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jury, as measured by percent of slices showing some water-soaked areas and associated fungal growth in fresh-cut tomato slices (*Lycopersicon esculentum* Mill.; cvs. Mountain Pride and Sunbeam). Ethylene concentration in containers without a perforation (perforations were made by piercing the lid of the container forming a 0.7-mm hole) significantly increased during storage at 5 °C, while little or no accumulation of ethylene occurred in containers with from one to six perforations. Chilling injury was greatest in slices in containers with six perforations, compared to slices in containers with one perforation an,d was over 12-fold greater than that of slices in control containers with no perforations. The percent ofage visible fungal growth of slices was roughly correlated with the degree of chilling injury. An experiment was also performed to investigate the effectiveness of including an ethylene absorbent pad in containers on subsequent ethylene accumulation and chilling injury. While ethylene in the no-pad control increased continually during storage at 5 °C under modified-atmosphere conditions, no increase in accumulation of ethylene was observed in containers containing ethylene absorbent pads throughout storage with 'Sunbeam' and 'Mountain Pride' tomatoes. The ethylene absorbent pad treatment resulted in a significantly higher percent of chilling injury and visible fungal growth compared with the no-pad control. In studies aimed at inhibiting ethylene production using 1-aminoethoxyvinylglycine (AVG) during storage of slices, the concentration of ethylene in control containers (no AVG) remained at elevated levels throughout storage compared to containers with slices treated with AVG. Chilling injury in controls was 5-fold greater than that in slices treated with AVG. All slices treated with AVG had visible fungal growth, while the percent of slices showing visible fungal growth in no-AVG controls was 54%. Furthermore, we tested the effect of ethylene pretreatment of slices on subsequent slice shelf-life and quality. In slices treated with ethylene (0, 0.1, 1, and 10 $\mu L \cdot L^{-1}$) immediately after slicing, ethylene production in untreated controls was greater than that of all other ethylene pretreatments. However, pretreatment of slices at 3 days after slicing resulted in a different pattern of subsequent ethylene production during storage. The rate of ethylene production by slices treated with 1 $\mu L \cdot L^{-1}$ ethylene at 3 days after slicing was greater during storage than any of the other ethylene treatments. With slices pretreated with ethylene both immediately and 3 days after slicing, the rate of ethylene production tended to show an negative correlation with chilling injury.

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Tomato Fruit Treated with 1-methylcyclopropene Provide Adequate Non-ripening Controls in Low-temperature Storage Experiments

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Chilling injury limits the postharvest handling of many fruit and vegetables. In low-temperature storage trials, control treatments typically consist of fruit stored above the injury threshold. Since chilling exposures for tomato fruit often exceed 2 weeks, controls stored above the threshold continue to ripen, confounding comparisons with fruit maintained at low temperatures. In this study, the ethylene action inhibitor 1-MCP was used to arrest ripening to permit more valid comparisons between fruit stored under the two temperature regimes. Mature-green tomatoes were treated with EthylBloc and then stored at 5 or 15 °C for 2 or 3 weeks after which time the fruit stored at 5 °C were transferred to 15 °C to allow the expression of injury symptoms. 1-MCP inhibited ripening of fruit stored at 15 °C for 2 to 3 weeks. Color, pericarp firmness, and pectin solubilization of MCP-treated fruit stored at 15 °C remained at the values of mature-green fruit, validating their use as controls for these physiological characteristics. After 2 to 3 weeks at 15 °C, MCP-treated fruit resumed normal ripening. Comparing the fruit removed from low-temperature storage with nonripening controls at 15 °C revealed that storage at 5 °C for 2 to 3 weeks decreased the hue (yellowing) but did not affect chroma or lightness, maintained firmness, and did not affect pectin metabolism. Electrolyte leakage increased or remained unaffected by cold storage. MCP-treated fruit had slightly higher electrolyte leakage than non-MCP-treated fruit after storage at either 5 or 15 °C. We conclude that MCP-treated fruit provide adequate controls in experiments designed to study many aspects of low-temperature storage.

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Effects of Low-temperature Storage on Carbohydrate Metabolism in Potato Tubers

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Following exposure to low temperatures (i.e., <10 °C), potato tubers undergo low-temperature sweetening (LTS), the conversion of starch to sugars. This phenomenon is of great importance to potato chip processors because high levels of reducing sugars lead to undesirable nonenzymatic browning during potato chip frying operations. The purpose of this study was to elucidate the biochemical differences in carbohydrate metabolism between a tolerant (ND 860-2) and a sensitive (Novachip) cultivar during 4 °C storage. On chilling, there was an increase in the levels of sucrose, fructose, and glucose in both cultivars, with levels being at least 2-fold higher in the sensitive cultivar. Increased levels of ATP and NADH, along with a higher respiratory rate observed in the tolerant tubers, collectively indicate a higher metabolic rate in the LTS-tolerant cultivar. ATP- and pyrophosphate-dependent phosphofructokinase activity was similar in both cultivars. Higher levels of ethanol and lactate were also observed in ND 860-2, suggesting a greater flux of sugars via anaerobic respiration. No significant differences were observed in enzymatic activities in the oxidative pentose phosphate pathway (PPP) or in levels of NADPH, thereby suggesting that the PPP does not play a role in conferring LTS tolerance. Therefore, we propose that LTS-tolerant potatoes may maintain low tissue sugar concentrations via an overall increased metabolism, rather than differing in one specific metabolic step. This increased metabolic rate does not appear to be due to greater enzyme expression (i.e., coarse control) but, rather, to a greater overall flux of carbohydrates through glycolysis and respiration.

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Beneficial Effect of Heat-shock Treatments on Lettuce Applied before and after Wounding

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Changes in phenolic metabolism are induced by minimally processing, which ultimately leads to the browning of lettuce tissue. Phenylalanine ammonia-lyase (PAL, EC 4.3.1.5.) is greatly influenced by storage temperature. Evaluation of PAL activity at temperatures going from 0 to 25 °C showed that peaks occurred sooner at higher temperatures but at lower levels. Heat-shock treatments (50 °C, 90 s) have a protective effect against browning, help to retain greenness of tissue, and decrease the production of phenolics when applied either after or before wounding. To achieve a considerable, beneficial effect from hot water treatments applied after wounding these should not be delayed more than 36 h. The best results for heat-shock treatments before wounding occurred when applied at ≈12 h before cutting the tissue. Although cycloheximide did reduce PAL activity in a similar pattern as heat-shock treatments, it did not prevent browning itself. Cycloheximide seems to cause some sort of chemical damage that promotes the browning of lettuce tissue. When cycloheximide was applied in combination with heat-shock treatments browning did not occur.

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Effect of Vigor and Duration of Chilling on Heat Shock-induced Chilling Tolerance in Cucumber Radicles

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Chilling 10-mm cucumber (*Cucumis sativus* L. 'Poinsett 76') radicles at 2.5 °C reduced their subsequent growth during 3 days at 25 °C. The reduction in radicle growth was linear for 1 to 3 days of chilling but then increased substantially until subsequent radicle growth was all but eliminated by 6 days of chilling. Heat shocks of 40 °C applied for 4 to 12 min increased chilling tolerance such that 4 days of chilling caused only a 36% decrease in radicle growth compared to 66% for seedlings not heat shocked, which brought the response in line with the responses of the non-heat-shocked seeds chilled for 1 to 3 days. Eight-minute heat shocks applied before 5 days of chilling resulted in a 45% inhibition of subsequent growth, compared to 82% for chilled non-heat-shocked controls. Heat shocks applied before 3 days of chilling did not result in a significant increase in subsequent growth compared to the non-heat-shocked controls chilled for 3 days. Heat shocks were only able to protect that part of radicle growth that was in excess of the linear decrease in radicle growth. There appears to be two effects of chilling on radicle growth. The first is linear and cannot be affected by heat shocks. The second is much more severe and can be prevented by heat shocks. Seeds were selected for three categories of vigor according to the rate at which their radicles grew to 10 mm. Seeds classified with different vigors neither responded significantly differently to 3 days exposure to 2.5 °C nor did they respond differently to chilling stress following application of heat shocks.