Session 8: Economics, Fruit Quality and Crop Loss
8.1 An Update on the Effect of HLB on Orange Juice Flavor – 1) Chemical Components

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It is reported that fruit from Huanglongbing (HLB) diseased trees do not color properly (hence the name greening disease) and have a bitter taste (1), which are two quality factors that can affect fresh fruit and processed juice. Although the rind color of symptomatic fruit is not normal, not much is known about whether the color of the juice is affected by the disease. Bitter taste and other potential off-flavors are reported but not well documented or identified, and could potentially affect the flavor of processed juice and fresh fruit. The objective of this work was to begin the process to determine the potential effects of HLB disease on orange fruit and juice quality.

Results from early infected Valencia trees in 2006 (juice from non-symptomatic fruit from HLB-symptomatic trees, verified by PCR, versus healthy trees) showed that differences between hand-squeezed lightly pasteurized juice from HLB-trees were mostly due to lower acid content and higher solids-to-acid ratio, resulting in sweeter juice (2). The difference between juice with and without pulp was also evaluated. There were no differences for α- or β-carotenoids or lycopene, although a* values and hue angle was slightly lower for healthy juice (more red-orange color), and total ascorbic acid tended to be lower. Among volatiles, α-pinene, acetaldehyde and methanol were higher in juice from diseased fruit. Removing the pulp reduced the volatile content in juice from both HLB and healthy trees.

More trees were sampled in 2007 from three cultivars from several harvests (one harvest each of Hamlin and Midsweet and 4 Valencia harvests), hand juiced and lightly pasteurized. There were no significant differences for citric or total ascorbic acids for Hamlin, Midsweet or Valencia juices in 2007. There was a significant difference in malic acid for Hamlin juice with HLB juice being lower in this acid than healthy juice. There were rind color differences (Minolta chromameter a*/b* ratios) for the fresh fruit of 3 of the 4 Valencia harvests. Hand squeezed fresh juice color values for Midsweet and one Valencia harvest were significantly lower for HLB samples, but still commercially acceptable. Brix was significantly lower for HLB samples for 2 of the 4 Valencia harvests, but there was no difference in titratable acidity (TA). Headspace volatiles for the 2007 fruit showed little difference for Hamlin, but some for Midsweet, with generally higher values for healthy compared to HLB juice. For Valencia there were differences in volatile levels, but no obvious pattern due to disease.

Samples from the 2008 season included both non-symptomatic and symptomatic fruit for 2 Hamlin and 2 Valencia harvests. There were significant differences in the size of Hamlin fruit in that symptomatic fruit were smaller, which is consistent with characteristics of the disease. Differences in hand squeezed, fresh juice color showed that juice from symptomatic fruit was lower in color than juice from non-symptomatic or healthy fruit. Brix and the Brix/acid ratio were lower in juice from non-symptomatic and symptomatic fruit compared to healthy for 1 of the 2 Hamlin harvests. Juice from symptomatic fruit was lower in TA compared to healthy and non-symptomatic HLB Hamlin samples. Chemical analyses of the commercially extracted (FMC) and pasteurized juice, however, showed no differences in Brix, TA, ratio, oil content, pulp, color, citric, malic or ascorbic acids for either of the Hamlin or Valencia harvests. The compounds

limonin and nomilin were higher in HLB Hamlin juice for both harvests compared to healthy, and slightly higher in one Valencia harvest. Headspace aroma volatiles for these fruit showed much more variation by harvest date and variety than by whether the juice came from healthy or diseased trees. In cases where the aroma volatiles did show significant differences due to HLB, it was mostly for Hamlin juice, and with the exception of ethanol and ethyl hexanoate, the volatiles were higher in healthy fruit.

In conclusion, there seems to be much variation in the results due to year to year seasonal, harvest date and tree differences, which makes interpretation difficult at this time and inconclusive. When differences between the levels of chemical flavor compounds for HLB versus healthy juice are found, they seem to be more prevalent in Hamlin, more detectable in fresh hand-squeezed juice vs. pasteurized juice, and very inconsistent. The next step in this research project will be to blend juice from fruit harvested from HLB versus healthy trees to simulate commercial product and determine if there are chemical differences that can be detected. More research data is needed to determine if differences exist in the levels of flavor components between HLB and healthy fruit juice, and for identification of what chemical(s) might be responsible for any possible off-flavors.

References: