Foliar Fertilization of Grapevines

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VineLines Editor's Note: Because the question applying nutrients by foliar sprays comes up often, I'm including comments by one of the world's leading experts in the field. Some comments relate to California vineyards, but the observations are valid for Midwest vineyards.

Applying nutrients to the foliage is widely practiced in fruit crop production. In many instances it may not be providing any benefit except to the manufacturer and dealer. So, when is it effective and economical? The literature is full of reports on foliar fertilization studies. This article brings some of the information to light in hopes that it will lessen the confusion, mysteries, and expense of this practice.

Micronutrients

Nutrient foliar sprays are most commonly practiced to correct micronutrient problems (9). There are several good reasons for this. Micronutrients such as zinc, boron, manganese, and iron are required in relatively small quantities by plants. Thus, foliar sprays can prevent or correct a problem with relatively small amounts absorbed by the foliage. The heavy metals such as zinc, manganese, and iron are also readily fixed by most soils. Thus, they are not free to move or remain available in the soil as a fertilizer (3).

Zinc. Foliar spray of zinc is the most common because it is the most widely deficient micronutrient. Treatment can also be quite effective if the correct material and methods of application are used (9). Neutral zinc (52% Zn) and zinc oxide (75% Zn) are the most economical and effective on a recommended label basis (6,7,10). There is no advantage in using chelated zinc products in sprays. They were originally intended for soil application, are more expensive, and less effective than neutral zinc and zinc oxide on a label recommended basis. Uptake is greatest with dilute application as compared to concentrate (7). The optimum timing to influence fruit set is three weeks before bloom up to bloom (8).

Boron. Boron can also be applied as a foliar spray but it is most commonly applied to the soil via a berm herbicide spray (11). Two to three pounds of Soluborr (20% B) per acre per foliar application is recommended, not to exceed a total of five pounds per year (3).

Manganese. Manganese deficiency is rare to San Joaquin Valley vineyards and is occasionally seen in Coachella Valley and North Coast. It is readily corrected with manganese sulfate at 2 to 3 pounds per 100 gallons (3,9,15). There are no advantages in using chelated manganese in a foliar spray (15).

Iron. Iron deficiency is by far the most difficult to correct. This is because it is fixed in the tissue with little or no translocation to growing regions. Often, the leaves themselves do not recover uniformly and are freckled with green spots indicating localized immobilization (3). Usually, it is necessary to apply repeated sprays at top label rates to get any degree of acceptable correction

(9). The literature contains conflicting reports as to whether the iron chelates or inorganic salts are more effective (26). However, iron chelates are the most widely used by growers.

Combination Micronutrients. Using products that contain various micronutrients is a common practice, especially as a "maintenance" philosophy. However, most commonly only one micronutrient is marginal or deficient in any particular vineyard and there isn't enough of any one of the elements in the product to correct a deficiency anyway. It is better to first determine what elements are marginal or deficient through petiole analysis. This is also a good way to confirm symptoms as some of the micronutrient symptoms are easily confused. Once a potential deficiency has been diagnosed, a single element compound spray can be used to prevent or correct it (3,9,10,26).

There is one problem to be aware of in using tissue analysis for micronutrients. Iron deficiencies are caused by its immobilization in plant tissue and not total uptake (3). Thus, iron deficient tissues will not be necessarily low in iron. Often as not, iron levels will be as high in deficiency symptom tissues as in normal tissue (9). It is best to ask the laboratory to skip iron analysis to lower the cost of analysis and to avoid confusion or misinterpretation.

Macronutrients

Foliar fertilization with macronutrients such as nitrogen, phosphorus, potassium, calcium, and magnesium is a more muddied issue than with micronutrients. It is common to see them used even though they are being adequately supplied by the soil and root uptake. It is a way to "cover all the bases" and it's usually just the cost of material to consider as the spray is being directed to something else anyway. There are several weaknesses in the idea of foliar feeding macronutrients (3,26). First, the nutrient is probably being supplied adequately via the soil. Second, there wouldn't be enough absorption of the macronutrient to correct a deficiency for very long, if at all. And third, all the evidence in the literature shows it to be an ineffective or impractical method to significantly supply macronutrients to grapevines.

Nitrogen. Nitrogen applied to the foliage as urea is a commercial practice in apples and citrus (3,14,26). These crops apparently absorb nitrogen better than most other. It is mostly used to supplement soil treatments as it sometimes takes six or more applications in one season to provide all of the nitrogen needs. Urea has also been tried on peaches and grapes with no measured benefit or increase in leaf nitrogen levels (3,10,17,20,26).

Phosphorus. Phosphorus foliar applications have resulted in few reports of responses on any crop (3,26). Repeated sprays of phosphorus (three per season) over two years in five replicated vineyard trials gave no response and did not increase phosphorus levels in the growing shoot tips (13). Phosphorus deficiency has not been documented in San Joaquin Valley vineyards (9).

Potassium. Potassium is required by most fruit crops in too large a quantity to be practically supplied through the leaves. Foliar potassium nitrate has been recommended in prune orchards as an interim corrective measure until soil applications take effect (22,25). It is not recommended in most other fruit crops because of a lack of response (22,25,26). Research in grapes has shown no effect on deficiencies or increases in foliar tissue potassium levels (10,19,23).

Potassium nitrate has not shown benefit in supplying nitrogen to fruit crops (25,26). Weinbaum (26) determined that 2-year-old prune trees would require 140 applications of 1.2% potassium nitrate per year to meet their requirement.

Calcium. Foliar applications of calcium are recommended for fruit disorders of some crops (3,26). A notable example is bitter pit of apple. Calcium foliar spray applications were evaluated for reducing "waterberry" our most important fruit disorder. No reductions of "waterberry" or any other fruit effects were found (4,5). Actually, calcium nitrate increased "waterberry." This was later found to be due to the increased nitrogen from the nitrate. "Waterberry" affected tissues in clusters have elevated levels of nitrogen compounds and symptoms can be induced with nitrogen applications. Thus, foliar nitrogen applications may actually be counter-productive in some cases.

Magnesium. Magnesium sulfate sprays are recommended on some crops to correct magnesium deficiency (3,4,5,18,26). It may be tried on grapes as an interim corrective measure along with soil applications. It would be a suitable substitute for soil application under a deficiency situation (9).

Macronutrient Combinations. This is the most controversial use of foliar nutrients. There is a constant barrage of claims that such products result in improved vine growth, production, and fruit quality. However, it doesn't seem logical that vines which are absorbing adequate amounts of macronutrients from the soil would respond to additional foliar applications. Also, they would be absorbed in such small quantities that they would be largely ineffective.

This logic is supported by trials in other fruit crops and in grapes (1,2,3,13,18,21,26). For example, multiple sprays of NPK products over four years have produced no response (21). However, claims of the "magical" effects of NPK foliar sprays will no doubt continue. They are usually based on non-replicated trials and endorsements. The best way to make a judgment is to put out trials of your own. The trial should not merely compare one 10 acre block with another, for example. This can be misleading due to vine differences. It is best to treat only a few rows and leave a check of a few rows. This should be replicated or repeated three or four times across the field. This way, you can avoid natural vine differences across the field in your comparisons.

Tank mixing is another consideration. Several pesticides have shown increased phytotoxicity when foliar nutrients are added. "Witches brew" tank mixes sometimes appear to contribute to berry scarring. It is possible that adding an unnecessary foliar nutrient can tip the balance towards scarring. Therefore, make sure the nutrient is needed. Otherwise, it may not be worth the risk. If there is any question about combinations or compatibility, first try it on a limited number of vines.

Summary

In summary, foliar nutrient sprays can be quite effective in correcting deficiencies of micronutrients. It is best to first determine which element is marginal or deficient and to apply only that element in inorganic form. The only exception is iron which is only marginally effective as a foliar spray and usually applied as a chelate. Macronutrients are generally not effective or practical as foliar fertilizers. Deficiencies or maintenance can be corrected or

supplied through soil applications. Questions can be answered by establishing replicated trials in individual vineyards. And finally, be cautious about tank mixes.

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