good. I use them for my replants.

After all these decades of growing various clones and making wine at your vineyard, what have you learned about what you would do now if you had to start all over?

Caldwell: Great question. My choice of varieties, rootstocks and clones would not change. A minor change would be to plant more 5BB rootstock and less 101-14. We are on a five-year plan with Wine X Ray to see what the differences are in anthocyanin levels and phenolic levels with our six Cabernet Sauvignon ENTAV clones at harvest and after fermentation.

You should focus your story on 337. Almost everybody in the CS biz knows this one. It's the first clone that made a difference in wine. I must have had 10+ trials in the late 1980s and 1990s, and it always came out on top. Most important, it is the F1 with Leafroll 2. I would not want a clean one, unless I planted an acre and compared the wine.

Do you think global warming affects the choices people should be looking at now versus in the past?

Caldwell: I do think global warming will "force" growers to change varieties and clones of varieties.

Deborah Passin Joins:

When did you write The Clone Book that is still available on your website?

Caldwell: I finished The Clone Book in 1995, with the help of Philippe Melka and Lucie Morton. Right now, I have hired Deborah Passin to update the book and to research new clones internationally. (**PHOTO 1**)

PHOTO 1: John Caldwell and Deborah Passin evaluate eight clones of Cabernet Sauvignon from Caldwell's clonal trial: 15, 169, 191, 337, 338, 341, 412, 685 in March 2023 at Caldwell Vineyard in Napa, Calif.

DEBORAH PASSIN

FIGURE 2: Vitis Navarra nursery fields in Spain. The company website has an informative video that shows its clonal selection initiatives and grafting methods (*vitisnavarra.com*).

Deborah, I understand that you are in charge of updating The Clone Book and have traveled abroad to get new information. What have you learned?

Passin: The main goal of the book is to inform grape growers and winemakers about clones available in the U.S. that are preferred for wine quality. I have been interviewing key researchers and scientists in France, Italy, Spain and Portugal, as well as winemakers and growers in the U.S., to identify the best clones for about 30 grape varieties. (**FIGURE 2**)

I plan to list specific sources for acquiring these clones—nurseries, universities, etc. I'd also like to weave in some background on significant people in the industry who have contributed to our clonal history or will be helping to shape the future.

And lastly, I have grand ambitions (a sequel?) to share expert recommendations and global approaches to creating more resilient vineyards that can better adapt to challenges, particularly climate change and disease. One of the best ways to do this, I'm learning, is to increase the genetic diversity of a vineyard.

How are you approaching the factors relating to wine quality?

Passin: I'm following IFV's lead (ENTAV is now IFV) on the parameters for quality: "Appreciated for their organoleptic quality, particularly regarding balance, color and structure." IFV also considers the clone's aptitude for producing wines suitable for aging.

Of course, the ratings for the ENTAV-INRA clones are mainly based on trials in France as the Italian clones are mainly based on trials in Italy. The purpose of me interviewing winemakers and growers from different regions in the U.S. is to balance out the feedback and distill down commonalities (Sonoma Coast, Oregon, Napa, Washington, Paso Robles, Mid-Atlantic, etc.).

Through my travels, I learned about the incredible research being done in Portugal to identify clones and varieties that could be better adapted to climate change. For example, according to António Graça, head of R&D at Sogrape, Portugal, has conserved 255 clones of Tempranillo. Through field trials, they determined that some clones maintain surface leaf temperatures of up to 5.9°F cooler than the most sensitive ones. This means they could potentially select, say, 12 clones that do better in heat due to this variable; and because there are 12 and not just one, this behavior will be stable across different places and years.[2]

An example of specifics I learned, while in France, is that Cabernet Sauvignon clones 1124 and 1125 are the new ENTAV-INRA solutions to the discontinuation of the original 191 and 337, two popular clones in Bordeaux and California that had Leafroll 2.

CS 191 was treated in France to remove the virus, and that is now 1124. According to IFV, 1125 has a different story. After 337 was discontinued, growers started asking ENTAV to provide a cleaned-up version. They did clean 337, but the quality was not as high as the original. So they explored its original sibling plants, which have been preserved all this time. One of the plants hit the mark on quality, and this became 1125. According to the Chambre d' Agriculture, Gironde, despite some behavioral differences in the vineyard, growers in Bordeaux seem to be happy with both 1124 and 1125.

Most winemakers in California know FPS 33 "reported to be 191" and FPS 47 "reported to be 337." These are alleged clones that arrived from France in 1989 and were treated at UC Davis to remove the virus. Hopefully, with the release of this book, growers and winemakers will be better informed of these types of differences when deciding what to plant.

What have scientists told you about the role of virus in wine quality? It's not a black and white issue for every virus; in fact, grapevines can host 70 or so viruses, the vast majority of which are asymptomatic.

Passin: The topic of treated versus not treated clones is really important. Per a geneticist I spoke to in Italy, the treatments used by IFV and FPS (Foundation Plant Service) today are not intrusive enough to make changes to the clone genetically. The only changes that occur are from the removal of the virus, not from the process. The virus was causing some positive behaviors/traits (or suppressing negative ones). When you remove the virus, you lose those traits. Another point is that if cleaned-up clones are more productive, you can influence wine quality with certain vineyard practices, such as dropping fruit.

France, Italy, Spain, Greece and Portugal are trying to find high-quality, clean selections to begin with, but with their more limited restrictions regarding virus, they will have access to clones we won't be able to get. For winegrapes and rootstock varieties in France, only two viruses are mandatory to eliminate: Fanleaf (GLFLV and ArMV) and Leafroll, plus Fleck (GFkV) for rootstock.

LUCIE MORTON

FIGURE 3: Late-season leaf reddening caused by Leafroll 2 virus in Cabernet Sauvignon ENTAV# 191 in Middleburg, VA

As I understand it, in the U.S., there are over 20 disease agents that must be eliminated before a vine can be registered for commercial propagation: Arabis mosaic virus, asteroid mosaic, corky bark, fanleaf virus, fleck virus, leafroll-associated viruses (Type 1, 2, 2RG, 3, 4, 5, 7, 9), grapevine virus (A, B, D), rupestris stem pitting, Kober stem grooving, tomato ringspot virus, Phytoplasmas, Pierce's Disease (Xylella fastidiosa). Are we over-cleaning grapevines in the U.S.?

Passin: In addition to other testing methods, Foundation Plant Service now has the ability to use high throughput sequencing (HTS) to detect even pathogens we are not specifically looking for. What will FPS do with this information? Hopefully, that list won't get any longer.

How do European clonal selection programs address current and future needs?

Passin: IFV is still doing clonal selections to increase genetic diversity, and so are counterparts in Spain, Italy, Portugal and other organizations throughout France. They look for vines that have traits that might be missing from existing clones of each variety. Here's the circa 15-year process:

1. Go to old vineyards or repositories and find a vine with interesting characteristics—something different than the other clones that exist.
2. Observe for two years in the vineyard.
3. In the winter, take cuttings from one vine and bring to IFV.
4. Hot water treatment to get rid of Flavescence Dorée (45 minutes, 122°F).
5. ELISA or PCR (Polymerase Chain Reaction) test for Fanleaf, Leafroll and Fleck (GFkV).

LUCIE MORTON

FIGURE 4: Late-season leaf reddening caused by Leafroll 2 virus in Cabernet Sauvignon ENTAV# 341 in Middleburg, VA

LUCIE MORTON

FIGURE 5: This photo of Cabernet Sauvignon ENTAV# 337 was taken on same day in Middleburg, VA as **FIGURE 3** and **FIGURE 4**. The vine is virtually asymptomatic for Leafroll 2 virus.

6. In the winter, graft buds on indicators (indexing) in pots for a few years and observe for symptoms.
7. Then bring cuttings to regions from which they came and plant five to six replicates: Chenin to Loire, Pinot Noir to Burgundy and Champagne, etc. (local partners).
8. Observe: Five years viticultural observation, three years of winemaking and tasting panels, and document characteristics.
9. Apply for registration.
10. At IFV, take cuttings from original potted plant, graft and plant 10 vines (onto SO4), and that's in the ENTAV-IFV collection, like the Foundation block at FPS, but FPS keeps at least two plants of each. Distribute from here.

Outside of government-sponsored programs, are growers generally interested in fostering genetic diversity?

Passin: On my trip I met with people from all over France (Burgundy, Bordeaux, Loire and Champagne), as well as Italy, Spain and Portugal who are on a similar mission. They are going out to old vineyards to find and preserve old varieties and clones that have been ignored because they were not relevant in the past.

I heard that the harvest in Burgundy is now one month earlier than it was 40 years ago. Pierre Marie Guillaume (the same owner as Guillaume Nursery in California), whose family has been doing clonal selections of Pinot Noir and Chardonnay in Burgundy since the '60s, told me that they used to select clones that had high sugar levels and were ripening early because growers in Burgundy struggled to get their grapes ripe.

For the last 15 years, after recognizing the pattern of climate change, they have been looking for the opposite—clones with lower sugar, good acid and a pattern of late ripening. They have even started to plant other varieties, such as Malbec (Cot), in their vineyards in Charcenne just outside Burgundy. I tasted a wine made from four Malbec clones they have planted there, including one from a 150-year-old vineyard in Argentina. The wine was very good!

When will your clone guidebook become available?

Passin: Estimated release of *The Clone Guidebook* is sometime in 2024; but as mentioned, there may be a second book to encompass all the other useful things I have learned that growers and winemakers in the U.S. will appreciate.

Comments from Laurent Audeguin, Research Scientist at L'Institut Français de la Vigne et du Vin

Author's Note: I hope I am able to convey in my article how much we owe the French and other European agencies for their amazing clonal work and how cheap, at $0.24 per vine, a royalty is to contribute to these programs. Of particular value is time spent—literally, generation-long studies of the vineyard and wine traits for each selection.

The World of Clones, Then and Now

Audeguin: It is safe to say that CS 337 is one of the most popular French clones, both in France and the export markets. It has an interesting history because there were five plants made from a single mother vineyard after a preselection in Bordeaux that began in the 1950s. These were grafted and planted in the INRA Grand Parc collection. In 1975, the clone was registered by INRA, and each of the five vines was transferred to ENTAV as 337F1 to 337F5.

ENTAV chose 337F1 to represent this clone for distribution between 1975 and 1995 (when trademark licensing began). The LR2 virus did not manifest during indexing or in the field. It was not until circa 1997/8 that ELISA testing for LR2 allowed for its detection. It was found in a number of ENTAV-registered clones, including those selected for excellent wine quality, like CS 191 and 341.

"Ironically, in the case of 337, only the F1 individual tested positive; its twin sister vines did not. (Note: viruses are not always evenly distributed throughout the vine.) This caused French scientists to share their findings with American virologists. Because this LR2 had very slight, leaf-reddening symptom expression in 337 and there were no vectors that spread it to other vines, it was permitted to remain certified, but no new increase blocks would be established going forward.

In the meantime, Serge Grenan led efforts to clean up the CS clones 191, 337 and 341 with micrografting of apical meristem. Next, the Chambre Agriculture Gironde set up an experimental vineyard that included original clones, "clean" clones and the four twin sister clones (F2-F5) of 337F1. The four twins did not have to undergo virus elimination because they were free of LR2.

Many years of experimentation would follow. Data collection and wine tastings would lead to the following new clonal entries: CS1124 (cleaned-up 191) and 1125 (one of the 337 "twins"). Interestingly, the cleaned-up 337F1 did not perform well enough to achieve certification.

Of the 17 clones, seven (underlined) are no longer in the Foundation Plant Services Registry:

- Cabernet Sauvignon: 191, 341, 337 (on two rootstocks: RG & 101-14)
- Cabernet Franc: 214, 327, 623 (on RG, 101-14, 3309)
- Merlot: 181, 182, 343, 347, 348 (on RG, 101-14, Slate Quarry Riparia)
- Malbec: 595 (RG)
- Petit Verdot: 400, 1058 replants (RG, 101-14)
- Sauvignon Blanc: 376, 530 (RG)
- Sauvignon Gris: 917 (RG)

I asked Sean Martin, vice president of Boxwood Winery, if the clonal diversity is something he shares with his clientele. He replied: "Boxwood recently had a winter wine club allocation for their premium wine club members. Each time we have a wine club allocation, we offer a special barrel tasting to get a glimpse of and endear our members to the future vintage. Because Boxwood barrel ages its reds by varietal clone, we were able to share these with our customers. For this tasting, we used clones Merlot 181/RG for its aromas and power and PV 400/RG for its structure and finish. The exercise is a great way for the members to understand the vintage and how we look at each clone when creating our blends."

All my clients today are using California or New York certified rootstocks and clones, as these programs give the best chance for growers to begin with healthy plant material from known sources. There were only two years when a few of them planted exclusively with the Caldwell ENTAV rootstocks." **WBM**

References

1. Dong, Y. et al., "Dual domestications and origin of traits in grapevine evolution." *Science* 379, 892–901 (2023).
2. Carvalho L, E. Gonçalves, S. Amâncio and A. Martins (2020) Selecting Aragonez genotypes able to outplay climate change-driven abiotic stress. *Front. Plant Sci.* 11:599230. doi: 10.3389/fpls.2020.599230.

Websites

There are many resources on the Web that provide information on all types of grapevine cultivars, including the following:

- *entav-inra.fr/en/plant-material/*
- *plantgrape.plantnet-project.org/en/cepages*
- *entav-inra.fr/en/news/*
- *calameo.com/read/0053898924ebbfb44a489*
- *entav-inra.fr/en/plant-material/*
- *fps.ucdavis.edu/fgrvarieties.cfm*
- *fps.ucdavis.edu/WebSitePDFs/Newsletters&Publications/GrapeImptBrochure.pdf*
- *fps.ucdavis.edu/ucresourceslinks.cfm*
- *vignevin.com/en*

Morton's Experience with Caldwell Nursery Clonal Vines in the Mid-Atlantic

We are approaching the 20th anniversary of four of my clients who purchased ENTAV clones grafted on ENTAV rootstocks (not California-certified) from Caldwell Nursery in Napa during Caldwell's brief time in the grapevine nursery business. The wineries that made those purchases were Maryland-based Black Ankle Vineyards in Mt. Airy and Sugarloaf Mountain Vineyard in Dickerson; and two in Virginia: Boxwood Winery in Middleburg and Rosemont of Virginia in La Crosse.

At these four wineries:

- Not a single vine had Red Blotch, except where re-plantings took place later from other sources.
- In most years, LR2 does not affect ripening and the Cabernet Sauvignon fruit continues to go into the top wine blends. In very wet years or in compacted places, the leaf reddening is more obvious.
- CS 191 and 341 show LR2 reddening much sooner and stronger than on 337F1 in these vineyards. This would seem to confirm ENTAV's decision to allow 337 to continue to be registered in France. However, none of these are registered in the U.S. due to LR2.

The first plantings of Caldwell Nursery vines took place at Boxwood Winery in 2004 and 2005. The photos (**FIGURES 3, 4** and **5**) were taken on the same day, during harvest, in 2009. Today, Boxwood Winery has seven Bordeaux varieties on four rootstocks.