Title Parameters Affecting Impact Testing of Fruit

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Abstract

Low-mass impact testing is becoming an acceptable method for inline firmness assessment of many fruits. The dynamic test is aimed o replace the traditional quasi-static compression test, which evaluates the force-deformation fruit property, and the penetration test, that measures the yield strength of the fruit. However, many researchers reported various problems associated with the impact testing. Several impact characteristics may affect the impact test results, especially in inline operation conditions. These are: (a) fruit characteristics (shape, variations of flesh properties around the fruit); (b) the impact device characteristics (mass, shape, sensor type and signal amplification); (c) test conditions (impact velocity, impact angle, fruit location and orientation); and (d) the analysis method (time or frequency domain, and the selected impact parameters). The purpose of the paper is to analyze these characteristics and to evaluate its effects on the performances of the test method. Parameters affecting low-mass impact testing of fruit for firmness evaluation have been investigated. Impact tests of calibration rubber balls and several fruit varieties were performed by using bench-top firmness tester. Variable inline test conditions were simulated by measured changes in sensor height and operating pressure (variation in impact velocity), and fruit location (variation in impact angle). Traditional and new impact parameters were considered as firmness indicators and compared with the quasi-static destructive tests. The sensitivity of the impact parameters to variations in fruit and impact device characteristics, and test conditions, were examined and analyzed both theoretically and experimentally. Limitations of the various test methods, including the impact firmness algorithms and he destructive tests, were discussed. An improved impact test method and firmness algorithm for variable test conditions is presented.