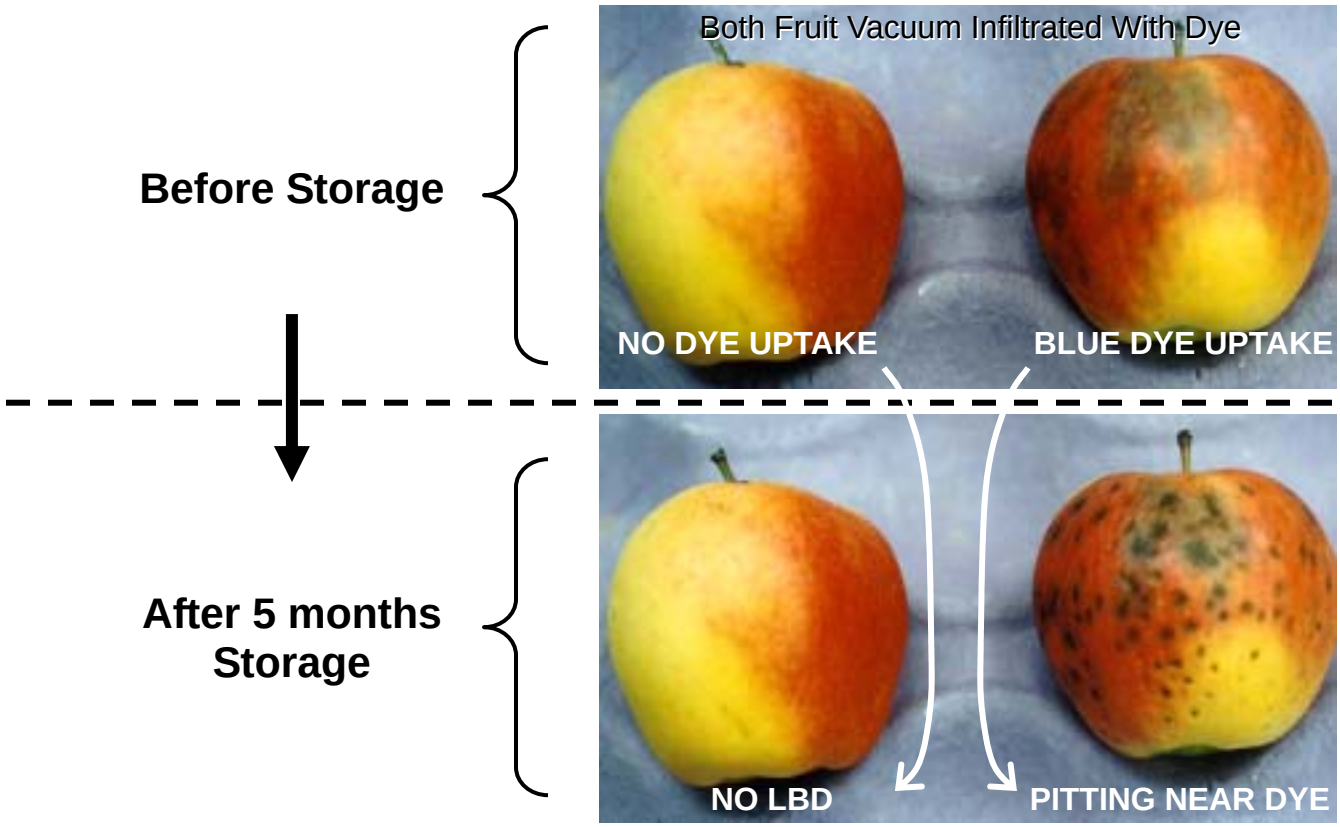
Predicting Susceptibility of 'Gala' Apples To Lenticel Breakdown Disorder:
Guidelines for Using the Dye Uptake Test

Dr. Eric Curry and Dr. Eugene Kupferman

Preliminary research indicates the following test may be a useful aid in assessing potential for 'Gala' apples to develop LBD (Lenticel Breakdown Disorder) after storage.

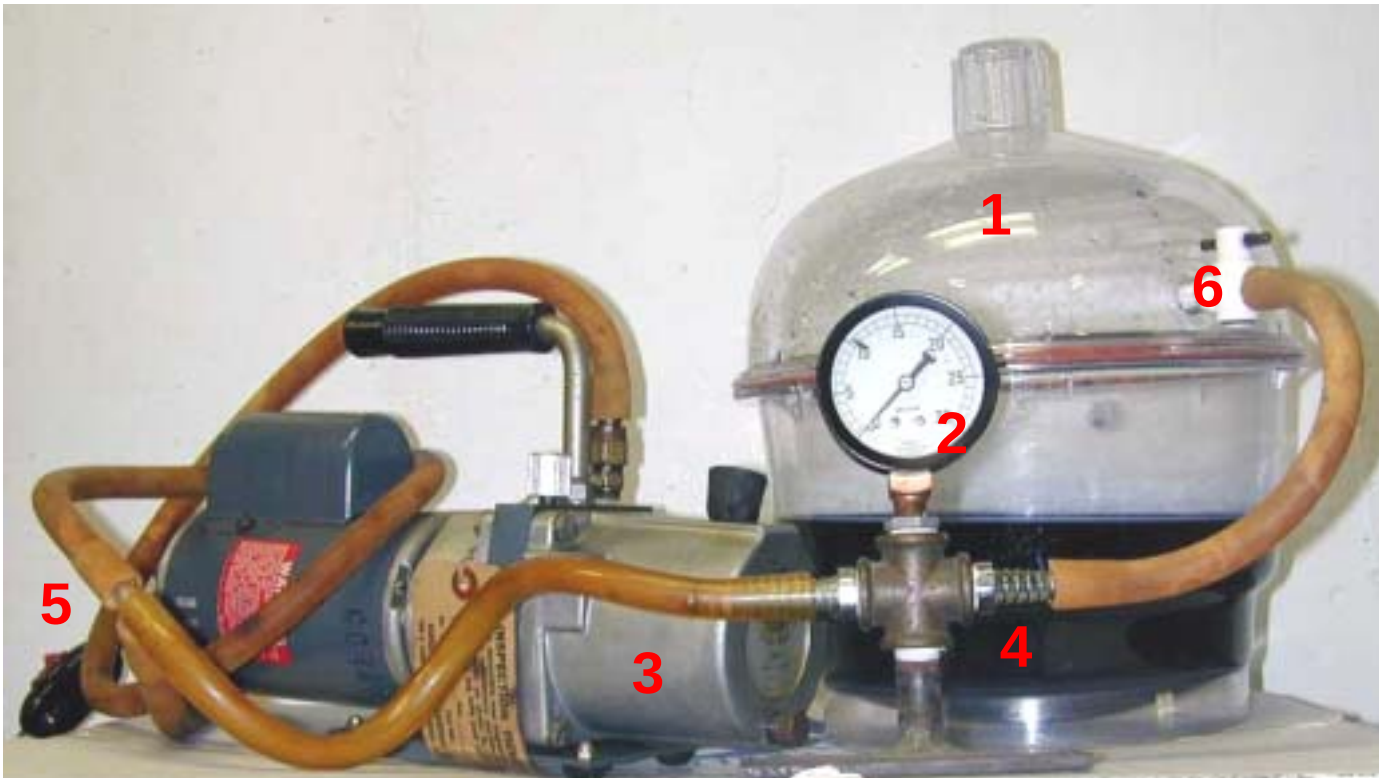


NOTES: LBD susceptibility probably originates in the field (from causes not entirely known). This said, a number of factors will contribute to the validity of this test including: 1) previous history of LBD in each orchard; 2) environmental conditions; 3) orchard management; 4) differences in the way the dye test is conducted; and 5) storage conditions. Rarely are all of these identical. Therefore, the most important factors for reliability of the test are:

Consistency & Cleanliness

TYPICAL MATERIALS NEEDED

1. **Transparent Polycarbonate Desiccator (www.VWR.com, catalog number 24987-048)**
2. **Pressure Gauge**
3. **Dry Vacuum Pump (GE Model 5KCI9SGR124DT)**
4. **Aniline Blue Dye = Methyl Blue (www.VWR.com, catalog number JTB362-3)**
5. **¼ inch vacuum tubing**
6. **Shut-off valves for tubing**
7. **Desiccator plate (not shown), any 230 mm plate from www.VWR.com**



Any similar apparatus should work reasonably well.

!! Method consistency is most important !!

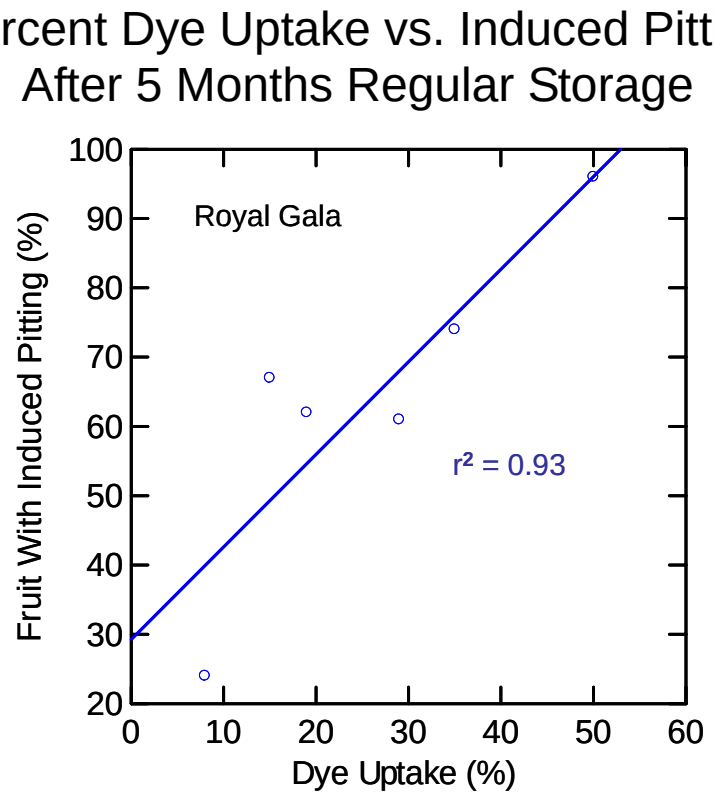
TYPICAL METHOD

1. Make up a dye solution. Example: 2 grams of aniline blue or methyl blue powder in 1 liter of water.
2. Fill desiccator ½ to ¾ full with aniline blue dye solution.
3. Rinse fruit in clean, cool, flowing water for 20 to 60 seconds.
4. Place apples in desiccator with dye solution making sure that all apples are fully immersed. (You may need to place a weight such as a 230 mm desiccator plate on top of the fruit.)
5. Place lid on the desiccator, making sure that the seal is tight.
6. Connect vacuum tube to the desiccator and open all valves.
7. Run pump until the vacuum gauge reads **10 inches** of mercury (may take 1 - 2 minutes).
8. Hold vacuum at **10 inches** of mercury for 30 seconds by closing the valve on the desiccator and turning the pump off.
9. Release Vacuum but keep fruit submerged in dye for another fruit for 1 to 2 minutes before removing.
10. Remove apples from blue dye solution and rinse briefly in cool, flowing water.
11. Dry fruit on trays for 30 minutes. Transfer to fresh trays for storage; or assess immediately.

TYPICAL RESULTS

Some fruit subjected to this test will take up much dye whereas others very will take up little.

Data in the graph to the right are from 6 orchards with histories of LBD. The line through the points indicates a reasonably good linear relationship between the amount of dye taken up by the fruit and the degree of pitting after 5 months regular storage of untreated fruit from the same location within the orchard on the same harvest date.



WHAT'S BEHIND THE DYE TEST

The premise of this test is that as the fruit enlarges, the cuticle too is in a constant state of expansion. If conditions are not ideal the skin may expand too quickly for the capacity of the tissue to keep up the supply of wax needed for 'healing' these microcracks. As a result the microcracks, especially around the lenticels, crack deeply enough to reach the sensitive unprotected cells beneath the cuticle in the hypodermis. These exposed cells begin to desiccate, or become contaminated with salts, surfactants, etc., which begin dissolving sub-lenticular cells creating a cavity which, when the flesh softens later in storage, manifests as a sunken pit centered on the lenticel—especially when the fruit are run through the packing process. Since cracked lenticels are the potential precursors of LBD, exposing the fruit to dye through this simple test provides an indication of the number of lenticels that are cracked and which have not yet healed over.

FINAL COMMENTS

1. The test works best with fruit harvested as close to storage as possible. That is to say, reliability of the test improves the closer to actual harvest you evaluate the fruit. Too much can happen the longer you wait between using the dye test and actual harvest. The best case is to evaluate fruit as it is brought in from harvest.

2. LBD may be associated with desiccation of the fruit. If the distance from the orchard to the warehouse is great, consider using a tarp to cover the bins when in transit.

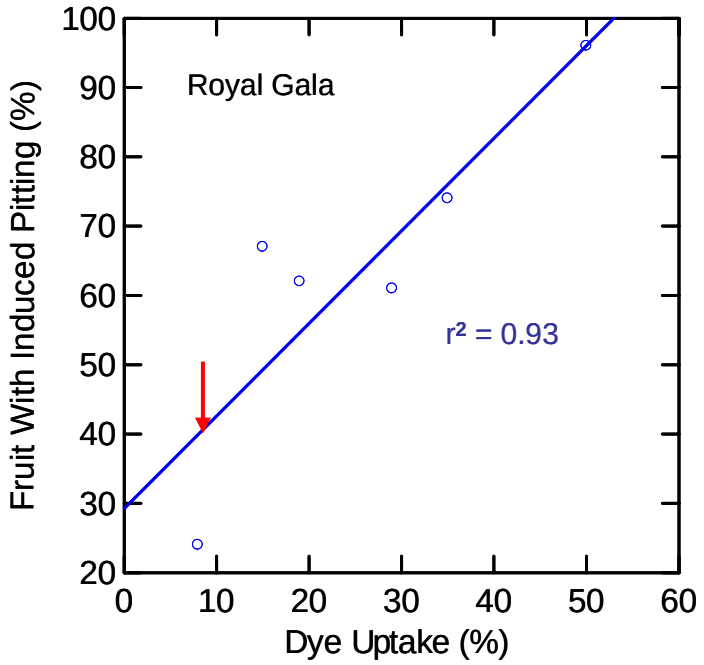
3. LBD progresses with flesh softening. Even though fruit may take up a lot of dye, therefore indicating a high potential for LBD

after 5-6 months regular storage, by maintaining firmness of the fruit, or selling the fruit before actual softening begins, much of the potential pitting can be avoided.

This dye test is best used with other information relative to the individual orchard or site in determining LBD potential and/or storability of the fruit. Because not all areas that take up dye develop into actual pits, the test represents a worst case of potential LBD.

Looking again at the following graph, one can see quite a jump in pitting after about 10% dye uptake.

Data in the graph to the right are from 6 orchards with histories of LBD. The line through the points indicates a reasonably good linear relationship between the amount of dye taken up by the fruit and the degree of pitting after 5 months regular storage of untreated fruit from the same location within the orchard on the same harvest date.



It might be simplest to group fruit into 4 categories of dye uptake: **0 = no dye uptake**, **1= less than 10% lenticels affected**, **2 = 10 – 40% dye uptake**, and **3 = greater that 40% lenticels taking up dye.**

If you still have questions concerning the test, the protocol, or interpretation of results, you can contact either:

Dr. Eric Curry
Plant Physiologist
USDA, Tree Fruit Research Laboratory
Wenatchee. WA 98801
Ph: 509 664 2280 XT 209
email: CURRY@tfrl.ars.usda.gov

Or

Dr. Eugene Kupferman
Postharvest Extension Specialist
WSU Tree Fruit Research and Extension Center
Wenatchee, WA 98801
Ph: 509 663 8181 XT 239
email: Kupfer@wsu.edu