Boron and Fruit Set

As we head into bloom, the matter of fruit set is on the mind of growers. Fruit set is one of the most unpredictable events of the entire growing season and the resulting crop load never seems to be "just right." If yields are down, vineyard economics suffer and it can even lead to overly vigorous vines. If the crop is too heavy, well, I've preached ad nauseum on that topic but mainly fruit and/or wood may not ripen properly with unpleasant consequences. Even if it is right on target, good set may mean tight clusters on some varieties that can increase risk to bunch rot pathogens.

In 1987 in Oregon we had the unpleasant surprise of hardly any crop on the vines. This was an industry-wide phenomenon. It caused a lot of head scratching. Lots of BB sized berries, hens and chicks and zig-zaggy, stunted shoots. We suffered a classic case of severe boron deficiency. Researchers at Oregon State University got right on it, explaining that very dry conditions during the previous fall caused the problem Recommendations included pre-bloom split foliar applications of solubor and eventually, foliar B applications in the fall, after leaf drop. With that, the problem was pretty much solved.

There was actually some debate about the effects of mild boron deficiency on wine grape quality. Since botrytis is a big late season problem in Oregon and modifying cluster architecture was viewed as a potential solution to the problem, the hens and chicks phenomenon was not viewed as all that bad. Most of us were thinning crop anyway at lag phase, so it could actually save us some labor costs. But fine tuning boron to regulate crop was just too difficult to do and the possibility of drastically reducing yields was considered too risky.

A recent study by Pete Christensen, Robert Beede and Bill Peacock in California published by California Agriculture[1] highlighted the options for boron supplements to improve fruit set potential. Boron and zinc are identified as the two micronutrients most often deficient in California vineyards and in particular the basaltic and granitic parent materials in the Sierra Nevada (similar to the soils of the Eola Hills in the Willamette Valley). Typically growers would correct by adding boron to the soil but the timing was tricky to get the B where and when it was needed so they decided to evaluate foliar and drip applications. A successful first trial with foliar boron demonstrated that it was relatively easy to boost bloom-time boron with early applications. A follow up study was expanded and yielded interesting results. Five treatments were included: 1) untreated control; 2) previous fall foliar (10/19); 3) dormant soil berm (2/18); 4) pre-bloom foliar (5/4); and 5) bloom foliar (5/20, 50% cap fall). All treatments were applied at one pound boron per acre (20.5% solubor product). Foliar applications were made with 150 gpa, berm sprays at 30 gpa on a 4' band. Dormant canes/buds, petioles (opposite clusters) and veraison shoot tips were sampled. Fruit response was determined by grading individual clusters (8/15) in each plot for boron deficiency symptoms. The results were quite dramatic with the fall foliar application having the greatest impact on reducing both severity and incidence of boron deficient fruit, even over the pre-bloom application. Interestingly, the boron tissue levels at fruit- set were higher in the pre-bloom plot than the fall plot but without the best effect.

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[1] Christensen, Peter L. Robert Beede, William Peacock. California Agriculture. Vol. 60. No 2. pp 100-103.

The authors presume that the pre-bloom treatment was not early enough to reverse the effects of boron deficiency on primordial tissue development in developing buds. Also, boron mobility in the plant as well as uptake may be slow, thus preventing enough timely accumulation in critical reproductive tissues.

The recommendation based on these research results is for fall foliar applications of boron. This can be made in a single application of 1 lb boron (actual) to the post-harvest canopy. In Oregon, we applied boron to dormant canes with the intent of getting better access to the bud scales although the California researchers and Terry Bates suggest that applying boron on canes still with leaves is effective. Increased rates are only valid for fall applications. Since boron can easily be toxic as well, great care needs to be taken when applying to green tissue. Toxicity symptoms include downward leaf cupping and burning of the leaf margins. Split applications of spring boron can be made safely. My experience was to make 3-5 applications of boron at 1 lb solubor (0.2 lb actual) per acre. It is possible to tank-mix boron with some fungicides but boron will affect the pH of your spray water so be sure to read the product label for compatibility and buffer if necessary. There is no problem tank-mixing boron with sulfur. To prevent burning, do not apply 0.5 lb rates within 14 days and do not use water soluble packets, oils or surfactants in the same tank[2].

While foliar applications offer a good annual maintenance approach to boron deficiency, a longer term solution may be a correction of soil boron levels. Soil applications vary according to soil texture but range from 1-4 lb/ac. Soil boron should be in the 2 ppm range. Timely irrigation can also help to improve boron levels at bloom.

The adequate range for boron is 25-50 ppm[3] and staying in or near these boundaries is critical due to the easily deficient or toxic nature of this micronutrient. Soil pH will affect the uptake of boron although movement is most strongly influenced by water availability. It will readily leach and become very inaccessible in drought conditions.

As we move towards bloom you can take a petiole test if you suspect boron or zinc might be a problem. Foliar applications should begin around 5-6". A petiole test at bloom will reveal boron status for future reference and vine nutrition maintenance.

To download a .pdf of the California Agriculture article, please visit their web site at http://californiaagriculture.ucop.edu/. You can read Dr. Terry Bates' Vineyard Nutrition Management at his web site http://lenewa.netsync.net/public/Bates/Home.htm.

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[2] Terry Bates. Vineyard Nutrient Management. 2001.
[3] Ibid.