

Thesis Title	Study of Impact Bruising of Guava Using Fractal Image Analysis
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ABSTRACT

Guava fruits were examined under different impact test conditions such as drop height and either number of drops or storage temperature. In the first trial, the completely randomized design (CRD) was assigned two drop heights (0.3 and 0.6 m) for once and five times compared with control as no drop for impact testing of ‘Gim Ju’ guava. The peeled color of bruising guava and fractal dimension (FD) value using image analysis was analyzed at the bruise region. Results show five drops from a height of 0.3 and 0.6 m gave greater bruise area (BA), bruise volume (BV), bruise susceptibility (BS), bruise score and a^* value, with lower L^* , b^* , C and FD values than those of the other three treatments, as indicated by browning level. The FD value gradually declined with increasing of storage time and bruise severity. The correlation coefficient (r) values of FD between BA and BV were more significant than those L^* and a^* values. It was the first report to exhibit FD potential for assessment of bruise impact damage in guava and other fruits.

In the second trial, the experimental design was response surface methodology (RSM) using central composite design (CCF) with three independent variables. The aim of this trial was to investigate factor analysis of impact testing in ‘Glom Sali’ guava. The drop heights (0.2, 0.4 and 0.6 m), number of drops (1, 3 and 5) and storage temperature (10, 20 and 30 °C) were employed for impact testing of ‘Glom Sali’ guava.

Twenty simulated impact treatments were conducted for 48 h to assess and analyze bruise area (BA), bruise volume (BV), browning index (BI), the total color difference (ΔE), bruise area by image analysis (BAI) and fractal dimension (FD) for impact bruise damage on guava. The correlation coefficient ($r = -0.6055$) between ΔE and FD value was higher than that of ΔE and either BA ($r = 0.3132$) or BV ($r = 0.2095$). The FD variable exhibited the highest R^2_{adj} value (81.69%) among the other five variables which represented the highest precision model with a high determination coefficient value (R^2_{adj}) (>0.8) for impact bruising prediction. A lower FD value performed a higher impact bruising severity level of guava and supported conventional bruise determination. The optimization of impact testing to minimize its bruising was drop height of 0.53 m for five drops with a storage at 30 °C under simulated impact test. Overall conclusion in this thesis research, it was the first study to apply RSM design in impact bruising of guava and other fruits. RSM was performed in drop heights, the number of drops and storage temperature factor that had an individual effect on impact bruising of guava. A lower FD value exhibited a higher impact bruising severity level of guava and supported conventional bruise determination. The fractal dimension of peeled guava assessed by image analysis was achieved a highly capable measurement to determine impact bruising susceptibility in guava fruit.

Keywords: Bruise Susceptibility, Fractal Dimension, Impact Bruise, Mechanical Injury