

10:00–12:00 noon CC 319

Oral 12: Fruits/Nuts: Postharvest

Presiding: Bhimanagouda S. Patil, Texas A&M Univ., Welasco

10:00 a.m.

Delaying Papaya Fruit Ripening by 1-Methylcyclopropene

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Papaya fruit have a limited shelf life due to rapid fruit softening. Preclimacteric (PC) and ripe (R) 'Sunrise Solo' papaya fruit were treated with 1 to 10 ppm 1-methylcyclopropene (1-MCP), an ethylene action inhibitor, at 20 °C for 12 to 18 h, and the fruit were stored at 20 °C. Firmness, skin color, respiration and ethylene rate, brix, and electrolyte leakage were monitored during storage for 12 days at 20 °C. Both PC and R fruit fumigated with 1-MCP retained firmness longer than control fruit although the response to 1-MCP was greater in PC fruit. After 12 days, PC fruit treated with 1-MCP had significantly higher mesocarp firmness (14 N) than control fruit (6.1 N) ($P = 0.005$). R fruit treated with 1-MCP also had higher mesocarp firmness (4.7 N) than controls (3.9 N) ($P \leq 0.05$). Ethylene production was significantly lower in PC fruit treated with 1-MCP than fruit without 1-MCP ($P \leq 0.001$). Ethylene production by PC control fruit reached a maximum of 1.81 $\mu\text{L}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ on day 5, at which time ethylene production in MCP-treated fruit was 0.38 $\mu\text{L}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$. Maximum ethylene production in MCP-treated fruit (1.38 $\mu\text{L}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$) was observed after 10 days of storage. 1-MCP treated PC fruit had lower electrolyte leakage than non-treated ones ($P \leq 0.005$). The total electrolyte leakage of 1-MCP treated and non-treated PC fruit was 18.9% and 20.7%, respectively, on the last day of the treatment. PC fruit treated with 1-MCP maintained green skin color 2 more days. On the basis of firmness, skin color, and overall appearance, 1-MCP extended the shelf life of papaya fruit 2–3 d at 20 °C. Current experiments are addressing the effect of MCP on the performance of fresh-cut papaya fruit.

10:15 a.m.

Patterns in the Volatile Profile for 'Redchief Delicious' Apple Fruit during Ripening and Senescence

Alejandra Ferenczi* and Randolph Beaudry; *Michigan State Univ., Horticulture Dept., East Lansing, MI 48824-1325*

The volatile profile of apple fruit was tracked from 3 weeks prior to 8 weeks after the onset of the ethylene climacteric. The peak in ester production roughly coincided with the maxima for respiration and ethylene production. The hexanoates were evaluated as an ester class. As ripening progressed, the chain length of the alcohol-derived portion of the predominant ester declined. Prior to the onset of the ethylene climacteric, hexyl hexanoate predominated. Throughout the early portion of the climacteric, butyl hexanoate predominated. Propyl hexanoate was the predominant hexanoate ester during the late climacteric and early senescence phase. In late senescence, ethyl hexanoate was the predominant hexanoate ester. Free hexanoic acid was detected only after the respiratory and ethylene climacteric peaks, coinciding with the decline in total hexanoate synthesis. The data suggest that the ester precursor production is developmentally regulated throughout ripening and senescence. The free hexanoic acid may indicate that fatty acid precursors are in excess during the latter stages of ripening and throughout senescence.

10:30 a.m.

Effective Use of 1-MCP to Store 'Redchief Delicious' Apples

Sastry S. Jayanty*, Nazir Mir, Erin Curell, Najma Khan, Melissa Butkiewicz, and Randolph Beaudry; *Dept. of Horticulture, Michigan State Univ., East Lansing MI-48824*

1-Methylcyclopropene (1-MCP), a specific inhibitor of the ethylene binding, adheres to the ethylene receptors, regulating the fruit ripening process and delaying senescence. We earlier showed that the repeated exposure of 1-MCP gas is more effective than single application in retarding fruit softening in apples only at temperatures greater

than 0 °C. To further investigate the interaction of fruit sensitivity and temperature, we conducted experiments by treating 'Redchief Delicious' apples of single harvest with 1-MCP gas at different concentrations (10 ppm to 0.02 ppm) at different temperatures (0, 5, 10, 15, and 20 °C). Samples were collected at regular intervals and analyzed for firmness and chlorophyll fluorescence. The concentration of 1-MCP needed to saturate its response did not appear to change with temperature during the first 80 days of the study, suggesting that the relative decline in effectiveness of repeated applications is not likely due to a change the dose response to the gas per se. Chlorophyll fluorescence data indicate that a loss of chloroplast function was not protected by 1-MCP treatment. To reduce the decay encountered at higher temperatures, a commercial fungicide treatment was applied to small lots of fruit. There was no measurable benefit to fungicide treatment under the conditions of the experiment.

10:45 a.m.

Ionizing Radiation on Grapefruit Functional Components during Prolonged Storage

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Grapefruits (*Citrus paradisi* Macf.) shipped to certain U.S. states and some export markets such as Japan and South Korea, must be certified free of quarantine pests. Irradiation has been studied as a quarantine treatment for over 40 years and recently several scientists suggested low dose irradiation treatment as a non-chemical alternative quarantine treatment for grapefruit. Grapefruit functional compounds such as flavanones [naringin, narirutinosides (NR)], limonin 17-beta-D glucopyranoside (LG), and vitamin C have been shown to have potential human health benefits including cancer and cardiovascular disease prevention. This study was undertaken to test the feasibility of irradiation as a treatment for increasing the functional components during postharvest storage. 'Rio Red' grapefruit were treated with 0, 70, 200, 400, 700 Gy radiation and stored up to 4 weeks at 10 °C followed by 1 week at 24 °C and relative humidity during both temperature was maintained at 90% to 95%. The effect of irradiation on functional components was measured immediately after treatment, and again after five weeks. Naringin, NR and total flavonones concentrations were significantly increased ($P < 0.05$) in fruits treated with 70 Gy irradiation at the end of storage period and concentrations of LG and ascorbic acid were slightly increased but not significantly affected. In contrast, no significant differences were observed in fruits treated with 0, and at or above 200 Gy irradiation although some deviations from this trend were noticeable in case of NR.

11:00 a.m.

Mitigation of Impact Injury by Common Packing Materials

Kathryn Taylor* and Karol Kelly; *Horticulture Dept., Univ. of Georgia, 21 Dunbar Rd., Byron, GA 31008*

Packing line facilities in Georgia were assessed for impact force and those forces were then simulated in the laboratory. Along packing lines in which steps have been taken to mitigate damage the most injurious steps were dry dumps (few houses still have these) and the dropping of fruit into the box. Impact injury under simulated conditions varied by variety and was only somewhat correlated with fruit firmness at the time of impact. Fruit architecture and flesh type appear to have the greatest effect on degree of injury. Packing line velocities can be slowed to reduce this injury with the most susceptible varieties. Extended study addressed practical inexpensive methods for mitigation of impact injury. Several industry recommended padding materials were compared against bubble wraps and common packing peanuts. For drops into the box, the best material appeared to be common packing peanuts. At the dry dump, forklift operators can be trained to alter the velocity of dumping to reduce impact force and therefore injury.