

Changes in Physical and Mechanical Properties of Tomato during Growth and Development

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Tomato is one of the most popular fruit vegetable grown in Sri Lanka. However, sometimes many producers are struggling with excessive production. This excessive production can be processed mechanically to produce value added products of increased economic value. The objective of this study was to investigate the changes in selected physical and mechanical properties during growth and development of tomato. Homogeneous 30 plants were randomly selected and their date of flowering (5 flowers per plant) was recorded. Then, destructive random sampling of fruits was done starting from 10 days after flowering up to 40 days for quantitative measurement of selected physical and mechanical properties such as length, width, thickness, geometric mean diameter (GMD), weight, volume, coefficient of friction, aspect ratio, sphericity, true density, bulk density, Total Soluble Solids (TSS), firmness, thickness of pericarp and moisture content of deep flush and pericarp using standard methods. Physical properties such as GMD, true density and thickness of pericarp are important parameters in processing of tomato. Results showed that, GMD of tomato after 10, 20, 30 and 40 days of flowering were 17.32, 37.55, 42.37 and 47.53 mm, respectively. The true density of tomato 10, 20, 30 and 40 days after flowering were 0.85, 0.93, 0.94, 0.97 g/mL, respectively. Thickness of pericarp of tomato after 10, 20, 30 and 40 days of flowering were 1.09, 3.23, 3.87 and 4.84 mm, respectively. Results of this experiment revealed that physical properties such as weight, length, width, thickness, GMD, volume, true density, and thickness of pericarp in 10 days interval increased significantly ($p < 0.05$) with time, whereas, sphericity, aspect ratio and bulk density did not differ significantly ($p > 0.05$) with time. However, mechanical properties such as coefficient of friction of tomato fruit did not differ significantly ($p > 0.05$) with time, whereas, firmness significantly ($p < 0.05$) decreased with maturity stages. Further TSS increased significantly ($p < 0.05$) with time, whereas, moisture of pericarp and deep flush did not significantly ($p > 0.05$) change with time. The drastic changes in physical and mechanical properties observed between 10 days and 20 days of flowering. Furthermore, positive linear relationship was obtained for the properties such as moisture of pericarp and deep flush, thickness of pericarp and moisture of pericarp and TSS of fruit and volume of fruit with R^2 values 0.94, 0.83, and 0.92, respectively. Hence, it is important to maintain tomato plant without any stress between 10 and 20 days of flowering to produce fruit with good physical and mechanical properties at the time of harvesting. The results of this study could be useful to facilitate mechanical design of processing plants.

Keywords: Growth, mechanical properties, physical properties, tomato