

Title Effects of X-ray irradiation and sodium carbonate treatments on postharvest *Penicillium* decay and quality attributes of clementine mandarins

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Abstract

The integration of sodium carbonate (SC; dips at 20 °C for 150 s in aqueous 3% SC solutions) treatments and X-ray irradiation (at doses of 510 and 875 Gy) was evaluated on artificially inoculated 'Clemenules' clementine mandarins for the control of postharvest green and blue molds, caused by *Penicillium digitatum* and *Penicillium italicum*, respectively. Although significant, the reduction of both disease incidence (number of infected fruit) and severity (lesion diameter) on fruit either incubated at 20 °C for 7 days or cold-stored at 5 °C for 21 days was not sufficient for satisfactory disease control under hypothetical commercial conditions. Therefore, the combined treatments could not be a substitute for conventional chemical fungicides. However, pathogen sporulation was greatly inhibited on infected clementines, thus X-irradiation could be of value for management of *Penicillium* resistant strains and to reduce inoculum levels in citrus packinghouses. X-ray irradiation at 195, 395, 510, and 875 Gy did not influence either decay incidence or the area under the disease progress curve (AUDPC) of lesions of green and blue molds on mandarins inoculated with the pathogens 2, 3, or 6 days after irradiation and incubated for 7 days at 20 °C. Therefore, X-ray treatment did not induce disease resistance in the rind of irradiated fruit. Although X-irradiation at doses up to 875 Gy followed by either 14 days at 20 °C or 60 days at 5 °C caused very slight rind pitting, minor decreases in fruit firmness, and modest increases in juice acetaldehyde and ethanol contents, these changes had no practical impact on fruit quality. Rind color, titratable acidity, soluble solids concentration, maturity index and juice yield were not influenced by irradiation. 'Clemenules' can be considered as a clementine cultivar highly tolerant to X-irradiation.