Foothill Vineyard Post Harvest Activities: **FERTILIZING**

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Information summarized from "Grapevine nutrition and fertilization in the San Joaquin Valley"-Pete Christensen, Amand Kasimatis, and Fred Jensen. UC ANR pub. 4087 (the "black book")-now out of print.

If your vines are in need of some boron or potassium, you can make your fertilizer application post-harvest and get better uptake and save yourself the time next spring. Exceptions: Nitrogen should **not** be applied in fall due to possible loss by leaching from winter rains (better to do a split application in spring and early summer). Foliar fall sprays of zinc, used to correct zinc deficiency in fruit trees, has **not** been found effective in grapes; however, soil applications ONLY for sandy soils can be applied in the dormant season with a band of concentrated ZnSO4 (1 lb. per young vine or 2-3 lbs. per mature vine) shanked in furrows 8-10" deep, about 18" on either side of the vine.

Boron and potassium fall fertilizer applications to soil are helped by rainfall pushing the material to the root zone. The other advantage in applying post-harvest is that the results should be picked up in next year's petiole sampling; while, for instance, boron applied foliarly in spring will make your petiole sample look artificially sky high.

Severe K deficiency results in burning of leaf margins. Cab. Sauv.
Photo: L. Wunderlich

POTASSIUM (K). If your vines are potassium deficient, and many foothill vineyards are due to the nature of our soil parent material, then late fall or early winter is an excellent time to apply potassium fertilizer, allowing winter rainfall to move the material into the soil. The latest K should be applied to soil is before bud break. Applying in fall allows you to make the applications where you see foliar symptoms, which don't show until the very end of the season ("red leaf" symptoms can be due to potassium deficiency).

Symptoms are not corrected immediately after treatment. A small improvement in vine growth or leaf color may not appear until the following summer, a full response isn't attained until the 2nd or 3rd year after treatment.

*Petiole analysis:
Deficient at < 1.0%
Adequate above 1.5-2.0%
*Based on work by the late P. Christensen, UC Viticulture

K deficiency in Zinfandel (top) and Sauv. Blanc. (bottom).
Photo: P. Christensen.

Specialist. Some labs indicate higher levels for adequate (i.e. 3.0%). In my experience, vines with higher petiole numbers have still exhibited symptoms of K deficiency.

Soils high in clay and clay colloids "fix" K fertilizer; meaning the potassium then is unavailable or only slowly available (as it solubilizes) to the vines. K fixation by soil can be beneficial, as it serves against rapid leaching of K from soil. The problem with some of our foothill soils is that K fixation can be so great it requires a large amount of K fertilizer to overcome the fixation and make K available.

Potassium Rates. Since a large amount of K is needed to overcome most foothill high K-fixing soils, the quickest response (and, again, it takes several years to see a total response) can be obtained by a single heavy application rather than annual applications, according to information from Christensen et.al. Their recommendation is as follows:

- Severe deficiency: 5-6 lbs. of K_2SO_4 per vine or 4-4.5 lbs. of KCl per vine.
- Moderate deficiency: 4 lbs. of K_2SO_4 per vine or 3.5 of KCl per vine.
- Mild deficiency: 3 lbs. of K_2SO_4 per vine or 2.5 of KCl per vine.

The symbol "K", used for the element, is from the Latin word for potassium-Kalium. Potassium is usually reported in terms of the oxide, K_2O, also called potash.

Potassium chloride (KCl, muriate of potash) contains 52% of actual K, 62% K_2O.
Potassium sulfate (K_2SO_4, sulfate of potash) contains 44% of actual K, 53% K_2O.

Although KCl may be more economical, it should be used with caution because the Cl will contribute to soil salinity.

Potassium Application. Place the fertilizer as close to the root zone as possible, under the drip and in a hole (not on the surface) and leave the hole uncovered to allow rainfall to move the fertilizer in. Rocky foothill soils mean application by hand, unless a French (row) plow or other furrow applicator can be used.

Foliar sprays are popular with some foothill growers. Work by Christensen applying repeated sprays of 4-5 lbs. of KNO_3 in 100 gals. of water did not increase K petiole leaves or reduce deficiency symptoms over a test period of 3 years. Higher rates of foliar K can be toxic to vines and I have seen what I believe is K "burn" on vines that have been treated. Peacock showed work in table grapes that foliar K increased brix, but there remains concern that foliar applications in wine grapes can result in undesirable juice characteristics (high pH).

Foothill research. In 2010 I conducted a small K and P fertilizer trial in a "red leaf" vineyard. The block tested negative for leafroll virus (another potential cause of "red leaf") so I contacted Pete Christensen, the late UC Viticulture Specialist who conducted a large body of research on grape nutrition, and was advised to apply several soil treatments, including a "high" K treatment at 5 lbs. of K_2SO_4 per vine and a "low" K treatment of 2.5 lbs. of K_2SO_4 per vine. The

application was made prior to bud break and rain, and we showed an increase in petiole K the next season but no relief of "red leaf" symptoms. This year the grower called me to say there were obvious foliar difference between those vines that received our K**, three years ago**, and those that were untreated. The grower is also concerned about overly high levels of K in the vine that may contribute to undesirable characters in the juice. I hope to continue this work to help determine an appropriate K fertilizer regime for our foothill grown vines, including a treatment of foliar applied K.

BORON (B). (Note higher than recommended rates can cause toxicity). Because B deficiency can drastically affect fruit set and vine growth, and the cost of treatment is relatively low, B fertilizer application is recommended over entire vineyard blocks that have a deficient spot or as "insurance" against deficiency if you know you are generally low on B. Petiole analysis can help confirm B deficiency and your need for a B fertilizer program.

Shot berries can be caused by boron deficiency. Photo: L. Wunderlich

Petiole analysis:
Deficient at < 25 ppm
Questionable at 26-30 ppm
Adequate at > 40 ppm
Possibly toxic at 100-150 and above (confirmed with blade analysis, presence of symptoms, and/or soil analysis)
Toxic at > 300 in leaf blades
B levels don't vary much along shoot or during the growing season, except in soils with excess B, then petioles increase during the season. B does accumulate in blades, so it is higher in older leaves in high B soils.

Boron deficiency in Grenache, Sierra foothills. Photo: P. Christensen.

Boron Fertilizers: Industry used to express B as percent of boron trioxide (B_20_3) but now it is common for labels to state the amount of *actual* B, i.e. Solubor (U.S. Borax) contains 20.5% actual B, the label states that 4.9 lbs. of Solubor provides 1 lb. of boron. Solubor D.F. (formulated for foliar spray solutions) contains 17.5% B, so 5.7 lbs. of Solubor DF provides 1 lb. of actual boron.

The basic recommendation is 1lb. actual Boron/acre/year for soil application(equivalent to 5 lbs. of 20% formulated B fertilizer) with amounts adjusted to frequency of application, local experience, rainfall amounts, irrigation practices, and results monitored through tissue testing. Soil applications can be made during the fall or winter to allow winter rains to carry in the fertilizer.

Boron can be successfully applied through the drip using fertigation at a rate of 1/3 lb. per acre annually for two years to correct a mild deficiency; depending on the leaching potential a higher rate may be needed.

Foliar sprays can also be used to correct B deficiency, either as an emergency treatment or as a method of vineyard maintenance. Work done by Christensen, Beede and Peacock showed that B can be applied safely to foliage in the fall, postharvest (but while a good canopy remains), at a rate of 1 lb. actual B per acre. Alternatively, spring and summer sprays can be applied but the rate should be reduced to ½ lb. per acre per application because young foliage is more sensitive to phytotoxicity, not to exceed 1 lb. per acre for the season.