

Shelf-life Extension Technologies in the Fresh-cut Industry

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The pre-cut bagged lettuce industry has been the catalyst for the tremendous growth that the entire refrigerated foods category has witnessed during the past decade. This segment was made possible due to breakthrough advances in packaging technology and was only launched about 15 years ago. Prior to 1990, one would have thought it inconceivable that consumers would purchase bagged, branded lettuce.

However, current sales of bagged lettuce products dominate the value-added produce category today, with estimated U.S. sales during 2004 of well over \$2 billion. Cut-lettuce products will continue to account for a significant portion of category sales volume for the near term, but its success has opened the door for new opportunities in packaged fruit and vegetable products.

The convenience of product use and the variety offered by prepackaged items have changed consumer purchasing behavior and created "halo" effects for a wide array of other packaged pre-cut fruits and vegetables. However, critical to the success of these newly evolving products is the presence of technologies that extend product shelf life, while enabling safety and security. In the fresh-cut fruit segment, where significant category growth is expected in the years ahead, varieties marketed to date have been dominated by pineapple, melon (including watermelon, cantaloupe and honeydew), citrus products (including grapefruit and oranges) and grapes. Frequently packaged in polyethylene (PET) containers, these fruits have historically achieved shelf lives of just two to four days. Because of this short

shelf life, it is estimated that about two-thirds of retail sales to date originate from products that are cut by hand and packaged at store-level or within localized facilities that service supermarkets and use limited or no shelf-life extension technologies. However, in the past two-three years, new fresh-cut fruit offerings have become available, such as pre-cut melons with a 10-14 day shelf life and pre-sliced apples with a three-six week shelf life. In the years ahead, this fresh-cut fruit category, in particular, is projected to evolve *considerably* because of advances in technology.

Numerous variables will impact the flavor characteristics, sensory acceptability and, therefore, the attainable shelf life of fresh-cut produce such as:

- Variety and source
- Initial maturity and processing maturity (for example, fruits destined for processing should generally be harvested specifically for that use, and this is typically not the harvest maturity required for the fresh market)
- Pretreatment of the exterior surface prior to cutting (including steam treatment, disinfectants or irradiation of the exterior surfaces)
- Slicing and cutting equipment
- Disinfectant chemical wash aids and dips (these aids may include usage of a chlorine solution, peroxyacetic acid, ozone and/or other antimicrobial additives)
- Packaging environment conditions (including use of rigorous sanitation procedures, employee hygiene practices, avoidance of

cross contamination and, potentially, the use of "clean room" packaging conditions)

- Packaging processes (including use of modified atmosphere packaging and other "active" packaging techniques)
- Pre- or post-packaging pasteurization treatments that may be used (including heat pasteurization or ultra high pressure processing)
- Packaging materials utilized (that may contain enhanced barriers to oxygen, moisture, and/or light, antifog capabilities to reduce condensation or materials that enable product respiration)
- Packaging solutions that minimize or contain moisture migration (including new patented technologies that absorb and retain moisture within a food package, keeping excess moisture and opportunistic spoilage organisms away from contact with the product)
- Maintenance of refrigerated conditions throughout the process and throughout the entire cold chain (this is critical)
- Shipping and handling conditions that maintain temperature and minimize potential for bruising and other forms of damage during product distribution.

In addition to technologies that extend product shelf life, other technologies are now available that enable new applications for fresh-cut marketing. For

example, specialized films and trays will soon be available for the marketing of fresh, steam-in-the-package vegetables in which respiration will be enabled and a 10-14 day shelf life will be attainable and in which product is steamed and fully cooked during the microwave process. In addition, European supermarkets are now marketing similar fresh-cut products but are using different packaging technologies in which raw vegetables (or chicken, fish, etc.) are cooked via steaming during the microwave process in which a patented valve allows for pressure release.

Research over the years has determined that the combination of multiple hurdle technologies will best ensure microbiological safety, extend shelf life and enable successful product marketability. Temperature control and the reduction or containment of water in fresh-cut produce, especially in fruit products like watermelon, are clearly critical factors for shelf-life extension.

Many technology alternatives are now available and will continue to be introduced in the years ahead. The fresh-cut industry will evolve and grow rapidly as these technologies are able to demonstrate that a shelf life of at least 10-15 days is, in fact, attainable for a wider and wider array of products. Fruits, in particular, that have previously been considered too fragile for the fresh-cut market may now have the opportunity to be successfully marketed in both retail and foodservice applications. Improvements in product shelf life and safety and the integration of improved refrigeration units in supermarket produce sections will enable the birth of new product categories and new markets. ♦

Editor's Note: Cooperhouse is Director of the Rutgers University Food Innovation Center, and Julie Elmer is associate director, Food Technology, at the Food Innovation Center. This unique economic development outreach center provides critically needed business development and technology expertise from the resources of Rutgers University and strategic partners throughout the nation to the agricultural and food industry of the New Jersey region. The Food Innovation Center also has technical facilities for the evaluation of extended shelf-life technologies for the food industry and its suppliers. For further information, please contact Lou Cooperhouse at cooperhouse@aesop.rutgers.edu or Julie Elmer at elmer@aesop.rutgers.edu



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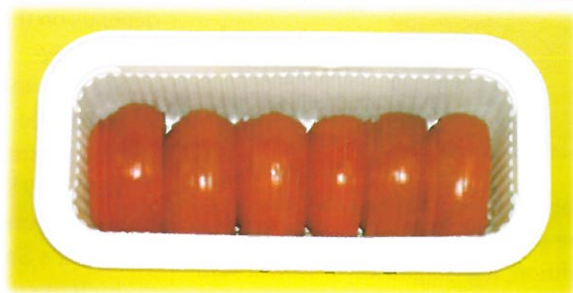
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