

Title Determination of bruise susceptibility of tomato fruit by means of an instrumented pendulum
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Abstract

Tomato fruit quality is substantially reduced by bruise damage. The occurrence of bruising depends on the direct mechanical damaging of the tomato and the subsequent action of cell wall-related proteins. Although much research has been directed towards possible causes of mechanical injury during tomato harvest and grading, there is a clear knowledge gap concerning the internal fruit characteristics that contribute to bruise development. A simple method to determine the bruise susceptibility of tomatoes is a first requirement to close that gap.

An instrumented pendulum is presented as an appropriate instrument to conduct controlled impact experiments on tomato fruit. An evaluation method of the subsequent damage is proposed. Logistic regression models are discussed as the best statistical tools for bruise development evaluation. An experiment to determine the bruise susceptibility of three different tomato cultivars illustrates the proposed method.

For that experiment, red ripe tomatoes were subjected to dynamic loading by means of a pendulum at different levels of impact energy: low (0.024 J), medium (0.073 J) and high energy (0.171 J). Impacts were applied to tomatoes of the red ripe stage. All fruit were at room temperature (20 °C). Each tomato was impacted at two locations, being at the locular tissue and at the cross-wall tissue. Different logistic regression models were proposed and evaluated to best describe the bruise susceptibility of the cultivars. The tomatoes' susceptibility to bruise damage appeared to be dependent on the location of impact and cultivar, and was most simply expressed as a function of the applied impact energy. A logistic regression function based on accurate impact data, fruit parameters, and a sensory-based score for the resulting bruise damage, proved to be appropriate to describe the tomato bruise susceptibility.

Abbreviations: Adm, tomato cultivar 'Admiro'; cv., cultivar; CI, confidence interval; CW, cross-wall tissue or radial wall tissue; elast, elasticity; E_a , absorbed energy; E_i , impact energy; E_r , rebound energy; f , first resonant frequency; F_{max} , maximum force at contact; L, locular tissue; m , mass; place, location of impact; rc, restitution coefficient; S , stiffness; SG, tomato cultivar 'S&G 41-030'; time, contact duration of the impact; Trad, tomato cultivar 'Tradiro'