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Producing Better Produce

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How researchers are maintaining the quality and extending the shelf life of fresh fruits and vegetables

By Greg Tammen

ELENI PLIAKONI AND COLLEAGUES have an appetite for fresh produce production and storage research. An assistant professor of horticulture and natural resources at the Kansas State University Olathe campus, Pliakoni specializes in urban food production and postharvest handling, or how the handling procedures of fresh fruits and vegetables affect these foods and what techniques safeguard their quality and extend their shelf life.

“Fresh fruits and vegetables are very diverse, so there is not one postharvest-handling approach that will work for all,” Pliakoni said. “For example, tomatoes and broccoli cannot be stored at the same temperature. Because of the differences between fresh fruits and vegetables, we are required to use multiple techniques to develop different handling methods for every type of produce.”

Pliakoni collaborates with Cary Rivard, assistant professor of horticulture and natural resources, extension specialist and director of the Horticultural Research and Extension Center in Olathe, Kansas, and Helena Pontes Chiebao, postdoctoral research associate in Pliakoni’s lab. Pliakoni also leads a team of three graduate students who conduct research on various fruits and vegetables.

The researchers are focusing on a combination of tools and techniques, ranging from temperature control to low-cost greenhouse alternatives, to maintain taste and nutrition while extending the shelf life of fresh produce grown by smallholder Kansas farmers. These small-acreage farmers have fewer than 10 acres of land and represent more than half of the vegetable producers in the Midwest.

Helping smallholder farmers increase the
availability of locally grown, fresh fruits and vegetables in metropolitan areas is important for several reasons, Plakouni said. Urban populations are continuing to grow. Also growing is consumer interest in locally produced fresh farmers markets, which account for more than $6 billion in annual sales. Even more pressure will be placed on local food systems as the world’s population balloons to a projected 9.6 billion people by 2050.

No ‘one size fits all’

The Kansas State University researchers work with Kansas-grown broccoli, asparagus, beets, spinach, tomatoes, strawberries, melons and sweet potato slips.

Produce is grown on a university research farm, then harvested and transported to the lab for study in KoolKat, a trailer turned into a mobile refrigeration unit. The trailer can keep food cooled to as low as 31 degrees Fahrenheit, which reduces losses of temperature-dependent foods.

Because there is no “one-size-fits-all” approach to produce handling, foods.

‘As much as 40 percent of fresh fruits and vegetables are lost from harvest to market because of spoilage, rot and other causes,” Plakouni said. “We’re seeing that produce grown in high tunnels has a longer shelf life, which makes fruits and vegetables more marketable and adds to growers’ profits.”

Modified atmospheric packaging

Burtnieks also is working with modified atmosphere packaging. Modified atmosphere is the practice of changing the composition of the internal atmosphere of a produce bag to maintain the quality of the produce inside and extend its shelf life. Typically the bags are filled with a gas mixture that has decreased oxygen and elevated carbon dioxide content. Bags are produce-specific and designed for a specific optimum temperature.

“If leafy greens are processed and packaged at 40 degrees Fahrenheit, they then travel in a refrigerated truck to a distribution center, then to a grocery store and then onto the store display. The cold chain is disrupted in many of those steps, and you can imagine how big the temperature fluctuation is throughout that journey. That makes it challenging to design a singular package that adjusts to the different temperatures and remains beneficial.”

Researchers on the Agriculture and Food Research Initiative project are working on a possible solution: improving the storage efficiency of this packaging by developing proper atmospheric conditions for bags kept in ambient temperatures. They are storing spinach in commercial bags to abate optimum temperatures to identify possible improvements. The researchers then plan to collaborate with a packaging company to manufacture a better packaging solution for spinach kept at ambient temperatures.

Agricultural engineering students at the University of Florida are developing a prototype hot water treatment device that farmers can use on spinach and tomatoes in the field. Once developed, it will be reproduced at Kansas State University and used for research as well as for demonstrations. As part of the project, Richardson is working with a consultant and software developer to make a smartphone app that will help growers and extension agents keep track of locally grown crops, identify what is causing a crop loss, and adjust what crop is planted and when so that growers can maximize their food production.