

## Factors That Influence Fruit Set

Hans Walter-Peterson, Finger Lakes Grape Program



A Pinot Noir cluster at harvest exhibits signs of poor fruit set including few berries per cluster and small green (shot) berries.

Photo by Patty Skinkis, Oregon State University.

Source: <http://www.extension.org>

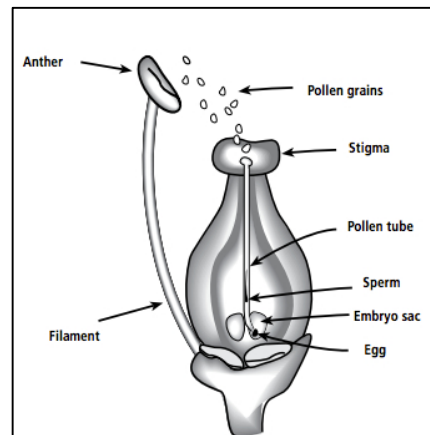
One of the components that influences yields in grapevines is the number of berries that set and mature on each cluster, or “fruit set”. Each flower cluster contains many individual flowers, each of which has the potential to become a grape. However, not every flower will successfully pollinate or get fertilized or develop a healthy embryo and the surrounding tissue that becomes the fruit that we want.

If too many flowers become berries, clusters become compact and are much more susceptible to bunch rots like botrytis. If only a small number of berries set, yields can be significantly impacted, and therefore grower profitability as well. Ideally, we’d like to have a certain percentage of those flowers to turn into berries, but not all of them.

### *What factors influence fruit set?*

There are a number of factors that determine how much fruit will end up being set on clusters. Some of these factors can be influenced to some extent by growers, while others are out of their control.

Environmental Factors – probably more than anything, the environmental conditions present before and during the bloom period can have a significant impact on fruit set. Cool, cloudy or wet conditions can all cause some problems that manifest themselves during set. If cool and cloudy conditions predominate in the prebloom period, the flowers may not develop normally, which will reduce the number that will ultimately form berries. Cool or hot temperatures (below 65°F and above 100°F) during bloom can also slow the growth of the pollen tube towards the egg, which is only viable for a certain amount of time. Rain during bloom can prevent the calyptra (the “caps” or petals on each flower) from completely detaching from the flower, which can also interfere with pollination. It can also dilute the fluid that sits on top of the stigma, which can prevent pollen grains from germinating.



Cut away diagram of a grape flower during pollination.

Source: “Grape Berry Growth & Development”, N. Dokoozlian. In *Raisin Production Manual*, ed. L. Peter Christensen.

Vine Nutrition – Poor fruit set can be the result of nutrient deficiencies in the vine. Recall that most of the vine’s nutrient needs before bloom are actually met by reserves in the permanent structure of the vine being remobilized, which means that significant deficiencies from the year before can impact the development of the flowers in the early part of the current season. The two mineral nutrients most often associated with fruit set are boron and zinc. The ratio of carbon to nitrogen may also play a role in as far as it

influences vine vigor, and nitrogen levels have been suggested as a possible explanation for early necrosis of the cluster. Many growers will include boron in one or two sprays before bloom to try to increase B levels in the tissues.

Vine Vigor/Balance – At bloom, the flowers on the vine are competing for resources with the growing shoot tips. The shoot tips are very strong sinks for resources. On an overly vigorous vine (or one that is undercropped), they can outcompete the flower clusters for nutrients and result in poor flower development and set. Vines that are overcropped or with weak growth will generally set poorly as well because of a lack of nutrients for the overall functioning of the vine.

*What can growers do to influence fruit set?*

While environmental factors often have the greatest influence on how much fruit ends up set on a cluster, there are a few tools that growers have at their disposal that can influence fruit set, either to increase or decrease it.

Increasing fruit set

*Nutrient sprays* – As mentioned above, the two mineral elements most often associated with fruit set are boron and zinc. A number of growers in the Finger Lakes include boron in their spray tank for one or two applications just before bloom. Some will also occasionally apply it to the soil in their early herbicide spray. Some work by Tim Martinson back in 1998<sup>1</sup> showed that both soil and foliar applications of boron before bloom can improve fruit set on Concord *in a vineyard where boron is deficient*. This is an important point – the vineyard where this work was done consistently had poor set and showed deficient levels of boron (<20 ppm) in petiole tests. While boron is not very expensive, adding some when vines already have an adequate supply can result in toxicity symptoms. Research in California has shown that applying boron to the foliage after harvest is more effective at improving fruit set than applications made at or before bloom<sup>2</sup>. This assumes, of course, that you have leaves that are functional for a few weeks after harvest, which isn't always the case around here.

Because of the soil pH in most of our soils and some of the spray materials that we use, I have very rarely run across a vineyard that shows signs of zinc deficiency, or with low levels in petiole tests. However, if a block consistently shows zinc deficiency and inadequate set, adding a zinc-containing foliar material may help.

*Shoot tipping*

Removing shoot tips in the midst of bloom has been shown to consistently increase fruit set. The basic reason that this works is that removal of the shoot tip alters the competitive balance between the tip and cluster as sinks for nutrients. By removing the strong sink at the end of the shoot, more nutrients and photosynthates can be directed to the flowers. The downsides of this practice include 1) the cost to do it if done by hand (shoots may not be long enough at bloom to be cut by a mechanical hedger), and 2) removing the tip from the main shoot encourages lateral growth, which can cause shading and disease problems if a lot of lateral shoots push.

### *Plant growth regulators and other materials*

Until a couple of years ago, a plant growth regulator called mepiquat chloride (sold as “Ponnax”) was used by some Concord growers in both the Finger Lakes and Lake Erie regions to increase fruit set. It could increase fruit set by 10-20% in some years and under certain conditions, and did this by temporarily slowing the growth of shoots during the bloom period<sup>3</sup>. Unfortunately, Ponnax is no longer available. There are other materials being marketed that tout the ability to improve set when applied to the vines, but most of them have had very little research done on them, so it’s hard to make any recommendation to use them for this purpose.

### Decreasing Fruit Set

*Early leaf pulling* – Removing leaves from around the cluster zone just prior to or at the beginning of bloom can reduce fruit set because it removes the source of photosynthates to the flowers during bloom, resulting in more of the flowers not fertilizing and being able to sustain early development of the seed and berry. This can be an effective solution to reducing compactness in tight-clustered varieties. The practice has been tested in a few different regions on different varieties,



including work by Bryan Hed at Penn State’s Lake Erie research station in Northeast, PA on Vignoles and Chardonnay. Removal of the basal 4-5 leaves (which looks and sounds extreme) no later than trace bloom has shown to be pretty effective at reducing fruit set and making clusters less compact, and thus less vulnerable to bunch rots later in the season. As with many practices, the question comes down to cost. This is not an inexpensive process, obviously. I’ve seen estimates of \$150/acre if it’s done by hand. Can it be done mechanically? Perhaps, especially with some of the newer machines that are better at removing leaves and not damaging clusters.

### *Plant Growth Regulators*

There are plant growth regulators available that are able to decrease fruit set in grapes, and are used extensively in table grape production. Gibberellic acid (GA) is a compound that exists in many fruiting plants, including grapes, and is used to reduce set in seedless table grape varieties. The problem with using GA and other materials like it on seeded wine varieties is that they will often have negative effects on shoot and cluster formation in the following season. At this point, there are no materials that have been shown to have a reliable and predicatble impact on fruit set, while also not impacting the following year’s growth and fruit production.

### Resources:

Skinkis, Patty (Oregon State University) “Causes of Poor Fruit Set in Grapes”  
<http://www.extension.org/pages/33106/causes-of-poor-fruit-set-in-grapes>

Smith, Rhonda (University of California Extension). “2008 Update on effects of CPPU on fruit set in Merlot”. [http://stream.ucanr.org/sonoma\\_grape\\_day/Smith/index.htm](http://stream.ucanr.org/sonoma_grape_day/Smith/index.htm)

Dokoozlian, Nick (University of California – Davis). “Grape Berry Growth and Development” in *Raisin Production Manual* (L. Peter Christensen, ed.), pp. 30-37.

<http://iv.ucdavis.edu/files/24467.pdf>

Hed, Bryan, Henry Ngugi & Naomi Halbrendt (Penn State University). “Management and research of fruit rot diseases in vineyards”.

[http://www.pawinegrape.com/uploads/PDF%20files/Meeting%20Presentations/IPM%202012/HED\\_2012%20Wine%20Grape%20IPM%20workshop%20presentation.pdf](http://www.pawinegrape.com/uploads/PDF%20files/Meeting%20Presentations/IPM%202012/HED_2012%20Wine%20Grape%20IPM%20workshop%20presentation.pdf)

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<sup>1</sup> Martinson, T. 1998 Boron Trial in Concord Grapes. *Finger Lakes Vineyard Notes*, May 3, 1999.

<sup>2</sup> Christensen, L. P., R. Beede and W. Peacock. Fall foliar sprays prevent boron-deficiency symptoms in grapes. In *California Agriculture*, 60(2): 100-103.

<sup>3</sup> Pool, R. The Who, What, Where, When and Why of Ponnax for New York Vineyards. *Finger Lakes Vineyard Notes*, May 3, 2001.