

Title Finite element analysis of mechanical damage in watermelon
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Abstract

Measuring internal stresses that cause bruise inside of fruit is extremely difficult. An alternative approach is to estimate the stresses using finite element analysis (FEA). In this research, two finite element models of watermelon were developed to investigate mechanical pressure. The pressure was simulated at two orientations of the fruit: longitudinal and transversal; for thickness of the rind from 0.6 mm to 1.8 mm. The validations of the FEA models were made based on a comparison of theoretical calculations and experimental data. FEA results indicated that the internal fleshes of watermelons were the main structural sites prone to fail mechanically after pressure. The simulated patterns of failure closely agree with those observed after subjecting fruits to compressive loading. Based on FEA, it is necessary that the magnitude of load on watermelon was maintained below 10 per cent of force that caused its rind cracking.