4 Enhancing and synchronizing berry maturity

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• This research team conducted a number of experiments throughout 2006 to 2008 – not all at the same location or testing the same parameters every year – with two goals in mind:
1) to characterize the natural degree of variability that exists in berry maturation, and 2) try to reduce that variability through the use of growth regulators.

• To achieve objective (1), they conducted repeated measurements of berry parameters and calculated the deviations of these measurements from the mean value (called "*coefficient of variation*"). To achieve objective (2), they treated the clusters with various plant hormones and recalculated the coeficcients of variability to see if they had been reduced, that is, if the hormones had been able to *synchronize* berry ripening.

• **How much variability is there during berry ripening?** We present here the general trends:
- Berry diameter variability and berry deformability variability (an indicator of ripening) tended to decrease from veraison to harvest in both Cabernet Franc and Concord. That is, **berries synchronize their size and ripening rate as they approach harvest** despite noticeable earlier differences.
- When three levels of variability were compared (vine-to-vine, cluster-to-cluster, and berry-to-berry), variability was observed to be the greatest between berries within a cluster.

• **Effect of growth regulators on ripening.** Reasearchers screened many types of growth regulators, but later narrowed it down to two treatments (see original report for concentrations and times of application):

*1) Gibberelic acid + cytokinin (**GA+BA**)*
*2) Ttwo types of cytokinins + brassinosteroid (**BA+CPUU+BR**).*

- Both GA+BA and BA+CPUU+BR advanced veraison and ripening, and decreased the variability of berry *diameter*, berry *deformability*, and berry *color*. This effect was greater in Cabernet Franc than Concord.

• **Effect of growth regulators on fruit composition and yield.**
- GA+BA produced the highest increase in fruit soluble solids, anthocyanins, and total phenol.
- In contrast, BA+CPUU+BR produced the highest yield of all the hormones tested.

As the authors noted, gibberelic acid (GA) seemed to increase berry size and weight; adding citokinin (GA+BA) seemed to increase soluble solids; and further adding brassinosteroid (GA+BA+CPUU) had the effect of enhancing ripening, increasing yield, and raising anthocyanin and phenolic levels in the fruit.

• **Influence of berry "position" on fruit parameters.** The authors observed the following interesting effects in Cabernet Franc due to the position of a berry in the cluster or in the vine:
- Clusters on canes more distant from the trunk weighed significantly more than those in the center of the vine, closer to the trunk;
- Berries were smaller at the top and bottom of a cluster, and larger in the middle of the cluster;
- Soluble solids were significantly higher in "bottom" berries compared to "top" or "middle" berries, that is, berries ripened faster in the lower part of the cluster.

Even though the authors detected some inconsistent responses across growing seasons and wishes to continue the trial to confirm the current observations, they were able to draw the following conclusions:

1) Berry variability was higher in 2007 than in 2006, which they attributed to the unfavorable growing season conditions in 2006 affecting inflorescence primordium development;
2) Variation at the berry level was consistently the highest source of variation (that is, higher than cluster-to-cluster variation and than vine-to-vine variation);
3) Variation was greatest around veraison, with berries somehow able to synchronize by harvest;
4) In general, growth regulators in the ***gibberelic family*** **increased fruit size and accelerated ripening** (due to an effect of GA on cell expansion), whereas growth regulators; in the ***cytokinin family*** **had a positive effect on juice composition**;
5) Growth regulator response in 2007 and 2008 was much more subdued than in 2006, which the authors attribute to the *spraying* of growth regulators in 2007/2008 being less effective than the *dipping* of clusters conducted in 2006.

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