Abstract

To determine the feasibility of using x-ray technology for internal defect removal, a discrete-event simulation model was developed with the capability to vary inspection machine configuration and placement and associated economic impact. To evaluate the profitability of X-ray inspection, the results of the simulation model were also used to estimate the unit cost (UC) and selling price per box of the inspected onions. A fundamental assumption of this work is that the increase in quality resulting from the X-ray inspection would command a higher market value as reflected by sales price. An Arena simulation model was developed based on data from two packinghouse time studies, from 2005 to 2006 onion X-ray inspection and sample measurements (4 cultivars each year) and from published cost estimates of sweet onion production and packing. The model results indicated the feasibility of incorporating three and four X-ray inspection units at 0.25 m s^{-1} belt speed under the simulated conditions to obtain realistic throughput rates. Estimated costs per 18.14 kg box of X-ray inspected onions ranged from US \$9.00 to US \$15.00 while the estimated selling price ranged from US \$11.35 to US \$25.34, depending on farm yield, the quality of incoming crop and the gross profit margin goals. The methods could be readily extended to other commodities destined for the fresh market; however, the results would be commodity and site specific.