

grape growing

Getting the Veg Out

Trying to avoid veggie character in fruit during a cool, wet growing season

Mark Greenspan

EVERY YEAR IS SPECIAL in the wine growing world, and every current growing season seems like the most "special." The 2011 growing season? Special it certainly was! We thought it unusual that last year was unusual in that it was quite cool for most of the spring and summer until we got hit by a series of severe heatwaves during late summer. Like 2010, the current season featured a cool spring and summer, but unlike last season, the heat never really materialized. Nevertheless, the 2011 season, as of this writing in early October, was slightly ahead of 2010 in growing degree days. Are the cool growing seasons experienced during the last two years an aberration or the beginning of a long-term trend? I am not qualified to say, but I would not bet that this trend will continue indefinitely. Yet, according to experts, we may see a greater degree of seasonable variability in climates than we have experienced in the past. As winegrape growers, we must adapt to the weather conditions of each growing season.

I was prompted to write about veggie flavors and aromas in Bordeaux varieties because it seemed as though all of my clients who grow them were frustrated by the threat of elevated vegetative flavors and aromas in their fruit. Veggie character is a no-no in today's winegrape market. Seasons like this one challenge our viticultural agility, but that's what makes it fun, right? I'm hearing groans out there because this season threw in a late summer/early fall series of rainfall events to throw a wrench into any plans for late harvests, thereby yanking any "fun" right out of it. One could almost hear the *Botrytis* sporulating in early October. Agility becomes useless when one runs off of a cliff!

Veggie character in Bordeaux varieties is a varietal character at low levels but a defect at higher levels. Cabernet Sauvignon, Cabernet Franc, Merlot and Sauvignon Blanc are the most pronounced in this character, and the difference between varietally-correct and veggie bomb is a pretty fine line. Unless the bell pepper character is a planned-for stylistic component (as it is in some Sauvignon Blancs), it is generally best to reduce that character in the fruit so that it does not become the primary reason to hold off harvest.

The veggie character is due to the compound isobutylmethoxypyrazine (IBMP), which seems to be a compound written about profusely in the scientific and trade literature. Other pyrazine forms are present, but IBMP is the most prevalent. I'm writing this column during harvest so don't look for a full literature review here. A glossing over of some of the literature I have on hand makes me very confused about the physiology of IBMP in developing grapes, but I think I have a working understanding about it. What is clear is

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that IBMP increases in the berries from fruit set through veraison and decreases from veraison to maturity. I can say this: it is easier to control IBMP by preventing its accumulation in developing fruit than it is to accelerate its degradation in the ripening fruit.

High IBMP levels are thought to be caused by vigorous, dense canopies where fruit is hidden under layers of vegetative cover. But is it lack of light, lower fruit temperatures or something else that leads to the increase in IBMP? Confusingly enough, Hashizume and Samuta (1999)¹ found that light actually stimulated IBMP in grapes. That seems counter-intuitive, but the work was done on detached berries, not on berries attached to the mother vine. Perhaps light stimulates IBMP production in grapes, but other factors must outweigh the response observed by those researchers. In fact, research generally indicates that open, less congested fruit zones reduce IBMP levels in grape berries. All of this considered suggests that IBMP is likely sourced in the vegetative portion of the vine and imported by the fruit (probably not actively but through the xylem stream).

In a recent report by Lakso and Sacks (2010)², they point to their research done in New York on Cabernet Franc that indicates that shoot vigor, not density, is positively correlated to IBMP levels in fruit. They did this by varying bud counts on vines so that shoot vigor was modified as a result of higher or lower numbers of growing points on each vine. Fruit zones were modified to create similar microclimates around the clusters across all of the treatments. By doing this, they found that shoot growth rate (vigor) was the primary driver for IBMP accumulation by fruit.

That said, it does appear from other research that fruit temperature is important in final IBMP concentration in fruit, but that is primarily due to the degradation of IBMP in the fruit during ripening, which is accelerated under higher temperature conditions. Several studies have shown a very high correlation between malic acid levels and IBMP levels in ripening fruit. It is not assumed that there is any cause and effect relationship between these two compounds, but malic acid is the primary energy source in the ripen-

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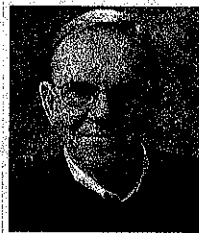


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Remembering L. Peter Christensen

By the time this is published, most of you will have known about the passing of L. Peter "Pete" Christensen. Pete has been long regarded as the leading expert in vineyard mineral nutrition worldwide, and his many research efforts, publications and presentations have served as a backbone for fertilization practices of grapevines. Personally, I have used the 1978 publication, "Grapevine Nutrition and Fertilization in the San Joaquin Valley," written by Christensen, Kasimatis and Jensen, as my nutrition "bible" for years and years, along with some other presentation materials from his numerous seminars. While much additional research has been performed since the publication of that document, many truths are still contained on those pages.



Pete served as a UC farm advisor for Fresno County and eventually moved into the position of Viticulture Specialist for the University, a position now occupied by Jim Wolpert. In my interactions with Pete, I was struck by how engaging and selfless he was. He would speak to me as though he was speaking to an expert, yet I was only at the onset of my new career. He was the expert and had vastly more experience than I did at that time, but he made me feel respected as well. He would add his input to the conversation as though it was another considered opinion. I was instantly enamored by his calm demeanor and his ability to make others feel important.

ing berry, and its metabolism is highly temperature-dependent. Apparently, IBMP shares a very similar temperature dependence. It also seems to stop declining late in the season just like malic acid, which tends to decline to a level (not absolute) and remain somewhat constant at about the time fruit attains marketable maturity.

To sum up, from my cursory evaluation of some, but not nearly all, of the literature, it appears that vegetative vigor is positively correlated to berry IBMP levels before veraison and higher berry temperature is negatively correlated to berry IBMP levels after veraison.

Vegginess in 2011

This past season was difficult from the vegetative perspective because of the strange growth pattern of vines during the early summer. Late spring rains fell through June, actually culminating in a substantial rainfall event on June 28 in early summer. Persistently cool temperatures kept shoot growth at bay, but the late replenishment of soil moisture set up a condition for rapid shoot growth once temperatures finally increased in early July. Like a compressed spring, the vines launched into shoot growth that we have rarely seen. We could almost watch shoots elongate as we stood there. It seemed that vineyards that had just completed a shoot-positioning pass needed to be shoot-positioned to the next notch yet again and yet again still after the second pass. This rapid shoot growth, instead of occupying several weeks of the growing season, was focused in a narrow time-slice just after fruit set. There is little doubt in my mind that the vigorous shoot growth contributed to the veggie flavors in the fruit that raised concerns from many of my clients and colleagues.

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Yet, I did not know Pete as well as some of my colleagues did. Viticulturist **Daniel Roberts** had this to say about him: "He was a great man and a great viticulturist. Quiet and without ego. He wanted to do the right thing, always. Willing to share information freely, just to serve the industry. I learned a lot about grapevines from Pete, and I am very sorry at his passing. His is a great loss."

Viticulturist **Nick Dokoozlian** knew Pete very well for most of his life and had much to offer about him: "There will likely never be another person in the grape research community with Pete's tremendous intellect and technical expertise. He had the practical experience gained from being raised on his family vineyard, combined with the scientific knowledge and observation skills resulting from his academic and research training. As great a viticulturist that Pete was—and in my opinion he was the very best in the world, unquestionably the premier authority on grape production—he was even a more outstanding person. Even with respect to his great professional accomplishments and contributions to the grape industry, it is his personal character—thoughtful, generous and unselfish—that I will remember the most. Pete spent countless hours mentoring young farm advisors and research scientists, ensuring their success and professional development. Many of the most memorable experiences of my professional career were spent in the vineyard, learning from Pete. Working with him was truly like standing on the shoulders of a giant."

Pete's obituary in the *Fresno Bee* may be found online at <http://bit.ly/nDOqcv>.

— Mark Greenspan

So, What is a Grower to Do?

While the weather conditions were uncontrollable, there were some minor adjustments that growers could do to mitigate high IBMP levels in their veggie varieties. The most effective method of IBMP control was vigor control through delay and restriction of irrigation. The late rainfall events dropped significant amounts of water, but according to soil moisture measurements made in several locations, that water was depleted by the vines in a matter of days, following each event. Nevertheless, sufficient soil moisture reserves occurred deep in the soil profile, and growers felt the itch to irrigate vines in July.

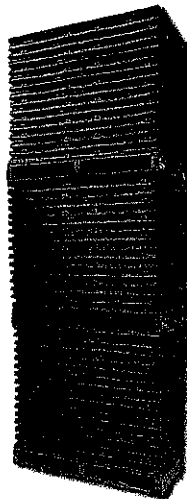
Working with clients by measuring soil moisture profiles and plant moisture status, we delayed irrigation well into August in many cases and even avoided irrigation altogether in some vineyards that had been irrigated in earlier growing seasons. In vineyards where irrigation was started, we used soil moisture measurements to apply only the irrigation amounts needed by the vines. Plant moisture status (leaf water potential and stomatal conductance) measurements were used to "steer" our irrigations to maintain a moderate stress on the vines, thereby curtailing their vegetative growth.

Using delayed irrigation and precision irrigation scheduling was successful, in my opinion, at reducing the vegetative quality of several vineyards. I had clients telling me that they had lower vegetative character in their vineyards this year than in previous years, and this was the high-veggie year!

While water management is an important means of vigor control, it is far from the only one. Soil preparation, rootstock matching to soil, vine spacing, trellis and pruning system selection all impact vine vigor, but those are (usually) one-time decisions made prior to vineyard establishment. Within any individual growing season, dormant pruning levels, suckering and shoot

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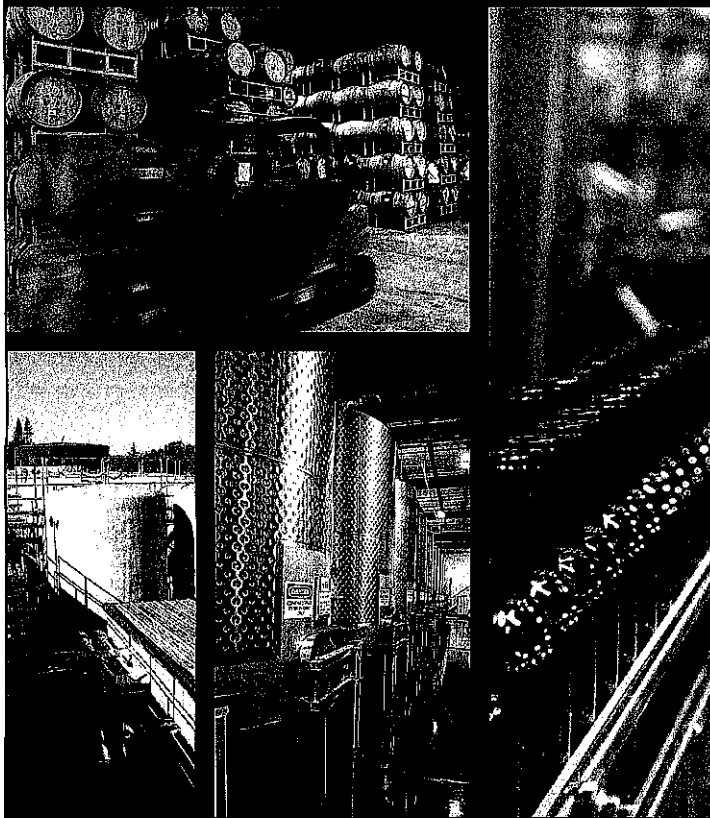
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Getting the Veg Out

thinning, and nitrogen management (less is more) are all ways that vine vigor is controlled outside of water management.

Secondly, moderate leaf removal is a means to reduce pyrazine levels, though it seems (per the discussion above) that the leaf removal may have less to do with reducing accumulation of IBMP and more to do with degradation of IBMP during ripening. After the heat damage experienced in 2010, I think growers were gun-shy about pulling leaves in the fruit zone this year. As someone who prefers only minimal leaf removal, at least in VSP systems, this would have been a good year to do it anyway.

But when is the optimal time to remove leaves? It still seems that the best time is shortly after fruit set. Early fruit exposure helps to allow the fruit to acclimate to an elevated light and heat environment, rather than shocking them into that condition later in the season. However, the action of pyrazine reduction, resulting from leaf removal, apparently occurs after veraison and not before veraison.

I was asked whether it was advantageous to remove leaves in the fruit zone late in the season because of persistent veggie character in the fruit. The idea behind the question is that late leaf removal (very late summer or early fall) avoids the risk of heat damage because heatwaves are quite rare that late in the season. My reply was that it was slightly better than doing nothing and that there was indeed little risk of sunburn at that time of year. However, as was shown by Lacey et al. (1991)³, both malate and IBMP decline rapidly right after veraison, and their decline slows or levels off near maturity. So the late-season leaf removal would have far less of an impact than would pre-veraison leaf removal.

The 2011 season could have been spectacular because of the mild weather. Early rains washed away much of that hope, but I'm sure that some wines will still live up to the promise. They might even have varietal character!
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