

Lower Temperatures in Cases with Doors Improve Produce Quality and Safety with Reduced Energy Consumption

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Time-temperature control of fresh-cut produce at 41°F (5°C) or less significantly reduces the growth of human pathogens. Since 2009, the US Food Code has required that packaged ready-to-eat leafy greens be kept at 41°F (5°C) or lower to minimize the potential of pathogen proliferation in the supply chain.

Under commercial settings, scientific studies reported large temperature variations and temperature abuse for produce displayed in open multi-deck refrigerated cases, often exceeding 41°F (5°C). Lower product temperatures in open cases are not achieved by simply lowering thermostat settings, because freezing temperatures and loss of product quality can occur in the rear sections of the cases. To address these issues, we determined in our research supermarket facility at the USDA Agricultural Research Service (ARS) that installing clear glass doors was the most cost-effective solution for achieving compliance to US Food Code, improved quality and safety of fresh-cut leafy greens, and reduced energy consumption.

Open versus Doors

At USDA-ARS, two commercial-scale 12-ft multi-deck display cases were installed in a research supermarket facility. One of the cases was retrofitted with clear glass doors for comparative studies involving packaged fresh-cut leafy greens (e.g. baby spinach, chopped romaine lettuce and lettuce trio). Ambient conditions during the tests were 70°F (21°C), 60-70 percent relative humidity, and thermostats were set at 33°F (0.6°C).

Bagged leafy green products were displayed in both cases in three- to four-day trials, allowing for the collection of tens of thousands of temperature data points from the produce stored in both cases. The differences in temperature uniformity were striking. In the open case, product temperatures in the front often exceeded the US Food Code temperature requirement of 41°F (5°C). In the display case with doors,

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the non-compliance with Food Code was greatly reduced at the front of the case, and product temperature differentials decreased significantly.

Quality of Produce

In the open case, the quality of baby spinach samples in the front was standard after four days of storage. Trained sensory panelists gave these samples the lowest ratings, often described as “wet,” and showing significant decay, particularly from samples by the front of the case. On the other hand, the visual quality of baby spinach in the case with doors was higher and with lower decay. Data showed good statistical correlation between visual quality scores and storage temperatures.

Food Safety

To validate the effects of the Food Code compliance in the case with doors, packaged fresh-cut leafy greens were artificially contaminated with three major human pathogens, including *E. coli*, *Salmonella enterica*, and *Listeria monocytogenes*. After displaying the products for three days in the case with doors, with temperatures maintained below 41°C (5°C) and above freezing, no pathogen growth was observed during the entire period.

Operational Energy Costs

We evaluated the operational energy use of the display cases, which included the energy consumption by the condensing units, the evaporator fans, and the LED lights. Anti-sweat heaters were not used for the glass doors, which would have contrib-

uted to the energy use. We determined that overall energy consumption can be reduced by as much as 69 percent with the display case with doors under typical door-opening frequencies and durations (every 10 minutes for 6 seconds).

Engaging Retailers

Recently, some retailers took actions toward displaying produce behind glass doors. The latest awardees of the 2014 and 2015 Retail Sustainability Award from PRODUCE BUSINESS (Wegmans and Weis Markets) have pilot programs in place to retrofit open cases with doors for produce, and according to the reports, the initiative has been positive for the stores and accepted by their customers. The opportunity of a truly win-win situation at the intersection of food quality, food safety, and energy efficiency is at hand for the retail industry.

About The USDA Agricultural Research Service (ARS)

The ARS works to ensure that Americans have reliable, adequate supplies of high-quality food and other agricultural products. ARS accomplishes its goals through scientific discoveries that help solve problems in crop and livestock production and protection, human nutrition, and the interaction of agriculture and the environment.

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Study Leads To Food Safety And Quality Decisions

BY JIM PREVOR, EDITOR-IN-CHIEF, PRODUCE BUSINESS

The difficulty of sustaining optimal temperatures in open cases is well recognized. In floral, for decades now there is substantial evidence that the quality and life of cut flowers and floral arrangements is optimized by displaying the flowers and arrangements behind closed doors.

Yet, though some floral departments use closed-door displays and others may have a closed-door display for expensive or pre-ordered arrangements, there are far more flowers in open refrigerated cases than closed and quite a large number of floral displays not in refrigeration at all. The reason is that these are supermarkets, not museums; the goal is not the preservation of flowers but their sale. Even if shrink could be reduced via the use of the closed-door cases, the goal is not to minimize shrink; the goal is to maximize profits and it is, of course, easy to imagine scenarios in which an open, easier-to-access display maximizes sales and profits while simultaneously increasing shrink.

Over the long term, however, closed-door cases, which sustain the cold chain and thus quality, could actually boost sales. Presently, consumers may not buy flowers or produce; they might limit what they are willing to buy, because they have long experience that makes them feel these products have a limited shelf life in the home. If closed-door cases sustain the cold chain — delivering products that will last longer at home — consumers might be more likely to purchase and might be willing to pay a higher price. It could take a very long time before consumers make a connection between a closed-door display case and more useful life with floral or produce.

In this case, there is a distinction between the argument for closed-door cases in produce as opposed to floral. In floral, we are talking about a strictly commercial deci-

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sion. We ask questions such as: Does the closed-door case depress sales; does overall profitability rise due to energy savings and less shrink; or does profitability fall due to lower sales? When we turn to produce, and specifically fresh-cuts, we have two other concerns. One is a legal requirement for retailers to maintain temperatures in accordance with the FDA's U.S. Food Code, and one is a moral obligation to do all that can reasonably be done to avoid selling food that could cause foodborne illness.

It would be interesting to have a good study on the impact on sales by switching to closed-door cases. It may well be that fresh-cuts are more of a shopping list item than, say, a bouquet of flowers, so sales may not suffer much or at all. Indeed, if consumers perceive the cases to keep food fresher, the closed-door cases might increase sales, but that is research for another day.

For now, retailers are stuck with this persuasive study and its implications. Namely that retailers that choose not to invest in closed-door cases for their fresh-cuts are consciously deciding to sell their customers product that is of lower quality and more likely to carry a foodborne illness.

More broadly, this study points to a pivot point in food safety and produce. Ever since the Spinach Crisis of 2006, the focus has been on buyer-directed food safety programs. These programs involved retailers directing producers to meet certain

food safety standards. This study argues retailers need to turn their attention inward to how their own practices contribute to food-safety risk.

Retailers would argue that the fault is always with producers. After all, if no pathogen is in the package, then the fact that pathogens can grow more quickly at higher temperatures is not relevant. There is something to this argument, but less than it seems at first glance. Food safety is a difficult subject in produce precisely because our knowledge is imperfect. There is no known set of standards that can guarantee safe produce, so the smart thing to do is use multiple levels of protection: proper growing standards to reduce the likelihood of field contamination; good manufacturing practices so that processing plants are likely to remove any pathogens that exist; cold chain management along the entire supply chain to inhibit growth of pathogens; and consumer education and outreach, so they don't cross-contaminate, use product past appropriate dates or abuse the cold chain at home.

After years of telling growers what to do, this study pretty well lays out what retailers need to do. Perhaps the government will eventually require closed-door refrigeration compliance. If not, one wonders if energy efficiency and moral requirements will be sufficient to make retailers move on this issue.