Title Tomato quality evaluation by peak force and NMR spin–spin relaxation time

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Abstract

Throughout the fruit and vegetable processing industries, improving processing efficiency requires the development of in-line sensor technologies. The goal of this study was to determine if there is a basis to develop nuclear magnetic resonance (NMR) sensor technology based on spin–spin relaxation times to assist in quality sorting of processing tomatoes. The specific objectives were: to determine if firmness is an adequate indicator of maturity, to assess the effect of common defects on fruit firmness and NMR spin–spin relaxation time (T_2) and to correlate firmness values and T_2 values. The study spanned three processing seasons and evaluated a number of standard processing varieties. To evaluate firmness, whole fruit compression tests were performed; NMR spin–spin relaxation times (T_2) were determined using a CPMG pulse sequence and mono-exponential fitting. During the first season, a reasonable correlation was found between T_2 and peak force ($R^2 \geq 0.75$) using sound red fruit. Therefore, the study was expanded in 2005 and 2006 to include more processing varieties, maturity levels and common defects. Analysis of variance was performed on the responses, T_2 and peak force. In general, there were statistically significant differences in the mean values of the spin–spin relaxation times at the $P = 0.05$ level, yet these differences were small in magnitude. In addition correlation between NMR spin–spin relaxation time and fruit firmness in both 2005 and 2006 was poor. Neither of these experimental results supports continued development of an NMR sensor based on spin–spin relaxation time differences for in-line sorting of processing tomatoes.