FACTORS CONTRIBUTING TO LENTICEL BREAKDOWN

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INTRODUCTION

In the last year, a number of our research studies have shown certain factors are associated with increased lenticel breakdown in Gala and Fuji apples; other experiments are in progress. The purpose of this presentation was to present preliminary findings related to the occurrence of lenticel breakdown disorder in order to formulate and test hypotheses as to why some orchard sites are more susceptible than others. This report is a brief summary of the presentation.

THE PROBLEM

Lenticel breakdown (Figure 1) has increased in the past five years. Generally, the disorder is unapparent in the bin before packing. Studies in 2001 were mainly targeted to determine what factors in the packing process worsened the symptoms, and what cultural or environmental factors contributed to this problem.

Figure 1. Lenticel breakdown on packed Gala.

PACKAGING FACTORS

Fruit from six Gala and six Fuji orchards were taken from bins of commercially harvested orchards and taken to the lab for further evaluation. We conducted tests to evaluate the influence of components in the packing line on lenticel breakdown including: dump tank temperature, soap concentration, brushes, and waxing. The protocol for the different components in the experiments was as follows:

1. Fruit submerged in deionized water for 10 minutes
2. Fruit brushed (actual commercial brushes) with a 1X soap solution for 2 minutes or submerged in 1X soap solution (or Tween 20 surfactant) for 2 minutes (no brushes)
3. Brushes only for 2 minutes
4. Hand waxed with commercial wax using cheesecloth

All fruit remained at room temperature for 48 hours at which time the number of damaged (brown) lenticels were counted on the entire fruit. With minor exceptions data for Fuji apples was similar to that for Gala and will not be shown in this summary.

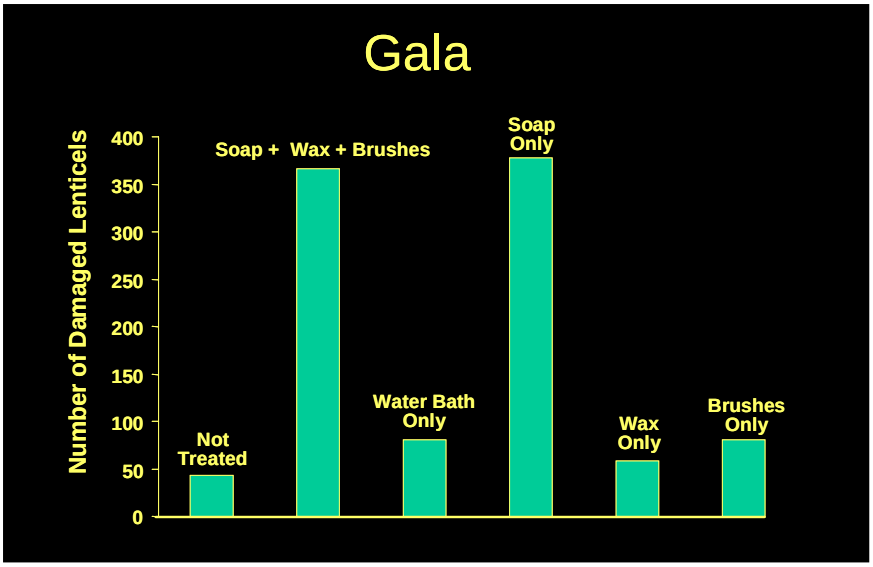

Figure 2a. Influence of packing line processes on lenticel breakdown of Gala prone to the disorder.

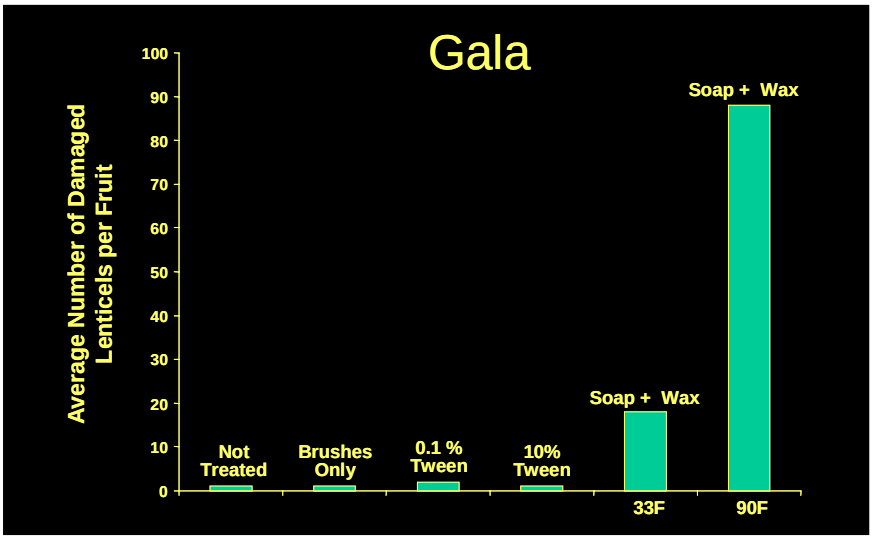

Figure 2b. Influence of packing line processes on lenticel breakdown of Gala prone to the disorder.

Figures 2a and 2b indicate that the combination of high dump tank temperature, soap, and wax, are most influential in increasing the number of damaged lenticels. My theory as to the

mechanism of this injury is as follows. Cold fruit from storage are placed in warm dump-tank water (often around 90 ºF). The combination of heat and water causes two things to occur: first, the fruit expands, which may cause cracking around the lenticels where cuticle is thin; and second, air from inside the fruit bubbles slowly out of the fruit because dissolved oxygen and carbon dioxide are more soluble in cold water than warm water. When the fruit are treated with soap, it enters these micro-cracks and destroys the delicate cell membrane of cells beneath the lenticel. This process further enlarges the sub-lenticular cavity, which susceptible fruit already have developed in the field. When wax is applied, it "seals" the fruit surface, and as fruit return to room temperature (or cold-room temperature) the shrinking air in the cavity exerts negative pressure on the cuticle and sucks it down creating a sunken area on the surface.

Other experiments using vacuum infiltration of dye into the fruit at harvest indicate that fruit that have "open" lenticels at harvest are most prone to develop the disorder after storage. Figure 3 shows two fruit from different orchards, which were both, vacuum-infiltrated with dye at harvest (top picture).

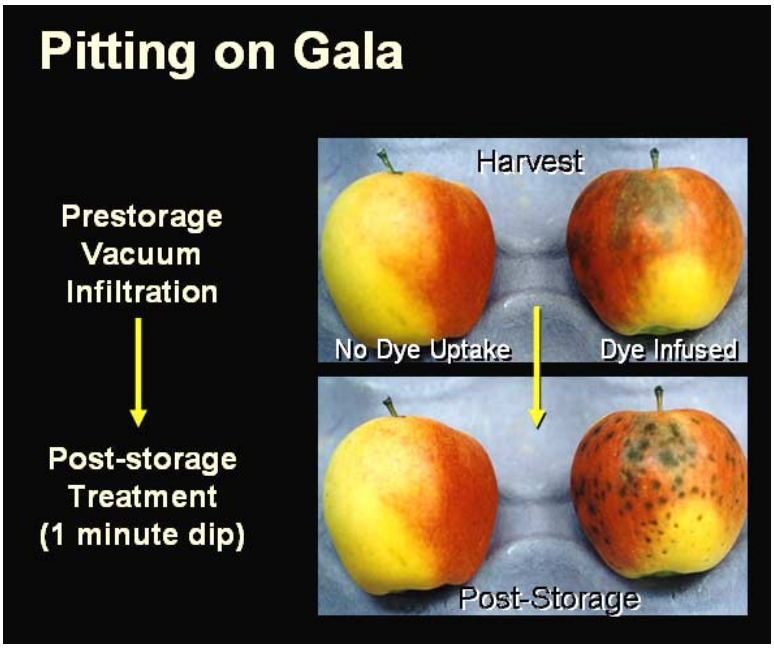

Figure 3. Gala vacuum-infiltrated with dye at harvest (top) and treated with soap and wax after 6 months cold storage (bottom).

After six months, the same fruit was subjected to the experimental protocol described above (warm water bath, soap and wax) and clearly, fruit showing uptake of dye at harvest (open lenticels) developed post-storage pitting.

What factors and conditions during fruit growth are responsible for the "open" lenticels?
Experiments are underway to answer this question.

ACKNOWLEDGEMENTS

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