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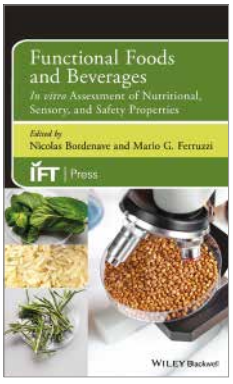

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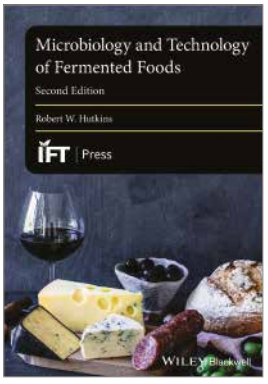

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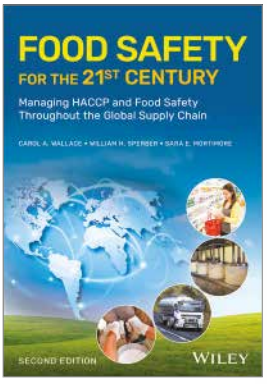

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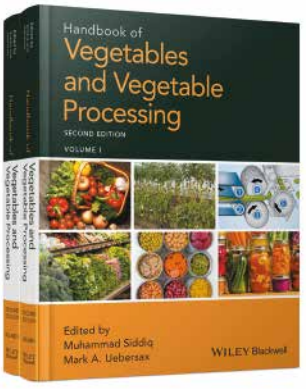

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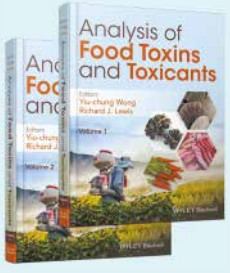

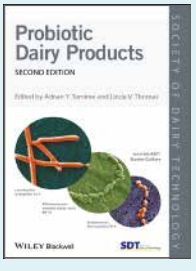

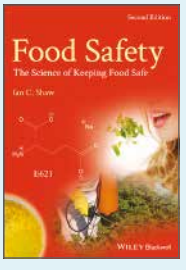

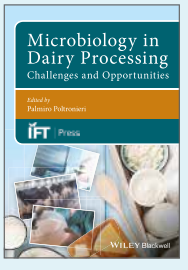

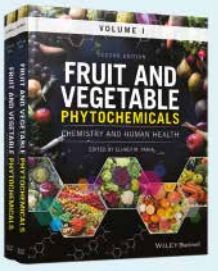

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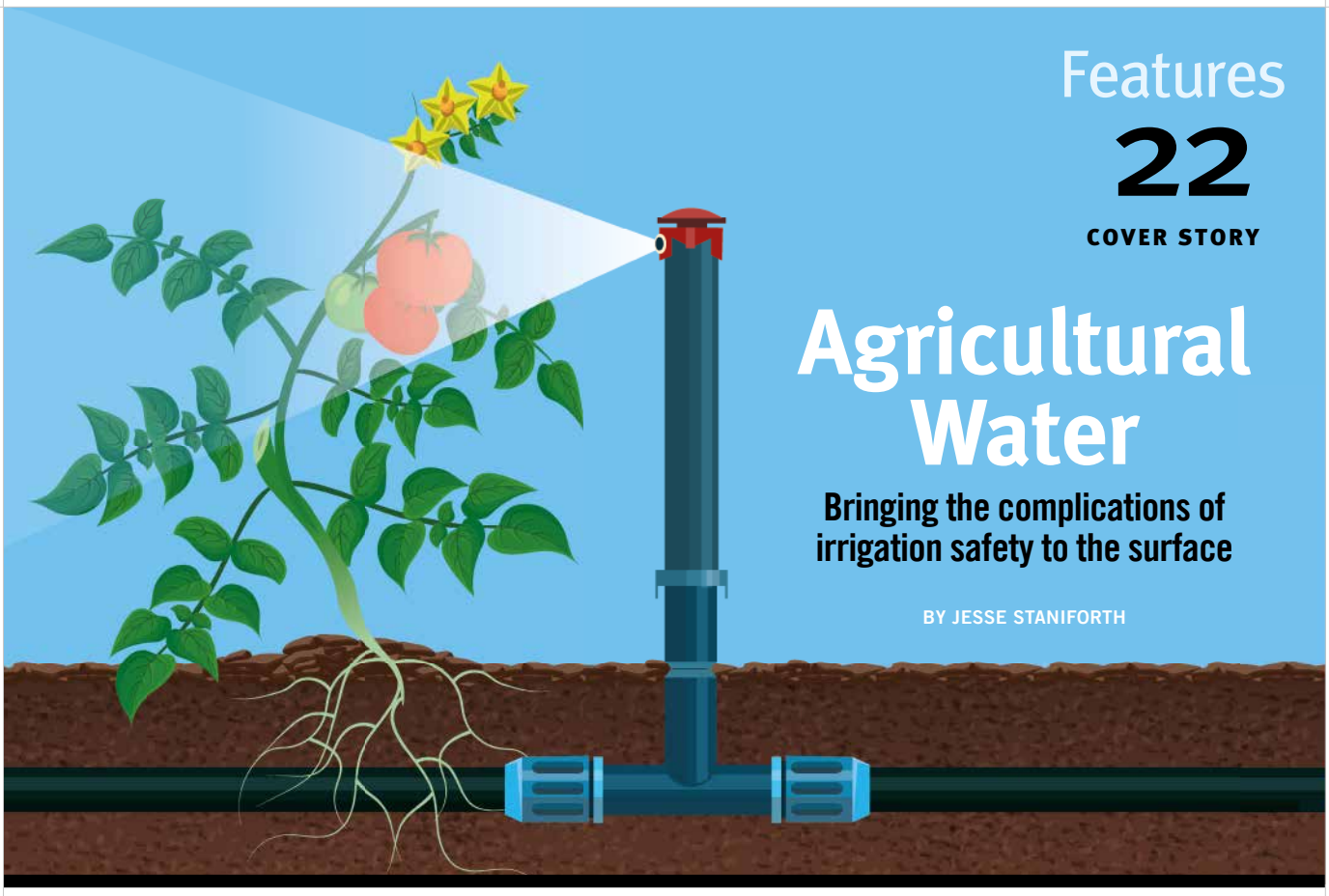

Features

Special Report

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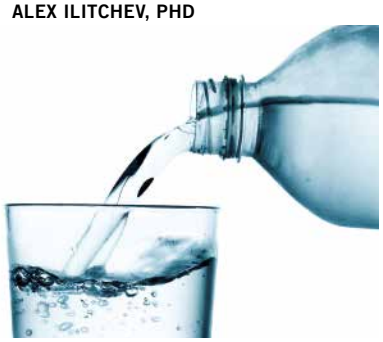

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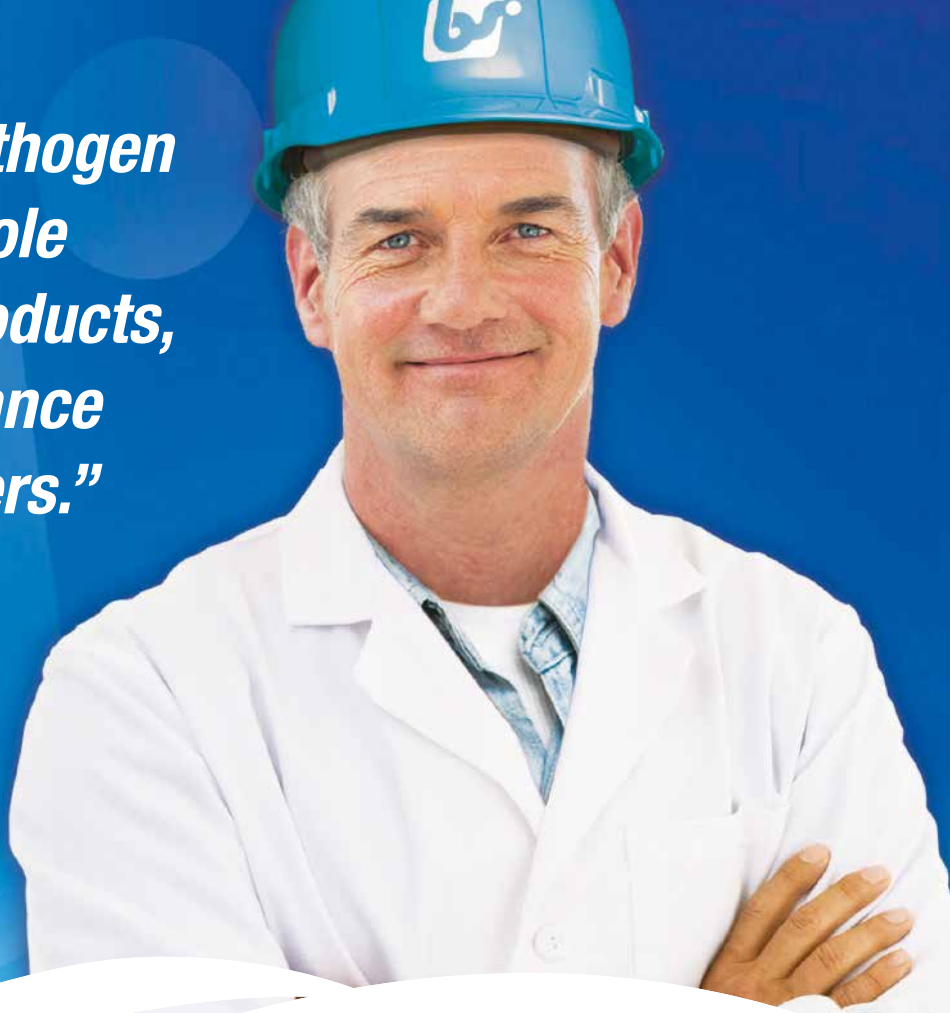

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From The Editors

Many of you probably heard the old joke: "What's worse than finding a worm in your apple?" The answer: "Half a worm"—implying you've ingested the other half of the critter.

As a culture, Americans are quite squeamish when it comes to insects, especially spiders, roaches, and earwigs. (Older people might remember the earwig story in Rod Serling's "Night Gallery" television show.) And most Americans certainly don't want bugs in their foods, although I wager many of you found something in your food over the course of your life—say, a grasshopper in canned green beans. It's unsavory and unappetizing, but at least the insect is now commercially sterile.

This is one reason why food processors are so conscientious when it comes to pest management. They want to keep flying and crawling insects out of their food plants and out of their products. What's ironic though is there's currently a movement to incorporate insects into our diets—including crickets, mealworms, and others. Will a processor who is making mealworm powder need a pest management program? Will it be an issue if a few crickets end up with the mealworm powder? We shall see as this new industry and trend grows.

But how did this transpire? Why are we looking at bugs as a food ingredient? The answer is the environmental movement. It takes a great deal of food and water to fatten up a cow or hog for slaughter, whereas bugs grow quickly and rapidly produce biomass that's high in protein. But really, how many people want foods made from insects? Most non-vegetarians would rather opt for a beef burger than a bug burger.

I've had the opportunity to travel the world, sharing foods with people in many different places. And I must admit that some of what I have been served included insects—yes, bugs were on the menu. I was served deep-fried cicadas and deep-fried scorpions in Asia. The cicadas were nice and crunchy, however, once was enough for the scorpions. Scorpions are full of formic acid, which dominated the taste.

My sense is it will be quite a while before insects make a dent in the market, although, there have been some tongue-in-cheek advertisements about insects in food. One of the major breweries ran an ad years ago featuring a table of appetizers at a party that included a dip located under an insect electrocuter...the partygoers really liked the crispy things in the dip.

Richard Stier
Co-Industry Editor

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FARM TO FORK SAFETY

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NEWS & NOTES

Preventive Controls for Breweries

The Brewers Association is developing a resource to assist craft brewers of all sizes to establish effective food safety preventive controls in all aspects of their brewery operations. The goal is to create a resource that will serve as the accepted "industry standard" addressing the implementation of a comprehensive preventive control program in breweries. Comprehensive guidance to implement preventive controls is not applicable to the unique processes used in brewing and fermenting beer. In most cases, implementation of preventive controls for human food is not a mandated regulatory requirement for producers of alcoholic beverages. However, not only are brewers increasingly required by their customers to have food safety plans in place as a condition of doing business, it is recognized that brewers need more guidance in how and why they should take steps to protect the consumer. The project is scheduled for completion in the summer of 2019.

SQF Code Recognized for 2020 Tokyo Olympics

The SQF Food Safety Code for Primary Production is recognized as a procurement standard for the 2020 Tokyo Olympic and Paralympic Games. The recognition includes the production of livestock; growing and production of fresh fruit, vegetables, and nuts; and extensive broad-acre agricultural operations including rice production. SQFI has developed an addendum to supplement the SQF Primary Production Code that sets the stringent sustainability, environmental, and welfare requirements prescribed by the Tokyo Organizing Committee. Growers and producers will be required to achieve and maintain certification to the SQF Food Safety Code for Primary Production and the SQF Tokyo Sustainability addendum. "SQFI is honored to be recognized by the Tokyo Organizing Committee and to be given the opportunity to integrate our globally recognized, GFSI-benchmarked food safety management standard with Tokyo's rigorous sustainability requirements," says Robert Garfield, chief food safety assessment officer and SVP, Safe Quality Food Institute. For more information on the Tokyo 2020 Sustainability Plan, go to https://tokyo2020.org/en/games/sustainability.

Climate Change Could Make Food Less Safe

As reported by Reuters, officials and researchers are advising governments to pay more attention to food safety as the planet warms and to address the issue in their action plans to tackle climate change. Climate change and the globalization of food production, coupled with a rising world population and increasing urbanization, pose new challenges to food safety, says the World Health Organization. "It is known that temperature increase as a result of greenhouse gas emissions may increase food contamination and foodborne diseases," according to Cristina Tirado-von der Pahlen, director of international climate initiatives at California's Loyola Marymount University. But her research found that only three countries mentioned food safety in their national action plans for adapting to climate change, prepared under U.N. negotiations.

Guidance for Responding to Customer Complaints

USDA's FSIS releases a best practices guideline to help the meat and poultry industry respond to customer complaints that are associated with adulterated or misbranded meat and poultry products. "FSIS has placed renewed emphasis on industry responding to customer complaints of foreign materials in meat and poultry and, as required, reporting those incidents to the agency within 24 hours once the determination has been made that the product is adulterated," says Carmen Rottenberg, FSIS administrator. In 2012, FSIS announced a regulation requiring all establishments to report to the agency within 24 hours when they have shipped or received an adulterated product and that product is in commerce. While this requirement has been in effect for several years, recalls associated with foreign materials have recently been increasing. While FSIS specifically developed its recent guidance to address foreign material customer complaints, companies can use the information for other complaints of adulterated or misbranded products. To access the draft guideline, go to https://bit.ly/2H5OCRb.

Organic Fresh Produce Sales Hit Over $5 Billion

In a year when total grocery store dollar growth reached only 2%, organic fresh produce surpassed the status quo according to new information released by the Organic Produce Network and Nielsen. In total, organic produce sales reached $5.6 billion in 2018, with the year ending on a high note as sales increased 13% the final week of the year. Fresh produce represented 26% of total store organic sales and a growth rate of 8.6% was on par with total store organic, which suggests a continued movement toward mainstream demand across product consumption. But products like strawberries and tomatoes experienced far greater growth in the conventional offering. Pricing is important for these categories. Prices were $1.97 to $3.38 per pound between conventional and organic tomatoes and $2.26 to $4.26 for conventional and organic strawberries. Onions, bell peppers, watermelon, and mandarins are all still disproportionately under-represented in organic sales compared to the total produce average. Ensuring organic items are available for purchase, particularly at key times of the year, such as summer holidays, Thanksgiving, and Christmas, is a good starting point for commodities still trying to reach more organic shoppers.

Top 10 Best-Selling Organic Fresh Produce Items for 2018

Category	2018 Dollar Sales	2018 Dollar Percent Change
Pre-Packaged Salads	$ 1.12 Billion	5.3%
Apples	$ 393 Million	6.4%
Carrots	$ 340 Million	3.5%
Strawberries	$ 298 Million	1.9%
Bananas	$ 290 Million	9.3%
Herbs & Spices	$ 263 Million	7.8%
Blueberries	$ 256 Million	33.3%
Lettuce	$ 252 Million	3.5%
Tomatoes	$ 204 Million	0.8%
Grapes	$ 169 Million	14.9%

Source: Nielsen xAOC, Total Food View, 52 Weeks Ending 12/29/18

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A Multi-Layer Approach for Safe Food Imports

FDA releases its "Strategy for the Safety of Imported Food," which outlines the agency's comprehensive approach to helping ensure the safety of food imported into the U.S. Determining the best way to use the full range of available tools across the different segments of the international food-supply chain—in ways that decrease public health risks while maintaining a level playing field for domestic and foreign producers—requires both dexterity and pragmatism. The strategy document describes how FDA is integrating the new import oversight tools with existing tools. The strategy is guided by four goals: 1) Food Offered for Import Meets U.S. Food Safety Requirements; 2) FDA Border Surveillance Prevents Entry of Unsafe Foods; 3) Rapid and Effective Response to Unsafe Imported Food; and 4) Effective and Efficient Food Import Program. The document outlines several methods the agency is using to accomplish these goals, including strategies for objectives. To access the strategy document, go to https://bit.ly/2TnSSC5.

USDA, FDA Make Formal Agreement to Regulate Cell-Cultured Food

The USDA FSIS and the U.S. Department of Health and Human Services' FDA announce a formal agreement to jointly oversee the production of human food products derived from the cells of livestock and poultry. The formal agreement addresses the regulatory oversight of human food produced using this new technology. The agencies agree upon a joint regulatory framework wherein FDA oversees cell collection, cell banks, and cell growth and differentiation. A transition from FDA to FSIS oversight will occur during the cell harvest stage. FSIS will oversee the production and labeling of human food products derived from the cells of livestock and poultry. This shared regulatory approach is aimed at ensuring that cell-cultured products are produced safely and are accurately labeled.

Business Briefs

Kestrel Management forms an alliance with **Ultra Consultants** to provide food safety compliance and remediation advisory services to North American food and beverage processors.

Hyland Levin LLP launches its Food and Beverage Law Group.

GFSI forms a Local Group in Australia and New Zealand, named GFSI AusNZ, as part of its regional outreach model.

Aquionics enters into a partnership agreement with **Valcour Process Technologies** for distributing its UV disinfection systems to cheese producers in the upper Midwest.

Wheatsheaf Group Limited acquires 90% of **Purfresh,** a provider of specialized controlled atmosphere systems that reduce cargo loss through spoilage in refrigerated ocean shipping containers.

The Food Laboratory Alliance adds **AOAC International** to its coalition of organizations devoted to the safety of the nation's food supply and the quality of food laboratory testing.

ReposiTrak completes its Service Organization Control 1 and 2 Type 2 annual audit recertifications, a verification standard defined by Association of International Certified Professional Accountants.

Biorigin Europe achieves GMP+ B3 - Trade, Collection and Storage, and Transshipment certification.

Corteva Agriscience forms a strategic R&D collaboration to advance ZeaKal's technology to improve seed quality and increase crop yield by enhancing the photosynthetic capacity and efficiency of plants.

Washington Report

Hydroponics in Hot Water

Groups petition USDA to ban organic crop certifications, revoke those already issued | BY **TED AGRES**

The long-running controversy over whether hydroponically grown crops can be certified organic has taken a new turn, with the Center for Food Safety (CFS), a prominent nonprofit public interest group, filing a legal action demanding USDA ban hydroponic production systems from being allowed to use the USDA-certified organic label.

In a rulemaking petition filed in January, Oregon-based CFS requests USDA to issue new regulations prohibiting organic certification of hydroponic agricultural production. CFS also wants USDA to ensure that "ecologically integrated organic production practices" (that is, practices involving soil) are required for organic certification, and to revoke all organic certifications previously issued to hydroponic growers.

"Hydroponic systems cannot comply with the organic standard's vital soil standards because hydroponic crops do not use soil at all," stated the 23-page petition, which was endorsed by 13 organic farmer, consumer, retailer, and certifying organizations, including the Cornucopia Institute, Food & Water Watch, the Northwest Organic Dairy Producers Alliance, and the Organic Farmers Association.

"Mislabeling mega-hydroponic operations as 'organic' is contrary to the text and basic principles of the organic standard," said George Kimbrell, CFS's legal director, in a statement. "Right now, there is a pitched battle for the future of organic, and we stand with organic farmers and consumers who believe the label must retain its integrity."

Battle Over Principles—and Pocketbooks

The battle, in part, is to uphold the soil improvement and biodiversity conservation principles embedded in the Organic Foods Production Act of 1990, which has been administered since 2000 by the National Organic Program (NOP) under USDA's Agricultural Marketing Service. Use of the term "organic" on food labels is limited to organic farmers and producers that have been certified by USDA-approved state, nonprofit, or private certifying agencies.

"Corporate agribusiness lobbyists have been working to water down the organic standards for decades," said Mark Kastel, executive director for the Cornucopia Institute, a Wisconsin-based food and farm policy watchdog group, in a statement. "In this case, the careful stewardship of soil fertility is not only a philosophical precept, it's codified in federal law."

While "soil fertility" and "soil management" are prominent components of the organic statute and regulations, USDA has never issued specific rules regarding organic certification of hydroponics. Rather, USDA holds that organic hydroponic production is permitted "as long as the producer can demonstrate compliance with the USDA organic regulations." Specifically, this means using "the same fertilizers and pest control practices as other organic farmers."

In general, hydroponics refers to a variety of systems in which terrestrial plants are grown without soil, with their roots housed in a liquid solution or solid substrate, such as peat moss, gravel, bark, sawdust, or coconut coir. Hydroponic growers have traditionally used dissolved synthetic salts and minerals as nutrients. But those solutions can also be made using natural salts and organic residuals.

Hydroponics variations include aeroponics, in which plant roots are suspended in air and sprayed with a fine mist of atomized nutrients; aquaponics, in which fish or other aquatic animals are inserted into the hydroponic system to create a blended, symbiotic environment; and bioponics, in which microbes, bacteria, and fungi commonly found in fertile farm soil are combined with organic nutrients. Bioponics is increasingly being used in "vertical" farm

systems, many of which are small producers in urban areas while others are large-scale indoor commercial operations.

Over the years, some USDA-accredited certifiers (including CCOF, QAI, and Oregon Tilth) have certified hydroponic producers. Currently 41 hydroponic crop operations are certified organic, of which at least 25 are entirely water-based, according to the CFS petition. Many other certifiers do not certify hydroponics, thereby creating an "inconsistent standard" that confuses consumers and puts soil-based organic growers at an economic disadvantage, CFS maintains.

Indeed, a lot of money is at stake. Organic food sales in the U.S. totaled $49.4 billion in 2017, up 6.4 percent from the previous year, according to the Organic Trade Association's (OTA) latest survey. "Consumers trust the organic label and pay extra for the assurance that it indicates a more healthful and environmentally-friendly way of producing the food they buy," according to the CFS petition.

"Allowing hydroponic systems to be certified as organic undercuts the livelihood of organic farmers that take great lengths to support healthy soil as the bedrock of their farms," states Kate Mendenhall of the Pennsylvania-based Organic Farmers Association, which is supported by the Rodale Institute.

Economically, hydroponics is no slouch, either. In 2017, the worldwide hydroponic crop farming market accounted for $5.2 billion, according to a recent analysis by KD Market Insights. By the end of 2023, this is expected to reach nearly $14 billion. This fast growth is fueled, in part, by hydroponics' higher yields as compared to traditional farming methods.

For example, Matt Barnard, CEO of Plenty Unlimited, a San Francisco-based clean food farming startup, claims his hydroponic system "yields up to 350 times that of traditional systems and can be located close to consumers, regardless of climate, geography, or economic status."

In a 2017 statement to the National Organic Standards Board (NOSB), the federal panel that advises USDA on issues related to organics, Barnard wrote, "We're able to deploy an organic field-scale farm within months, which means we're able to scale U.S. organic production capacity fast enough to meet growing demand."

"We must take advantage of all available solutions to meet growing demand, while staying true to our identity as organic producers," Barnard stated. "We also must embrace U.S. innovation to maintain our leadership in the industry and foster the solutions that will ultimately feed the world."

> ...USDA has never issued specific rules regarding organic certification of hydroponics.

Amazon Inc. founder Jeff Bezos and Japanese tech giant SoftBank Corp. are among Plenty's financial backers. Barnard told Reuters last year that China could potentially host at least 300 of Plenty's farms. The company is hiring in China and scouting for locations and distributors in Beijing, Shanghai, and Shenzhen. Plenty has also hired a team in Japan and has "locked down" a few farm sites there, Barnard said.

Long-Running Controversy

CFS's petition is the latest in a multi-decade-long controversy over organic hydroponics. In 2010, NOSB issued a non-binding recommendation to USDA that hydroponics cannot be classified as a certified organic farming method "due to their exclusion of the soil-plant ecology intrinsic to organic farming systems and USDA (National Organic Program) regulations governing them." USDA did not act on the recommendation.

In 2017, NOSB reversed this position by narrowly voting down two proposals that would have banned hydroponic and aquaponic crops from organic certification. The board did, however, agree by a wide margin to prohibit aeroponic production from receiving the organic certification. But again, USDA did not act on the recommendation.

OTA, the U.S. organic industry's main trade group, generally opposes the certification of hydroponics, but notes that USDA may provide additional guidance in the future. "In the meantime, hydroponic operations certified under the NOP must comply with the organic crop regulations as they are written," OTA says.

In addition to the CFS petition, the Cornicopia Institute in 2016 filed a formal complaint with USDA's Agricultural Marketing Service requesting an investigation into the organic certification of hydroponic operations in the U.S. that "appear to conflict with the statutory language of the Organic Foods Production Act of 1990 and current federal regulations governing organic food production."

The complaint specifically targets Driscoll's and Wholesum Harvest Family Farms, two large commercial growers of organic greenhouse tomatoes, cucumbers, squash, peppers, berries, and other produce. The complaint alleges that the organic certifiers for these operations "could have been deceived, could have acted incompetently, or could have been a co-conspirator in the alleged violations." It is unclear whether USDA ever undertook an investigation.

Driscoll's says that it does not grow hydroponic crops. "Containerized production is not the same production system as hydroponics, which is a water-based production system," the company states on its website. "Driscoll's organic supply comes from both certified in-ground production and certified containerized production." Wholesum Harvest also uses containerized greenhouse growing methods but additionally grows in open fields in Arizona and Mexico.

A 'Settled Issue'

Earlier this year, USDA clarified that it considers the organic hydroponics matter to be a "settled issue."

"Last year we issued an Organic Insider [an email newsletter] that indicated that hydroponics had been allowed since the beginning of the program and that [they] are still allowed," Jennifer Tucker, NOP deputy administrator, told The Packer's 2019 Global Organic Produce Expo on Feb. 1, 2019. "We consider that a settled issue."

Explaining why some certifiers certify hydroponic operations and others do not, Tucker noted that some certifiers don't have the administrative capacity or technical expertise in hydroponic systems. "There are some certifiers that certify hydroponics, and there are some that do not;

(Continued on p. 42)

Market Initiatives

From Produce to Pecans

Food safety programs and protocols for fruit, vegetables, and nuts are improving to minimize the possibility of contamination

BY **LINDA L. LEAKE, MS**

Devoted to diligence. That best describes the efforts of stakeholders to minimize the risk of produce contamination by pathogens.

While the multistate outbreak of *E. coli* O157:H7 associated with romaine lettuce during fall 2018 was declared over as of Jan. 9, 2019, the FDA—along with CDC, and state and local agencies—continues its investigation into the potential source of the pathogen. And FDA continues to recommend to suppliers and distributors that romaine lettuce be labeled with a harvest location and a harvest date or labeled as being hydroponically or greenhouse grown.

Produce industry partners are definitely devoted to minimizing the possibility of future pathogen contamination associated with their products, says Jennifer McEntire, PhD, vice president of food safety and technology for the United Fresh Produce Association. "We continue to work with a wide variety of stakeholders to determine measures to minimizes the likelihood of contamination, improve traceability throughout the supply chain, gain alignment on consumer-level labeling, and improve the investigative process," Dr. McEntire relates.

United Fresh estimates that the market value share of fresh produce is at $57.2 billion annually in the U.S., Dr. McEntire says.

"As a result of the 2018 romaine outbreaks, United Fresh is working, in collaboration with other associations throughout the supply chain, from produce growers to retailers and restaurants, to implement measures that will prevent outbreaks, improve traceability if an issue occurs, gain industry consensus on and consumer understanding of new voluntary labeling for harvest sources, and improve collaboration during outbreak investigations," Dr. McEntire relates.

"Since the fall of 2018, there has been a real uptick in interest among our members regarding how to handle a recall or other food safety crisis," she notes. "Bear in mind that there were very few actual recalls associated with the romaine outbreaks, but any company handling the product was impacted. Those in the leafy greens industry want to better prepare, and those dealing in other fresh fruit and

vegetable items realize that these types of events can impact them."

Training Programs

United Fresh has been publicly offering its Recall Ready Program and Recall Ready Workshop for several years, usually once or twice a year, in locations that are convenient to its members, most often in California and Florida. Workshops are also delivered in states that fund training for their constituents.

"These programs equip hundreds of members with resources that prepare them for the chaos of a recall," Dr. McEntire says. "This training is offered in a partnership between United Fresh, the legal and communications experts at OFW Law (Olsson Frank Weeda Terman Matz PC), and Watson Green, LLC, which is one of the food industry's leading crisis counseling firms."

United Fresh also offers *Listeria monocytogenes* intervention and control workshops in collaboration with the Produce Marketing Association (PMA). "The two-day workshops focus on sanitary design, sanitation best practices, environmental monitoring, and more," Dr. McEntire says. "More than 300 people have participated in these workshops since they were launched in July 2017.

"Luckily, fresh produce hasn't suffered notable *Listeria*-related outbreaks recently, but FDA's swabathons, the increased use of whole genome sequencing, and the desire for continuous improvement make the United Fresh-PMA *Listeria* workshops a popular event," Dr. McEntire continues. "We'll hold several of them in 2019, in Atlanta, Ga., Yakima, Wash., and the Midwest."

> "Since the fall of 2018, there has been a real uptick in interest among our members regarding how to handle a recall or other food safety crisis,"
>
> says Jennifer McEntire, PhD, VP of food safety and technology, United Fresh.

FSMA Happenings

Dr. McEntire mentions that most United Fresh Food Safety Modernization Act (FSMA) trainings have transitioned into "maintenance mode," and emphasis has shifted to helping members understand how the various rules will be enforced. "The comment period is open for two FSMA guidance documents of key interest to the fresh produce industry, one related to the Produce Safety Rule, and the other explaining how Preventive Controls applies to fresh-cut facilities," she notes. "The Food Safety & Technology Council, one of United Fresh's expert advisory councils, is actively drafting comments, and the FDA has offered to give webinars to our members on these topics."

To help build an enlightened food safety community, any employee of a United Fresh member company can receive up-to-date food safety information by joining the Food Safety Community email listserv. Summarized, at-a-glance information authored by Dr. McEntire and Emily Griep, PhD, manager of food safety for United Fresh, is sent to subscribers approximately every two weeks.

"Most of our members' products lack a kill step, so we're also focused on improving food safety practices throughout the supply chain, evaluating new technologies, and evaluating the diversity of customer requirements, especially when it comes to product testing and audit requirements," Dr. McEntire adds.

Produce Safety Innovation Challenge

In January, the Center for Produce Safety (CPS) announced a dynamic new grant program with the goal of improving the safety of fresh products.

Called Grower's Risk Assessment Biomarkers Investigative Tool, or GRABIT, the challenge was designed to stimulate the development of science-based approaches to support the broader critical knowledge needs in produce safety risk identification, risk intervention, and high-density data development associated with the domesticated animal-specialty crop interface, according to Bonnie Fernandez-Fenaroli, CPS executive director.

"GRABIT is not a tool to look for pathogens, but rather a tool to search for evidence of chronic or acute pathogen transfer factors from domesticated animal point sources," Fernandez-Fenaroli relates. "With GRABIT innovation cash awards, CPS is offering opportunities for technology innovators to develop, refine, and focus their solutions to meet the current critical industry need of identifying evidence or conditions where cross-contamination can take place in produce growing environments."

Up to $500,000 is available in three GRABIT award categories. Prime Time Ready includes four awards of $75,000 each. Solid Proof of Potential features five awards of $30,000 each, and Promising Proof of Concept offers 10 awards of $10,000 each.

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Fresh Facts on Retail

The quarterly FreshFacts on Retail Q4 2018 Report from United Fresh Produce Association measures retail price and sales trends for the top 10 fruit and vegetable commodities. Each report features a rotating spotlight on different topics, including regional insights, generational insights, and sales across various channels. The report also provides info on organics and value-added produce, as well as category-specific data and category spotlights on grapes, avocados, and packaged salads. Additionally, it includes a review of key sales trends for all of 2018.
To access the report, go to https://bit.ly/2SYdKuF. *—FQ&S*

(Continued from p. 15)

"In order to receive the Prime Time Ready award, technology must be ready to use or very nearly ready," Fernandez-Fenaroli explains. "This is not an award to investigate an idea, but to bring promising tools to fruition quickly." Applications for awards closed on April 22, 2019.

Pecan Conditioning

Did you know that pecans are the only tree nuts native to the U.S.? As the world's largest supplier of pecans, the U.S. produces, on average, 325 to 350 million pounds annually, according to the U.S. Pecan Growers Council; some 51 percent of global production in 2017/2018, as stated by International Nut & Dried Fruit Council.

Fortunately, there have not been any foodborne disease outbreaks traced to pecans, but contamination of in-shell pecans and nutmeats can occur preharvest, at harvest, and during postharvest handling and processing, says Achyut Adhikari, PhD, an extension food safety specialist with Louisiana State University (LSU).

"Conditioning prior to cracking is an essential step in pecan processing to not only reduce kernel breakage and improve shelling efficiency, but to also eliminate microorganisms that may be on the shell," he says.

According to Dr. Adhikari, some of the pecan conditioning methods currently used commercially are:

- Soaking in hot water at least 177.8 degrees Fahrenheit for one to eight minutes or steam processing for six to eight minutes;
- Immersing in cold, usually chlorinated, water for eight hours and then draining for 16 to 24 hours, or soaking in chlorinated water with a minimum free chlorine concentration of 200 parts per million at 59 to 86 degrees Fahrenheit for two minutes; and
- Moisture equilibration in a humidity-controlled storage room.

"FDA recommends that a treatment process must achieve a 5-log reduction of bacteria to be regarded as a kill step," Dr. Adhikari points out. "Food products processed with a kill step will ensure food safety in the final product, minimizing public health concerns. But most of the conditioning methods currently used remove a maximum of only 3-log colony forming units per gram (CFU/g) bacteria from the pecan shell. So, to increase the efficiency of pathogen control, those conditioning methods must be paired with other techniques."

> "...contamination of in-shell pecans and nutmeats can occur preharvest, at harvest, and during postharvest handling and processing,"
>
> says Achyut Adhikari, PhD, an extension food safety specialist with Louisiana State University.

Examples of other techniques include spraying with chemicals such as peracetic acid, chlorine dioxide, or hydrogen peroxide; thermal treatment such as hot air and dry roasting; high pressure processing; and treatment with irradiation.

Published in November 2018, recent research by Dr. Adhikari and several LSU colleagues demonstrates hot water treatment alone on in-shell pecans is effective in removing bacteria by more than 5-log CFU/g. "Based on our findings, growers and processors could use hot water either at 158 degrees Fahrenheit for 8.6 minutes, 176 degrees for 6.6 minutes, or 194 degrees for 4.6 minutes," Dr. Adhikari relates. "These time-temperature combinations were found to be effective against *E. coli* O157:H7, *Salmonella enterica*, and *Listeria monocytogenes*. Also, for scientific validation of pecan processing equipment or a hot water treatment process, *Enterococcus faecium* can be reliably used to evaluate the efficacy of the system."

The next step was to get some consumer feedback on kill step validated, hot water conditioned pecans. To that end, Dr. Adhikari and his team evaluated consumer acceptance and purchase intent of dehulled and roasted pecans that had been preconditioned in hot water according to the aforementioned protocol. Results were published in January 2019.

"We presented 112 consumers with roasted raw pecans as a control and roasted pecans pre-treated with hot water at three respective time-temperature combinations," Dr. Adhikari says. "Consumer acceptance was higher for hot water-treated pecans, with higher ratings on color/appearance and aroma. No effect of hot water pretreatment was observed by consumers on other sensory properties, such as texture and flavor."

Based on these results, Dr. Adhikari believes hot water conditioning holds greater promise than ever before. "Hot water conditioning has the potential to be regarded as a kill step to ensure the safety of pecans," he emphasizes. "The treatment will also enhance the color and aroma of the pecan without affecting its texture and flavor. Since hot water conditioning is already in practice by most of U.S. pecan shellers, no additional cost is required for setting up the system."

Dr. Adhikari says the hot water treatment process may hold promise for application to other nut species. "Hot water treatment has already been extensively used for tree nuts, especially almonds," he relates. "Recent research indicates that pine nuts, black walnuts, and chestnuts could benefit from hot water treatment by reducing food safety risks and increasing shelf life. However, thermal processes validated for one nut type cannot be generalized to all tree nuts. The efficacy of hot water treatment may be affected by the shape, size, surface area, or other characteristics associated with each specific nut species. Therefore, validation of hot water treatment for each type of nut must be performed before commercial use." ■

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For bonus content on the produce and nut markets, go to the April/May 2019 issue at www.FoodQualityandSafety.com/issue/april-may-2019/.

Legal Update

Food Industry High on Edibles

The dramatic shift in cannabis law presents an exciting and potentially lucrative opportunity for the food companies willing to enter the edibles market

BY **SHAWN K. STEVENS, ESQ.** AND **JOEL S. CHAPPELLE, ESQ.**

Over the last 25 years, cannabis laws and attitudes throughout the U.S. have undergone a remarkable transformation. As recently as 1995, cannabis was illegal in every U.S. jurisdiction, and its use was still widely taboo. The transformation began in 1996, when California voters passed Proposition 215, making California the first U.S. state to enact medicinal marijuana legislation. Since then, 32 additional states, the District of Columbia, Guam, and Puerto Rico have enacted medical marijuana/cannabis programs. More than a dozen other states permit use of cannabis derivatives, most notably cannabidiol (CBD), and numerous states have legalized recreational marijuana.

As legalization initiatives have swept across the nation, the legal cannabis industry has enjoyed explosive and nearly unprecedented growth despite the challenges stakeholders continue to face. Those challenges include conflicting state and federal laws, lack of regulation, burdensome tax schemes, and transportation hurdles.

Despite (or perhaps because of) the rapid legal and cultural shift, confusion regarding cannabis abounds. For purposes of this article, the term "cannabis" refers to both marijuana and hemp. Both are members of the family *Cannabis sativa* and share many properties, but there are meaningful distinctions between the two. Whereas marijuana typically produces significant levels of tetrahydrocannabinol (THC)—the psychoactive compound that produces a "high" when ingested—hemp does not. Hemp produces only a trivial amount of THC, generally less than 0.3 percent, which is insufficient to cause impairment.

Hemp has long been an important agricultural commodity. Archaeological evidence of hemp cultivation dates back 10,000 years to ancient Mesopotamia. More recently, George Washington cultivated hemp at his Mount Vernon estate. Hemp has many industrial applications. It is used to manufacture textiles, biofuels, paint, varnish, soap, lotions, rope, lubricating oil, and many other products. Unbeknownst to many, hemp was widely cultivated in the U.S. until the 1960s. Thereafter, it was swept up in the "War on Drugs" and, pursuant to the Controlled Substances Act, was prohibited under federal law.

With the enactment of the 2018 Farm Bill, hemp prohibition has effectively ended, though it will continue to be stringently regulated. The Farm Bill defines hemp as an agricultural commodity and removes its status as an illegal drug, provided the THC levels are below 0.3 percent. Hemp may now be introduced into interstate commerce, provided it is otherwise compliant with the law. Likewise, many of the onerous restrictions on the sale, transport, or possession of hemp-derived products have been eliminated.

Hemp will now be regulated pursuant to a cooperative framework under which state and federal authorities will work together to oversee hemp cultivation and production. The Bill directs departments of agriculture to consult with executive and law enforcement officials to devise and submit plans to the head of USDA. These plans will establish quality control standards for hemp production. Each state's plan must be approved by USDA prior to the state commencing licensure and regulation. To the extent a state opts out, USDA

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will implement its own regulatory regime pursuant to which cultivators may seek licenses and will be subject to oversight.

FDA Regulation and Classification

Today, hemp is most well-known for CBD, a promising compound widely credited with offering therapeutic benefit for a variety of ailments, including stress, pain, and seizure disorders, among others. Though CBD is now legal under federal law when derived from hemp—as opposed to marijuana—hemp-derived CBD remains subject to FDA rules when used as an additive to foods, beverages, or supplements. Put differently, CBD as a compound is no longer illegal. However, CBD is still considered a drug ingredient, meaning it requires FDA food additive approval. FDA will treat CBD as it does any other FDA-regulated product—meaning it's subject to the same authorities and requirements as FDA-regulated products containing other drug ingredients.

Shortly after the Farm Bill became law, FDA Commissioner Scott Gottlieb (who is scheduled to resign from his position in April) released a statement affirming that "While products containing cannabis and cannabis-derived compounds remain subject to the FDA's authorities and requirements, there are pathways available for those who seek to lawfully introduce these products into interstate commerce. The FDA will continue to take steps to make the pathways for the lawful marketing of these products more efficient."

Other parts of the hemp plant, including hulled hemp seeds, hemp seed protein, and hemp seed oil, have been deemed safe by FDA. Therefore, these products may be legally marketed in human foods without food additive approval, provided they comply with all other rules and regulations.

Marijuana, on the other hand, remains classified as a Schedule I substance under the Controlled Substances Act. Schedule I substances are deemed to have a high potential for dependency and no accepted medical use. The effect of that designation, from both a legal and economic standpoint, is profound. Among other things, Schedule I substances may not be transported through interstate commerce, banks are barred from transacting business with legitimate marijuana businesses, medical providers are not allowed to prescribe marijuana, and federally funded institutions cannot conduct marijuana research, etc. (Medical providers sometimes circumvent prescription prohibitions by giving "recommendations" in states that allow medical marijuana use.)

It appears increasingly likely that many of the federal hurdles will soon clear, giving rise to yet another boom for the cannabis industry. Among the proposed legislation being circulated by Congress are bills that de-schedule marijuana, address tax fairness for cannabis businesses, and remove barriers to banking and scientific research. These would ostensibly lay the groundwork for a broader bill to end federal cannabis prohibition outright, which some analysts expect by the end of the year. Whether any such bills will pass is unclear, but the momentum is indisputably trending toward legalization.

Irrespective of marijuana's Schedule I status, states are charging ahead with legalization initiatives, and legal cannabis sales have surged into the billions of dollars annually.

Irrespective of marijuana's Schedule I status, states are charging ahead with legalization initiatives, and legal cannabis sales have surged into the billions of dollars annually. As the legality and social acceptance of cannabis use have grown, so too have the opportunities available to businesses willing to enter the cannabis market. Meanwhile, many other businesses have adopted a wait-and-see approach, reluctant to enter the market because of the legal ambiguity, lack of regulation, cost-prohibitive taxation, banking obstacles, and longstanding misconceptions about cannabis itself.

Food for Thought

One of the fastest growing cannabis sectors, projected to exceed $4 billion in annual sales by 2021, is cannabis-infused edibles. Many cannabis consumers prefer to attain the therapeutic or intoxicating effects of cannabis through the consumption of edibles, as opposed to inhalation through smoking or other means. The diversity of edible cannabis products is striking, and includes butter, honey, chocolates, olive oil, lemon cakes, and even pizza sauce. Chefs across the country are incorporating cannabis into elaborate culinary presentations.

The remarkable growth and success of the cannabis edibles industry is attributable to many factors, including sophisticated marketing and product development strategies. But perhaps more importantly, the edible industry has done a remarkable job of innovating and self-regulating to ensure the safety and quality of their products. Despite the lack of regulation, edible producers have demonstrated ingenuity and discipline in adopting responsible policies and procedures to ensure and enhance product safety.

Edibles present both common and unique safety and quality challenges for businesses, regulators, and policy makers. The safety of cannabis products, like any food, is dependent on many things, including traceability, supply chain integrity, proper lab testing for potency, pathogens, pesticides, heavy metals, etc. But there are additional safety considerations that are unique to cannabis and do not necessarily apply to other types of foods. These include secure childproof packaging, proper dosing (tolerance levels vary significantly between users), and consumer education. Edible producers, state regulators, and manufacturers are innovating and successfully developing the policies and procedures to address these risks.

Nevertheless, as the industry continues to grow, it will be important for cannabis industry entities to deal with the unique civil legal issues that are certain to arise. For instance, determining liability in product liability cases involving cannabis edibles will bring issues before the courts that have never been previously adjudicated. For food companies that choose to pursue the potentially lucrative opportunities, it will be vitally important to understand and mitigate the full range of potential risks—a feat that will necessarily entail the use of complex contractual agreements.

Regulation Challenges

Regulation of THC-infused edibles presents the most significant challenges. Consider that in some cases marijuana is a medicine, while in others it is a recreational intoxicant, and at other times it is both. Unlike most medicinal products, cannabis is a naturally occurring plant. It can be grown in a garden and does not require the strict manufacturing parameters required for the manufacture of most other medications. At the same time, THC is a powerful intoxicant, and due to its Schedule I status and its long-term effects, many express concerns that the effects of marijuana have not been adequately studied. Whatever policies one may support regarding the way marijuana should be regulated, there are compelling arguments to support them.

Colorado, which has some of the nation's most comprehensive cannabis regulations, observes numerous differences between the medical and recreational marketplaces. For example, Colorado residents with a Colorado medical cannabis card are not subject to minimum age restrictions, but any adult over the age of 21 can purchase retail cannabis products in person from cannabis stores, regardless of whether they are residents of Colorado. While ostensibly straightforward at the consumer level, these vagaries will likely create problems in terms of developing clear, consistent, policy-based federal regulations that apply nationally.

Traditional principles of federalism may offer the best course in developing and implementing effective cannabis regulations. The phrase "laboratories of democracy," coined by U.S. Supreme Court Justice Louis Brandeis, describes a legal process by which states serve as de facto "laboratories." They test novel social, legal, and economic experiments without subjecting the entire nation to the corollary risks of failed policy. Moreover, permitting states to adopt their own legal and regulatory policies encourages policy experimentation and provides valuable insight into what is (and is not) effective from a social, economic, and public health standpoint. Indeed, given the many social, economic, and legal consideration involved, we believe (as do many others) that the "states-rights" approach is the wisest course of action. In turn, we believe it is also the most likely approach the federal government will adopt. This approach would entail ending federal marijuana prohibition and allowing the states to regulate within certain broad parameters.

It is a fascinating time. Undoubtedly, cannabis issues are extraordinarily complex. They transcend our legal, social, geographical, and economic barriers. The many idiosyncrasies and ambiguities associated with cannabis will eventually have to be worked out. Indeed, we are only at the beginning of what is certain to be a long and policy-intensive process of enacting sensible federal cannabis laws.

At this point however, it does not appear likely that we will turn back. Rather, it appears cannabis is here to stay. The dramatic shift in cannabis law presents an exciting and potentially lucrative opportunity for food companies willing to enter the edibles market. If or when it is appropriate to do so, however, is a determination for each company to make. But when that time comes, ensuring the safety and quality of your products will be paramount. ■

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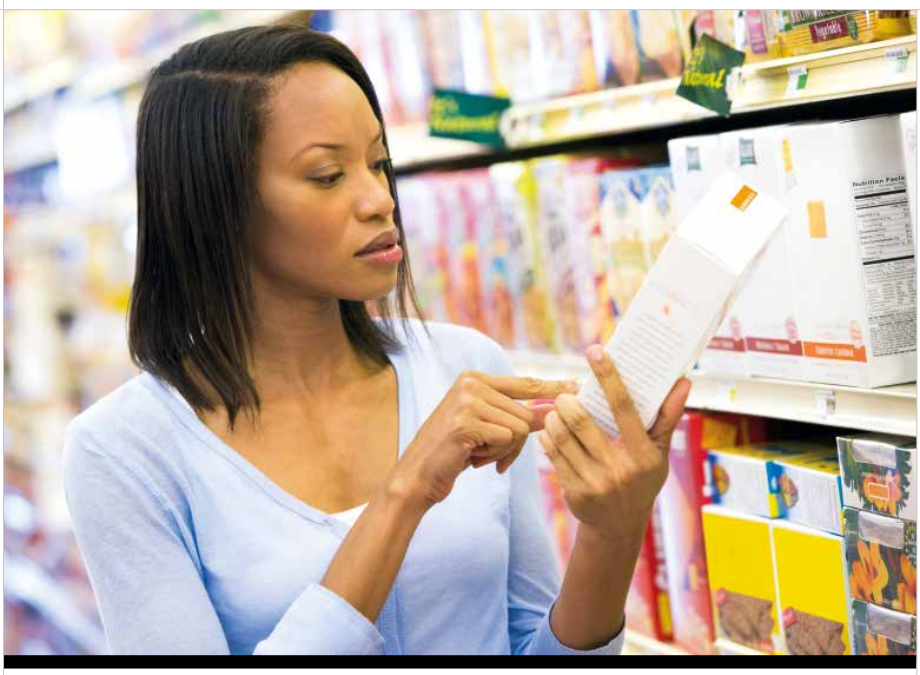
Global Interests



Labels *Do* Define You

Misbranding affects the industry's credibility and consumer trust

BY **AURORA A. SAULO, PHD**

Labels of food products sold in most parts of the world carry essential product information. In the U.S., a legal label for FDA-regulated foods consists of the principal display panel (PDP) and the information panel. The PDP is the front label panel read by the consumer and it bears the statement of identity or the common or usual name of the food, and the net weight.

The information panel is the panel immediately to the right of the PDP, and in 1990 included only the ingredient statement, Nutrition Facts panel, and the responsibility statement. The ingredient statement lists the ingredients used in product manufacturing in their decreasing order of predominance by weight. Nutrition Facts labels are required on most foods to declare the mandatory nutritional components unless additional nutrients are claimed. The responsibility statement gives the name of the manufacturer, packer, or distributor, and its street address or phone number. There are other requirements for food labeling compliance in the U.S. that will not be covered here.

The Nutrition Labeling and Education Act of 1990 mandated a standardized Nutrition Facts panel and defined terminologies for certain health claims or nutrient content claims. Further modifications to the food label occurred thereafter, including the Food Allergy Labeling and Consumer Protection Act of 2004 that required the declaration of one or more of the eight most common allergens if present.

In 2016, the first major revision of the Nutrition Facts label was promulgated to improve its ease of use in helping consumers make food choices based on new scientific information. All these label changes left the responsibility statement intact because FDA did not consider it as directly affecting the health of the consumer or the consumer's understanding of the nutritional information.

Responsibility Statement and Misbranding

The food label can help the consumer make informed decisions about the relationship of food to their health and wellness. This function is evident in the name of the food, how much food is in the package, the ingredients used to manufacture the food, the allergen warning, and the Nutrition Facts panel, but is not intuitively obtained from the responsibility statement, whose purpose is to allow the consumer to find and contact the responsible manufacturer, distributor, or packer.

Food labels are sometimes also used as a marketing tool. It is not uncommon to see a food label with a vignette of a place or a geographical location included in the product name, such as Hawaii pineapple, Idaho potato, Indian curry, or French Champagne. These labels market the romance and mystique from the geographical location associated with these specialty foods and often carry higher prices than their non-specialty counterparts.

Unfortunately, some manufacturers indiscriminately and falsely associate product names with geographical locations and vignettes. This practice of incorporating a geographical location in the product name that is different from that where the food originated (as declared in the responsibility statement) is a form of misbranding and is in violation of the Federal Food, Drug, and Cosmetic Act of 1938, which mandates that food labels must be truthful and not misleading.

Consumer Attitudes

In the early 1990s, as requested by the Hawaii Food Manufacturers Association, Christine Bruhn, PhD, retired, director, Center for Consumer Research at UC Davis, and I investigated how consumers behaved toward different examples of misbranded foods. Although FDA does

not routinely enforce misbranding because food origin does not affect public health, respondents (approximately 69 percent) considered misbranding to be an "important issue."

We described fictitious products, such as "Hawaii potato chips" and "Hawaiian Foods fruit cocktail." Seventy-three percent of respondents expected a relationship between the product name and the declared geographical place. Almost 80 percent considered it "inappropriate" when the product was not manufactured in Hawaii and the major ingredients were not from Hawaii, or the product was repackaged in Hawaii. When we stated the fictitious manufacturer, "Hawaiian Foods," was not located in Hawaii and the package vignette portrayed an iconic beach scene of Diamond Head and palm trees, almost 75 percent of respondents considered the label "inappropriate." Almost 80 percent of respondents indicated that an "inappropriate" label was "misleading," "deceptive," "borders on fraud," "lacks truth in advertising," and is a "lie." Sadly, almost half of respondents "expected such practices from the manufacturer."

To determine if consumer behavior toward food labels significantly changed since the early 90s, another misbranding study was recently completed using BiMiLeap (the app to Mind Genomics). Instead of asking the respondents one question at a time, BiMiLeap used a matrix of four characteristics with four elements describing each characteristic and using the ordinary least squares regression method for statistical analysis. For this study, the characteristics comprised of ingredients on the label, responsibility statement declaration, feelings evoked by label statements, and product price and value.

Results indicated that all respondents perceived that food label information was modestly honest (additive constant=37). Those who "most often" purchased food for the home had strong feelings that the "name or brand or vignette of the product is consistent with the manufacturer's location declared in the label" (coefficient=67), strongly considering product price and value when they shopped (coefficient=49). Coefficients of 10 or higher projected strong feelings.

Obtained data were mathematically clustered according to the pattern of how strongly they liked (i.e., coefficients) specific elements, resulting in two consumer mindsets. Mindset 1 strongly expected that the "name or brand or vignette of the product is consistent with the manufacturer's location declared on the package" (coefficient=24) and with "the product contained in the package" (coefficient=15). Mindset 2 reinforced those strong feelings of truthfulness of the product label, which, for them, pointed to "certain geographical locations" (coefficient=14) that state where "the product is made" (coefficient=10), that the "product is authentic" (coefficient=16), and may be of "good quality" (coefficient=24).

The statement that denoted truthful/not deceiving branding was "All contents were grown, raised, harvested in the geographical location stated on the label" (coefficient=7, response time=0.9 s), chosen by the respondents in one of the shortest response times. For this part of the study, transformation to binary value was made stricter such that coefficients of 6 or higher denoted strong feelings. The statements that denoted not truthful/deceiving branding were "Majority of contents were from a geographical location other than that stated on the label but cooked then packaged in the geographical location on the label" (coefficient=7, response time=1.3 s) and "Name or brand or vignette of the product and the manufacturer's location do not make sense" (coefficient=6, response time=1.5 s). The respondents took half as much more time to decide if the claim was not truthful/deceiving than that denoting truthful/not deceiving.

Results of the early 90s study and the more recent study indicate that consumer behavior toward misbranding of food labels has not significantly changed. Consumers still expect product label information and vignettes to be truthful and not misleading. But misbranding issues continue to occur.

Some Cases of Misbranding

In November 1996, Michael Norton of Kona Kai Farms was indicted for money laundering and wire fraud when he imported coffee beans from Panama and Costa Rica through a front company, removed the beans from the original bags, and re-bagged the same beans into Kona Kai Farms bags labeled "Pure Kona Coffee." It was expected that this scandal would change labeling rules, but it did not.

More recently in July 2018, the Chicago-based company Aloha Holdings LLC issued cease-and-desist letters to two businesses in Hawaii for using the words "Aloha" and "Aloha Poke" that the company has trademarked. Aloha Holdings LLC issued an immediate stop to the use of these words when selling food, products, and services, and "all packaging, marketing materials, advertising, photographs, Internet usage." Mainland U.S. businesses using those trademarked words were also issued letters resulting in a Washington restaurant dropping "Aloha" from its former name to become Fairhaven Poke and another in Alaska to rebrand as Lei's Poke Stop.

In November 2018, two consumers took legal action against Pinnacle Foods Inc. of Washington state, the parent company of Tim's Cascade Snacks that sells "Hawaiian Kettle Style Potato Chips," for the use of the word "Hawaiian" that the company registered. The product labels featured tropical scenes unique to Hawaii, such as palm trees by the beach with hula dancers and Diamond Head. The plaintiffs considered the labels "false and deceptive advertising" and contended that the company practiced "fraudulent and unfair business practices." The potato chips are made in Algona, Wash.

The above are typical examples of cases that are not considered public health concerns by FDA. These practices do not align with consumer expectations of truthful and not misleading behavior and support consumer contention that the food industry is neither honest nor trustworthy.

Although the responsibility statement was treated as not directly affecting the health of the consumer, recent foodborne outbreaks have indicated otherwise. In spring 2018, foodborne illnesses occurred due to contaminated romaine lettuce. As of June 28, there were 210 illnesses and five deaths in 36 states. There were no associated food recalls issued, only public health alerts because of difficulty in identifying the implicated product. Many retailers removed from sale all products that could have been potentially contaminated. It was a complex web of product growing,

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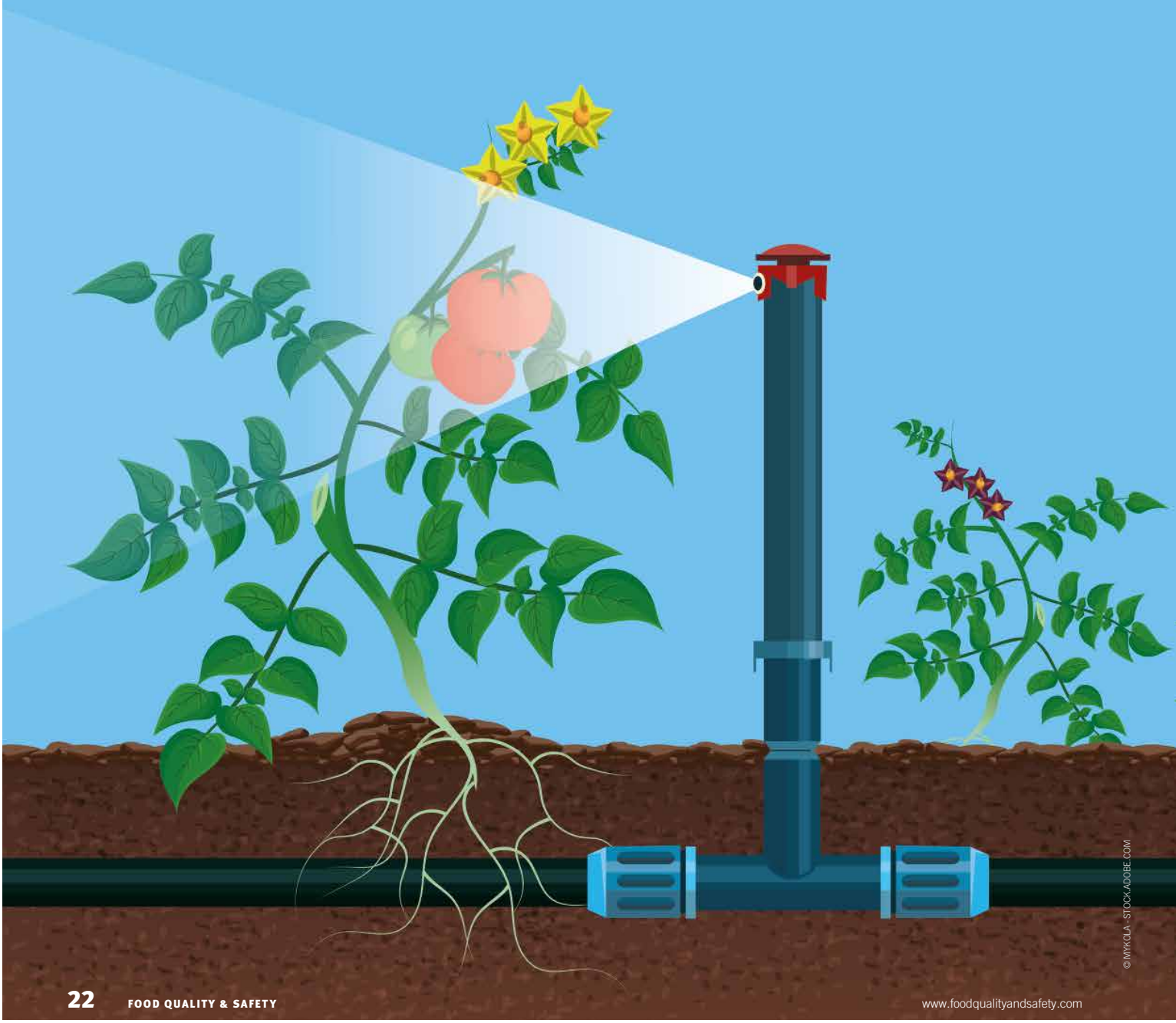
Agricultural Water

Bringing the complications of irrigation safety to the surface

BY **JESSE STANIFORTH**



The year 2018 was a hard time for romaine lettuce. Two massive, multistate *E. coli* outbreaks associated with leafy greens occurred (even extending into Canada), sickening hundreds of people and killing at least five. But as the outbreaks wound down, the culprit appeared even more difficult to control than leafy greens: It was a matter of contaminated agricultural water. And while the puzzle of making agricultural water safe has challenged food safety experts for a long time, the 2018 outbreaks introduced the question to the general public, many of whom now joined in asking, "How do we ensure the water used to irrigate fresh fruit and vegetables is safe?"

"Both the spring and fall outbreaks were devastating to the leafy greens industries," says Jennifer McEntire, PhD, vice president of food safety and technology for United Fresh Produce Association in Washington, D.C. "In both cases, it appears that there is an environmental source of the pathogen. This is a new type of challenge in that it's not about preventing an occurrence at a single point in time—it requires a revaluation of the system. Agricultural water has always been recognized as a risk and has always been managed."

Luke LaBorde, PhD, professor of food science at Penn State's College of Agricultural Sciences, concurs, underlining that the safety of agricultural water has always been notoriously hard to control.

"Especially," he tells Food Quality & Safety, "if you're using surface water from streams and irrigation ditches and things like that—it can change very suddenly. It can take some contamination upstream, what they call 'point contamination,' and spread it over wide distances, sometimes unexpectedly. In the case of the romaine outbreaks in Yuma, Arizona, it's thought that there were irrigation ditches used for their produce farms that ran adjacent to animal-holding facilities. Now, we've known for a long time that that's not a good idea. But still it happens."

This contradiction is at the crux of agricultural water safety, Dr. LaBorde says. Though many farms know what approach they should be taking, they can be limited in their ability to implement them by financial concerns and other challenges like a lack of control over how neighboring farms handle waste.

"It's tough, because people are slow to change their whole operation," he says. "There are all sorts of things people can do, like keeping the animal facilities farther away and watching for drainage and run-off, but if it's not your property, it's kind of hard to control what other people do."

Yet Rebecca Ozeran and Brooke Latack, livestock advisors at University of California Cooperative Extension, note that industry has hardly been inactive on the issue of agricultural water safety—particularly not the leafy greens industry.

"The food safety community has long been aware of the risks of water contamination, and water quality has not been ignored in food safety practices," Ozeran and Latack jointly explained in an email to Food Quality & Safety. "Most leafy greens growers in the U.S. (producing about 95 percent of our lettuce) are already certified by the Leafy Greens Marketing Agreement, which [...] regularly audits food safety practices at all certified operations. But there are inherent risks of contamination from eating any food produced in an open system. It is not feasible to grow all our crops in sterile, enclosed environments. Although operations can and do follow many practices to reduce the risks of food contamination and foodborne illness, the risks will never completely disappear. Even the best possible regulations and management will never achieve permanent zero percent contamination."

Sampling Falls Short

The overarching problem, says Dr. LaBorde, is that regardless of regulation, some producers will inevitably end up facing situations they couldn't have predicted. Existing regulations demand sampling and provide metrics for microorganisms, particularly (the largely harmless) generic *E. coli*, a good indicator of fecal contamination that can signal pathogenic *E. coli* or *Salmonella*. Even when sampling water according to regulations, a facility may miss pathogens.

"Taking some samples periodically is just not going to catch unexpected situations," Dr. LaBorde says. "You can't ask people to do more unless there are some assurances that what they are actually doing is going to have a public benefit. This *E. coli* sampling, for instance, sometimes it works, sometimes it predicts, sometimes it doesn't. But all the studies that have come out say it's a very poor predictor of human pathogens in water."

Phyllis Posy, vice president, strategic services and regulatory affairs, for UV-water-treatment firm Atlantium Technologies, agrees. "Taking a sample is just that—an indication of that time and place," she says. "How many folks are going to sample right after the rain stops, or when the temperature is coldest or warmest? We don't catch the extremes and that may be when the contamination is measurable."

Compounding the problem, says Dr. LaBorde, is the likelihood that sampling will miss contaminated silt in a reservoir or ditch. In the case of the Yuma *E. coli* outbreak, he recalls, "Some people say

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Compliance Dates for Agricultural Water Provisions Extended

FDA issued a rule on March 15, 2019 to finalize the new compliance dates for the agricultural water requirements in the FSMA Produce Safety Rule. Larger farms are now required to comply by Jan. 26, 2022, while small farms have until Jan. 26, 2023 and very small farms until Jan. 26, 2024. This rule does not change the compliance dates for sprout operations.

These compliance dates have been extended while the FDA considers how best to protect public health while addressing widespread concerns about the complexity of the agricultural water requirements and the practicality of implementing them across a wide variety of farms, water sources, and uses. The FDA intends to use this time to work with stakeholders to address these concerns.—*FQ&S*

(Continued from p. 23)

it might have been silt at the bottom of a ditch that was stirred up. Bacteria can attach to silt, so you may not have picked them up in the water itself. But if that silt or sediment is upset by mixing and flowing, then it can get into the irrigation system and onto the produce."

Ozeran and Latack also note the difference between surface-water quality and the presence of pathogens in water sediment. While changes to weather can change the constitution of surface water, "sediment that collects at the bottom of a reservoir, canal, or stream tends to have higher concentrations of bacteria than the water itself. With a rainstorm causing hillside runoff or flooding, sediment and the bacteria living there can become suspended in the water. Turbid water after a storm therefore may have a higher concentration of bacteria than it had before the storm."

While Ozeran and Latack encourage sampling as frequently as possible, and recording general site conditions while sampling (such as whether a flock of birds has recently been in the reservoir) in order to be informed about conditions affecting water quality, they acknowledge that available technology doesn't allow constant monitoring, making constant measures for the moment impossible.

United Fresh's Dr. McEntire puts it even more bluntly: "The bottom line is that there is no good testing protocol."

Drinking Water Is Not Irrigation Water

Dr. LaBorde says a foundational problem with discussions about water safety is that standards applied to drinking water are not applied to irrigation water, with good reason. Initial approaches to *E. coli* were based on incidences of sudden contamination such as a baby's diaper in a small lake, which is difficult to apply to irrigation.

"Transferring [an approach grounded in public health epidemiology] over to water that gets on a plant, that's different to your exposure when you're swimming and your mouth is open and you're gulping water," Dr. LaBorde adds. He notes that research on this subject is ongoing, with researchers trying to improve the means of quickly identifying fecal contamination. "But it's very frustrating for everybody because the systems just aren't that good right now, and while there is a lot of research to improve that, it takes time. I don't think there is a good answer right now. The thinking has been, 'Well this is good enough for now.' We've got to do something."

Meanwhile, says Posy, it's unwise to attempt to apply EPA drinking water standards to irrigation due to volume alone. She stresses that EPA has zero responsibility to oversee agricultural water, since its domain is limited to drinking water.

"If you use [drinking water] for something else—say a company uses it as an ingredient or a processing aid—you can't rely on EPA drinking water rules since the risk assessment on which those rules are based is for a household use of drinking water at less than one illness for 10,000 exposures," says Posy. "But a household won't have 10,000 exposures for about two to three years; a food plant will have 10,000 exposures the first day of the month!"

Is Treatment an Option?

Approaches to treating water differ, but for most the principal sticking point for irrigation water treatment is the price. Daniel Snow, PhD, lab director of the University of Nebraska's Water Sciences Laboratory, argues, "I think monitoring and understanding impacts to irrigation water quality is clearly important, but treatment will be extremely difficult and prohibitively expensive in comparison to monitoring and treating drinking water."

The difference, says Dr. LaBorde, is the massive volume of water used for irrigation—much of it turbid and full of organic matter.

"It's not like you can put some chlorine in a bucket of water," Dr. LaBorde says. "This is thousands and thousands of gallons. But some people have done that: They've had systems that run irrigation water through large pellets of chlorine, and it comes out treated. But chlorine isn't a very good sanitizer for high turbidity water."

The other question, he notes, is whether treatment is actually practical.

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"There is a real disconnect between the food safety community and the water safety community, both on the government and food processor/supplier/grower sides,"

says Phyllis Posy, VP, strategic services and regulatory affairs, Atlantium Technologies.

Trying to imagine how much sanitizing agent one would need to treat the water for a major leafy-greens farm, Dr. LaBorde comments it simply costs too much, though such an approach might be workable in smaller farms that would not have to invest as much as a major operator to treat the volume of their irrigation water.

"Some people are actually shifting away from surface water and going to well water," Dr. LaBorde says. "In theory it's quite a bit less risky because if it's a good well and it's maintained, it's not exposed to the surface and unexpected events and flooding." Yet wells—which demand access to a potable aquifer—are not always available, Dr. LaBorde notes, while "out in California, they have had a drought. Those wells are getting low, and there's only so much water."

Posy, however, believes there is a role for treatment to play in agricultural water safety. "Since chemicals can have disinfection by-products and require serious control to make sure they do not have impact on the produce itself, I'm a fan of UV disinfection," she says. "Even if you overdose the water, there's no negative impact downstream. Watering cycles are not 24/7—we need to get smarter about how to employ treatments that are well controlled and portable as well as remotely controlled. There are systems available that treat water by measuring the real-time quality of the water and using only the dose needed, when needed. Integrated reporting means that the machine tracks key parameters and tells you when you need to pay attention. The key is to use validated systems, not just 'check-the-box' systems."

Best Pathogen Practices

There are simply no easy solutions to the questions surrounding irrigation water safety, says the University of Nebraska's Dr. Snow.

"At the very least, we might consider developing programs to evaluate irrigation water safety in areas with intensive food crop production," he says, adding, "Regulation is seldom an efficient means for solving complex problems. If regulations governing irrigation water quality are being considered, there should be sound science supporting the type of monitoring and controls to be implemented."

This is what concerns Dr. LaBorde as well. Above all, he says, we simply don't know very much about irrigation safety, and many of the practices we've attempted to put into place for reducing pathogens are very expensive but may not be proven to reduce contamination risks. For smaller operators, shelling out for testing procedures they're not even sure will keep their produce safe is a source of resentment.

Dr. LaBorde says, "It always comes back to: 'Are you really sure that it's the best way to be certain the water is safe for its purpose?'"

We may not have very many answers right now, but the shortest route to better practices is discussion, says Posy. "There is a real disconnect between the food safety community and the water safety community, both on the government and food processor/supplier/grower sides," she says. "There's even less dialogue on the discharge/recharge side. We need more dialogue and forums."

For Ozeran, getting irrigation safety right comes down to developing high-level policy that balances scientific evidence, industry capacity, and pre-existing practices in the industries in question.

"For instance, if an industry is already implementing the best available practices but still experiencing food contamination," she says, "then we need to support additional research to identify better ways to reduce contamination risks. If new policies cannot be implemented, or lack scientific support, then those policies will not improve food safety."

The Food Safety Modernization Act carries with it a set of regulations pertaining to produce and agricultural water, but for Dr. McEntire it's important to remember those regulations reflect minimal standards for a marketplace that has internal requirements generally exceeding those demanded by regulation, and often more frequently inspected.

"Most growers are subject to one or more annual food safety audits that include

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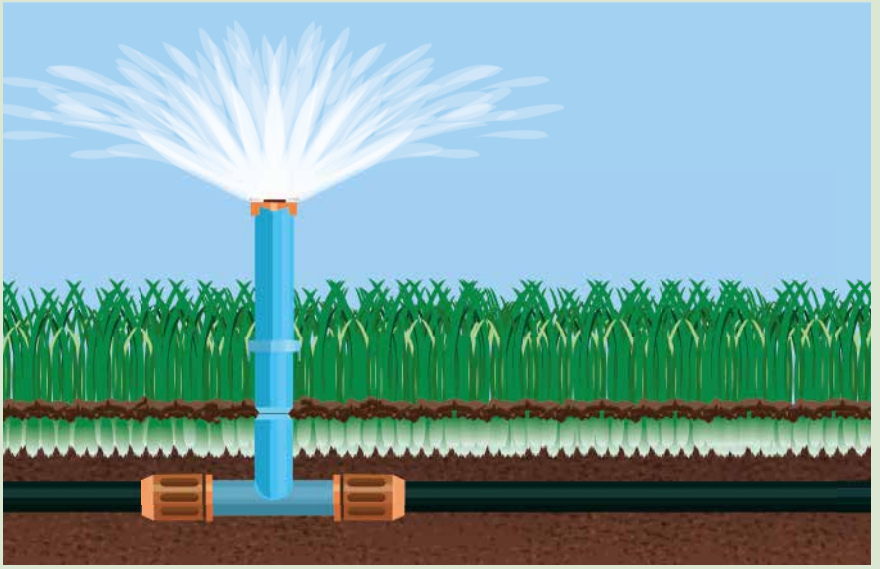

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United Fresh's Dr. McEntire puts it even more bluntly: "The bottom line is that there is no good testing protocol."

Special Report

The Health Controversy Behind Ultra-Processed Foods

Ultra-processed foods are being unscientifically portrayed as unhealthy based on misused dietary epidemiological methodology

BY **ROGER CLEMENS, DRPH,** AND **PETER PRESSMAN, MD**

Among the most controversial and contentious topics in contemporary foods and their impact on nutrition quality and health status is the concept of "ultra-processed foods," a concept that was actually discussed during deliberations by the 2010 Dietary Guidelines Advisory Committee. Thankfully, common sense prevailed as the committee deferred the topic to U.S. statutory definitions of processed food and minimally processed food. Even in this space, there are multiple definitions and descriptors established by the World Health Organization, USDA, and European Food Safety Authority, just to name a few.

Fundamentally, all foods that humans consume are processed in some manner from post-harvest activities to preparation in the typical home kitchen. Within the U.S., processed foods are those, other than raw agricultural commodities, that are subjected to washing, cleaning, milling, cutting, chopping, heating, and many other interventions that transform food from its innate state. With respect to minimally-processed food, most of the inherent physical, chemical, sensory, and nutritional properties are retained.

The NOVA Food Classification

Since 2010, numerous organizations, health authorities, and scientists, in search of a "cause" of obesity and poor health, have grouped foods into four categories termed NOVA (not an acronym). NOVA is the classification that categorizes foods according to the extent and purpose of food processing, rather than in terms of nutrients. The NOVA categories are:

1. Unprocessed or minimally processed,
2. Processed culinary ingredients,
3. Processed foods, and
4. Ultra-processed foods.

Examples of processed ingredients include vegetable oils, margarine, butter, cream, lard, milk and soy proteins, sugar, sweeteners of all types, starches, flours, "raw" pastas and noodles, salt, gums, preservatives, and cosmetic additives. Transitioning to ultra-processed foods, there are sugared beverages, juices, milks, "no-calorie" cola, infant formulas, follow-on milks, baby food, cheeses, sauces, and salted, pickled, smoked, or cured meat and fish. Also included are breads, breakfast cereals with added sugar, bars, savory and sweet snack products, chips, and crisps.

Upon close examination of NOVA categories and nutrient bioavailability, there appears to be a spectrum of evidence from the National Health and Nutrition Examination Survey analysis that indicates fortified ready-to-eat cereals provide positive nutrition, especially among those at-risk populations that typically fail to achieve nutrient adequacy, such as children, pregnant and lactating women, and seniors. In addition, as many investigators advocate potential health benefits of bioactives from plants, processing enhances bioavailability of many of these bioactives while improving the safety of these foods. For example, toxins that are innate to most of agricultural commodities, such as carrots (falcarinol), cassava (cyanogenic glycosides), radishes (isothiocyanate), parsley and celery (psoralens), cruciferous vegetables (goitrin), and even citrus fruit (limonene), are actually reduced, removed, and/or destroyed during many conditions of thermal processing.

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It is imperative to remember that the processing of fruits and vegetables actually contribute to their increased consumption. Of course, these foods provide an array of shortfall nutrients, such as potassium and dietary fiber. With respect to dietary fiber, the NOVA categorization contends that grains are transformed from minimally processed (whole grains), to processed ingredient (flour), to processed food (bread ≤ 5 ingredients) to ultra-processed foods (cereals and breads > 5 ingredients). Importantly, NOVA does not address whole grains, high fiber, or nutritionally enhanced foods in the categories and how processing actually enhances nutritional value consistent with dietary recommendations.

A Number of Studies...

Using a 24-hour dietary records approach, the 2018 French self-reporting, web-based NutriNet-Santé study published in The BMJ indicated that ultra-processed foods were considered of lower nutritional quality, primarily due to the presence of food additives and food-contact substances in packaging materials, and that these foods were associated with an increased risk of cancer (prostate, colorectal, breast) based on a Cox proportional hazard model. On the other hand, an earlier 2014 report published in Nutrition Today indicated food processing improves retention and bioavailability of bioactive food components, minimizes the formation of some carcinogens, and improves the overall quality and acceptability of foods.

A 2019 extension of the French NutriNet-Santé observational study published in the JAMA Internal Medicine indicated the consumption of ultra-processed foods was associated with an increased risk of early mortality among adults. The study participants consumed a reasonable composite nutrient profile, while the investigators noted these foods actually contributed lower levels of calcium, B-vitamins, and complex carbohydrates, just to identify a few. The classic use of Cox proportional hazards regression indicated a 95 percent confidence interval of 1.04 to 1.32. However, the authors noted a limitation that the included population mortality rates were probably lower than those of the study participants, and possibly this variable may underestimate the association.

Reflecting on this study, it remains somewhat arbitrary to define foods that have > 5 ingredients as ultra-processed. Food ingredients and food additives are safe and provide function and stability to those products. While the authors mention these variables, the study does not provide any data on the quantitative consumption of food additives, but only speculates on their association with longevity. It is interesting that, for example, homemade or artisanal bread is not considered ultra-processed, whereas the same product produced by the food industry using the same ingredients is considered ultra-processed.

> Fundamentally, all foods that humans consume are processed in some manner from post-harvest activities to preparation in the typical home kitchen.

A closer examination of this study certainly reveals that perhaps lifestyle, living alone, smoking, obesity, and low levels of physical activity are contributing factors to mortality rates. In addition, a review of the survey instrument calls into question of validity and even calculation of nutritional intake. Importantly, the study cannot establish that ultra-processed foods cause an increase in the short-term risk of death, especially since the differences in death rates between consumers and non-consumers of ultra-processed foods were small—in fact, the authors state, "No causality can be established for the observed associations."

A number of epidemiological studies suggest the consumption of ultra-processed foods contributes to excess calorie consumption and obesity. These kinds of studies from Sweden (1960-2010), the U.S (2005-2014), Brazil (2008-2009), Mexico (2012), and Europe (data from Living Costs and Food Survey and Data Food Networking 1991-2009) indicated an association with the consumption of ultra-processed foods and the increased risk of obesity and other non-communicable diseases. However, the association indicated by R^2 value ranged from 0.30 to 0.63, depending on adjustments for variables such as smoking and physical activity. Within the U.S., a 2017 study suggested these foods were associated with obesity and adverse cardiometabolic outcomes in the absence of any statistical justification.

The Necessity of Processing

It is important to point out that epidemiological studies do not directly indicate a causal impact. As a famous toxicologist once said, "Mathematics does not drive biology; biology drives mathematics." Statistical association without a plausible biological explanation or hypothesis is likely to represent little more than a spurious connection.

Moreover, one can argue that no single attribute of food processing contributes to an increase or decrease risk of a given chronic disease. Foods represent complex matrices with multiple nutrients and physical characteristics. For example, whole grain consumption may reduce the risk of hypertension and visceral adiposity. However, grains must be processed so that their nutritional contributions may be realized.

The NOVA classification of foods and its purported impact on more healthful dietary patterns is being considered a key justification within dietary guidelines recommendations. The concept of "ultra-processed" foods has morphed considerably since 2009. Food products continue to be reformulated across food categories such that those foods are components of dietary patterns consistent with those recommendations. Even with these efforts, it is critical to remember that all forms of processed foods are important components of the food supply chain. In fact, they reduce food insecurity issues, provide sources of vital nutrition, contribute to consumer choices, and even stimulate regulatory guidance in food composition and health claims. ■

Dr. Clemens, who has more than 40 years of experience in the food industry and academia, is an adjunct professor at the USC School of Pharmacy in Los Angeles and is presiding officer for the International Academy of Food Science and Technology. Reach him at clemens@usc.edu. **Dr. Pressman** is director, medical operations, at Polyscience Consulting, Chatsworth, Calif. Reach him at ppressman@polyscienceconsulting.com.

References Furnished Upon Request

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Basic Sanitation: Identifying 'Hot Spot' Areas

An effective sanitation protocol starts with a thorough inspection of a facility to locate areas and operations that could be root cause of a sanitation issue

BY **SHANE MCCOY**

A common catchphrase in pest management is, "If it's not documented, it didn't happen." This is true of the steps a pest management technician takes while serving a facility, but it's also true of the steps QA or plant managers must take to plan and implement good sanitation protocols.

Poor or haphazardly followed sanitation protocols are a leading cause of pest infestations in food processing, storage, and distribution facilities. Failing to sweep it up, wipe it up, and wash it puts a facility at a much higher risk for a possible pest issue. Failures in sanitation practices can also lead to poor or failed audits and inspections, contaminated products, and costly recalls that damage both your bottom line and brand reputation.

In fact, the British Retail Consortium (BRC), which audits tens of thousands of facilities, identified documentation (or more specifically, the lack of proper documentation of cleaning procedures) as the most common reason for audit failure. Almost 20 percent of facilities audited by the BRC had non-conformities in documentation of cleaning procedures.

Good sanitation starts with having a written plan that is communicated to employees from top to bottom to ensure buy-in and accountability. Not only is good sanitation a series of actions, it is also a mindset.

Where to Start

Creating a good sanitation protocol starts with a thorough inspection of a facility to identify areas and operational practices that could be the root cause of a sanitation issue. It's important to ask questions like, "What areas are most susceptible to sanitation issues?" or "Where do you start your inspection?"

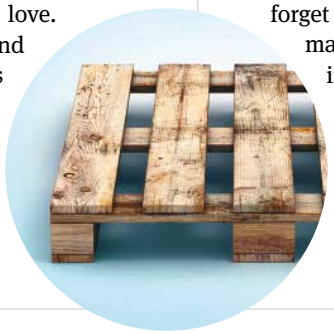
A sample sanitation checklist can be found in the sidebar on page 42, but to get you headed in the right direction, you need to know the "hot spot" areas inside and outside a facility.

The Inside

On the inside of facilities, the first-in and first-out inventory management system is a good practice to follow. If product has been sitting on a shelf two years past its use date, it can spoil and attract pests. Be sure to document using a barcode system when product arrives and when the "use by" date is approaching.

The following are potential indoor areas of concern.

Floor drains can be a big issue due to the buildup of food particles, water, and other organic matter that small flies and cockroaches love. Regular inspection and sanitation treatments are a must.



Processing machines can produce significant amounts of splatter and spillage. It may be necessary to regularly take apart certain machine components to clean and inspect for pests.

> Food waste may not be properly cleaned up in breakrooms, and vending machines may have food and liquid spillage.

Ceilings are a source of cobwebs and spider webs, and overhead pipes and exposed beams in warehouses must be cleaned regularly to prevent dust buildup that attract warehouse beetles and other pests.

Loading docks are collection points for everything workers don't know how to discard. Broken-down pallets, damaged shipping boxes, and spilled food commodities placed there can attract pests.

Breakrooms, cafeterias, locker rooms, and restrooms are prime pest hot spots because of the abundance of food and harborage locations. Employees bring in food and store it (and sometimes forget it) in lockers. Food waste may not be properly cleaned up in breakrooms and vending machines may have food and liquid spillage. All these are pest attractants where regular cleaning and staff education are needed to reduce the threat.

Roof leaks lead to big sanitation issues and the potential threat of harmful bacteria, including *Salmonella*, from bird droppings on the roof. If water collects in remote areas of a plant, it can support mold, fungi, and insect activity.

The Outside

The inside of a facility isn't the only place to check for sanitation hot spots. Regularly assess the following outside areas as well.

Railroad sidings are prime areas for food spillage that can attract rodents and birds.

Weed control around plants and rail lines will eliminate potential pest harborage areas. Mow grass regularly, trim trees and bushes, choose plantings correctly (non-fruit bearing trees and bushes), and leave a 2-ft.-wide rock barrier around the exterior to reduce rodent burrowing.

Proper drainage is essential to eliminating fly, termite, and mosquito harborage areas. Make sure drains in the parking lot and loading dock are clear, irrigation pipes and sprinkler heads are not leaking, and that gutters and downspouts drain away from the building.

Garbage and recycling dumpsters need to be placed on a concrete pad at least 100 feet away from a structure. The pad and the bin need to be cleaned regularly—"dumpster juice" is very attractive to flies, rodents, and stinging insects—and lids are a must. Staff members should not place bags around the bin when it is filled. Facility managers need to request more frequent trash pickups if this is a frequent occurrence.

Equipment, including pallets, pipes, storage racks, etc., needs to be stored away from loading dock doors and entrances, and all items need to be cleaned before they are brought back inside.

Good sanitation is achieved when everyone is working from the same playbook, and proper resources are allocated to training and equipment (e.g., mobile cleaning stations). Good sanitation practices must be part of a plant's culture, and the staff should be incentivized to make it a priority. For example, consider rewards for those who complete 100 percent of the master sanitation tasks, or give rights and authority to employees for identifying unsanitary practices. Staff can also determine specific metrics to track progress, or attend sanitation seminars to find out new trends and products.

A strong sanitation program complements a good food and worker safety program. Everyone has a stake in the process, and everyone wins when it is done well. ■

McCoy is director of quality and technical training for Wil-Kil Pest Control, Menomonee Falls, Wis. Reach him at smccoy@wil-kil.com.

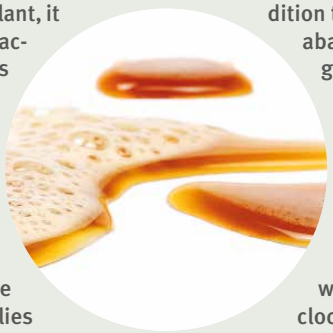
For a sample **sanitation checklist**, go to page 42.

Sanitation Horror Stories

Every pest management professional has walked into a food industry facility and stopped in their tracks due to poor sanitation practices—some intentional, some not.

Below are a few examples of situations where poor sanitation practices undermined even the best pest management programs.

The Case of the Spilled Soda. A soda manufacturer was experiencing an issue with fruit flies and could not figure out why. Upon arrival at the plant, it was noted there were no access aisles against walls to conduct inspections and cleaning (an 18- to 24-in. space is recommended). Pallets were haphazardly pushed up against walls and sugary liquid spillage accumulated beneath the pallets, providing fruit flies a prime breeding location.



Lesson Learned: Good sanitation practices include giving your maintenance and cleaning crews access to the areas that need cleaning.

A Cheesy Situation. During a routine inspection at a cheese manufacturing facility, a technician checked the floor drains in the processing area. The technician noticed the P-trap had fallen off the drain and was lying on rock bed underneath the cement slab. The drain was not connected to the sewer line, and cheese particles and water were falling unabated to the ground under the slab creating conditions conducive for cockroaches and phorid flies.

Lesson Learned: Frequent inspections are a must to stay on top of sanitation-related issues—if the technician had not taken the time to shine a flashlight down the drain, the buildup would have continued and the pest issue metastasized throughout the plant.

River Rats. Norway rats were gaining access to a large food storage and distribution facility located near a river in a major metropolitan area. In addition to the river, there were abandoned buildings, overgrown lots, and the facility stored pallets and located its dumpster right next to the building. This all added up to a facility with severe rodent pressure. It was a 24/7 facility, so doors were left open around the clock and an automatic door motion detector was installed to help keep doors closed when not in use. However, one of the workers put a piece of tape over the door's eyelet to stop it from closing, giving the rats easy access. Once inside, the rats left droppings and urine, and chewed through shrink-wrapped pallets to eat and spoil the food that was awaiting shipment to hungry consumers.

Lesson Learned: Part of a good sanitation protocol is training employees on what *not* to do to allow easy pest access to a facility: leaving doors open, storing pallets next to the building, and placing a dumpster close to a door.—*S.M.*

Color Me Safe

How facility owners and managers can best communicate their color-coding plans to the employees responsible for carrying out the plans

BY **ADAM SERFAS**

You created the perfect color-coding plan for your facility. Your new hygienic, color-coded tools came in the mail and have been hung on corresponding color-coded shadow boards or wall racks. Everything looks ready to go—but your job here isn't done and the tools shouldn't be touched until you do one very important thing: hold a company-wide training on the new color-coding plan.

In fact, your color-coding plan isn't a "perfect" plan at all unless it makes note of the necessity for regular employee training procedures. While some simple internet searching can return best practices for mapping out a facility color-coding plan, not much guidance is given on how facility owners and managers can best communicate the plan to the people who will be expected to carry it out.

Here are eight best practices for conducting training on a facility color-coding plan to get you started.

1. Pick a Time and Place that Works for Everyone

A facility-wide color-coding plan should be understood by everyone in the facility. That means it's important to schedule training when all employees can be in attendance. In the case of shift workers, consider holding more than one training session. Some facilities choose to record training sessions for employees who are unable to make it to an in-person session. Should you use this method, be sure to follow up with employees who receive training via video to see if they have any questions afterward.

2. Keep Your Training Simple

Any facility color-coding plan is more likely to be followed when it is kept as simple as possible, and the same goes for your training session. Aim to develop a quick, easy-to-understand training about the color-coding plan that can be completed in 20 minutes or less. If you find that time limit to be unreachable, consider whether or not the color-coding plan is indeed as simple as it should be.

> Focus on *why* you're color-coding, what it can help prevent, and what benefits it offers to the facility and to keeping everyone, including them, safe.

3. Address the Importance of the Training Right Away

We've all been in meetings where the unsaid thought in the back of everyone's mind is, "Why am I here?" Generally, that thought leads people to mentally check out of the meeting—something you don't want to happen when discussing something as important as quality and safety of your facility and products. To combat this, kick off the meeting with a recap of the necessity of the plan and the training session. Anyone can look at a color-coding chart and see what each color means. Focus on *why* you're color-coding, what it can help prevent, and

what benefits it offers to the facility and to keeping everyone, including them, safe. Does the facility handle allergens? Highlight the importance of keeping allergens separate. Does the facility handle toxic or flammable chemicals? Highlight the safety concerns of using them in the wrong area or letting them touch product.

4. Ask for Questions

Create a training atmosphere where employees are comfortable interjecting to ask questions as they arise. Be sure to start the presentation by making this clear and, when you're done going over the plan, invite questions once again. Some employees might prefer to ask questions without the presence of a large group, so offer yourself up for one-on-one sessions following the training. The last thing you need is an employee who isn't sure of the right procedure but doesn't confirm their assumptions due to a belief that questions aren't welcome.

5. Consider Bilingual Training Sessions

If the facility employs many non-native speakers, you'll likely need to hold training sessions led by someone who speaks the primary language of the employees. This topic is too important to be lost in communication, so be sure to work with human resources to understand the needs of your team going into training.

6. Use Real-World Examples

Remember in school when you used to question when in the "real world" you'd actually apply what you were studying? When told that what you were learning would indeed be applicable in adulthood, you tended to listen more because it seemed to be more deserving of your attention span and brain space. The same principle applies here. It's a good idea to use real-world examples that speak to the gravity of what's at stake. Fortunately, or perhaps unfortunately, there are many examples of food safety breakdowns in the news on a regular basis. These news stories reinforce the frequency of these failures and let employees know that yes, "This can indeed happen to you."

7. Keep the Plan Visible at All Times

Post the plan around the facility so it's accessible long after the training is over. Keep signage simple and easy to understand, and consider adding bilingual versions as needed.

8. Revisit the Need for Regular or Updated Training Sessions

Every color-coding plan must be reviewed on a regular basis to identify potential issues and updates. Should anything change with the plan, it's essential to hold a training session to explain the modifications. It's also important to work closely with human resources to ensure that when new employees are onboarded they receive proper training. Besides needing to address new plan updates and new employees, you should be holding color-coding plan training on a regular basis to provide a refresher on expectations.

The best color-coding plan is truly only as good as the training procedures designed to interpret it. Food quality and safety is a serious business—just one employee in a facility who's unclear on color-coding procedures can have devastating effects. The very best way to mitigate mistakes is by holding clear and regular training so no guesswork takes place. ■

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State of Training in Food and Beverage Industry

TalentLMS recently surveyed 200 employees in various roles (managerial, behind-the-scenes, and customer-facing positions) in the food and beverage industry on the topic of training. It discovered that 52% of respondents say they only received training when they started working at their current position (a.k.a. onboarding training). This means that only 48% of employees have some experience with continuous learning at work.

In regards to what type of training employees receive, compliance training came out on top. Roughly 38% of employees indicate they received quality assurance, compliance, and food safety training.

When asked to describe their training, 75% of respondents depict it as compelling, constructive, and team-building.

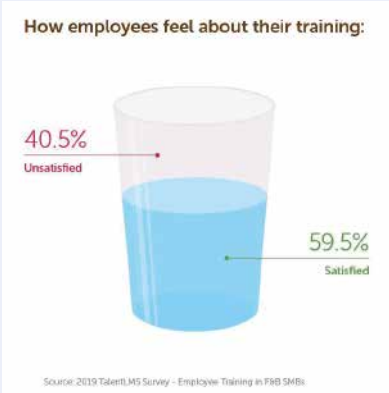
However, in terms of satisfaction with their food industry training, 40.5% of respondents are unsatisfied.

Other stats include:

- 43.5% of respondents said training boosts their motivation;
- 47% of respondents said their training builds their confidence;
- 46% of respondents elevated their problem-solving skills through training;
- 61.5% said that training enhanced their overall professional performance; and
- 4% of respondents say they don't want any more training.

The survey also asked employees whether lack of training of any kind would influence their decision to leave a company: 62% said yes.

To access the complete report, go to https://bit.ly/2XRSWJ2.—*FQ&S*



In The Lab

CONTAMINANTS

Locating Microplastics in Bottled Water

Using spectroscopic analysis to find and identify trace microplastic contaminants in consumer goods before they hit the shelves

BY **MASSIMILIANO ROCCHIA, PHD, SON MINJUNG,** AND **ALEX ILITCHEV, PHD**

When the average consumer is asked to picture plastic waste, they will probably imagine a crumpled water bottle, eternally unchanging in some forgotten ditch. Plastic does, however, break down, but not in the way we might hope. Just as ocean waves erode rock into sand, mechanical forces (along with UV radiation and oxidation) break down plastic litter into smaller and smaller pieces, eventually resulting in microplastics, or plastic particles less than half a centimeter in diameter. These minute pieces of debris are spread across the world, appearing everywhere, from the deepest sea trenches to Antarctica. In fact, even bottled water, often advertised for its purity, is not immune to the scourge of microplastics, with some commercial products containing thousands of particles per liter. A study at the State University of New York at Fredonia even found that 93 percent of tested bottled water had microplastic contamination.

The concern is not just one of physical pollution—there is increasing evidence that these microplastics have a detrimental effect on the environment as well as on human life. This is largely because they suffuse a variety of hazardous chemicals, such as bisphenol A, phthalates, and persistent organic pollutants into their surroundings. As research continues into the ramifications of this ubiquitous plastic litter, scientists are faced with a unique hurdle: accurately finding and identifying microplastics, either among the countless other microparticles in the environment or at the scant concentrations found in consumer goods.

The particles that are identified must be characterized without ambiguity in order to trace their origin.

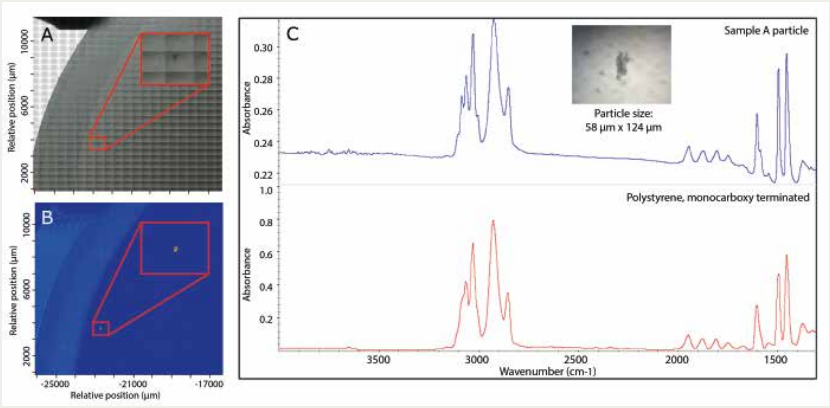
Bottled water, in particular, poses a significant challenge as contaminants can be few and far between. The particles that are identified must be characterized without ambiguity in order to trace their origin. That is why techniques that are capable of analyzing individual particles, and not just the bulk sample, are so important. Both infrared (IR) and Raman spectroscopy are well suited to do so, as plastics and polymers all have a distinct "fingerprint" signal between 500 – 1,500 cm^{-1} in their infrared spectra. While it is difficult to directly interpret the information in this region, it can easily be correlated against a reference spectrum. Advanced systems are even capable of automatically comparing and matching against an entire library of standard spectra, providing clear, nearly unambiguous identification in seconds.

Automated FTIR Microparticle Analysis

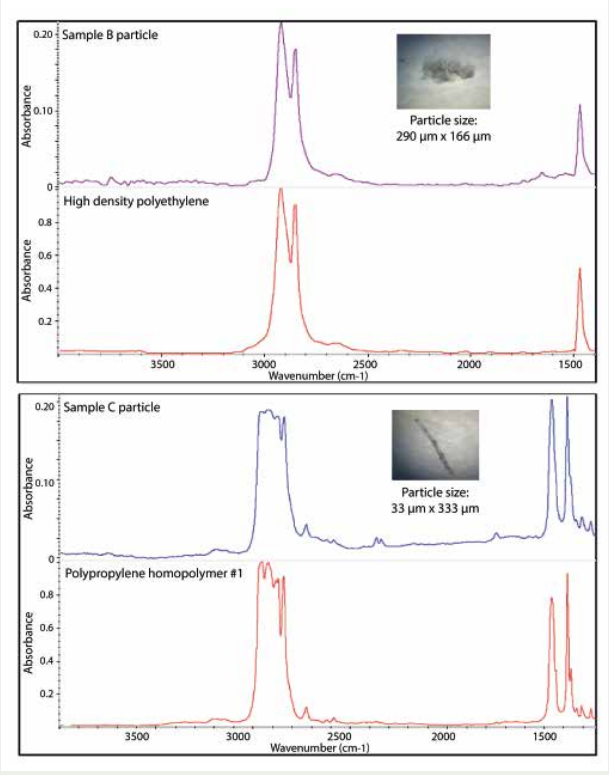
Up until recently particles were visually pre-sorted with a stereo-microscope prior to analysis; this fundamentally restricted the minimum size the particles could be, as, even with magnification, the smaller the particles, the more difficult it is to distinguish between them. Additionally, thorough sorting was an arduous process, taking substantial human labor to perform.

A combination of automated analysis with high-quality Fourier transform infrared (FTIR) spectroscopy circumvents both these issues, increasing the sensitiv-

Figure 1. Bottled water (Sample A) microparticle identification. A) Optical image of the particle on the filter surface. B) Chemical correlation map of the polystyrene signal. Close-up of the particle is inset in red. C) Comparison of particle FTIR spectrum and polystyrene reference spectrum.



THERMO FISHER SCIENTIFIC



THERMO FISHER SCIENTIFIC

▶ **Figure 2. Comparison of particle FTIR spectrum and library reference spectrum for bottled water samples B and C.**

ity, scope, and speed of analysis. A mosaic combination of optical images is initially taken of the entire surface on which the microplastics are distributed, an area that could be as large as 50 mm in diameter. Regions of interest are then identified, and automated software obtains spectra of each individual particle contained therein. These spectra are compared against a library of reference signals from a range of polymers and plastics, generating a clear side-by-side comparison of experimental signal and standard. An added benefit of this approach is that the analysis of low particle concentrations is equally facile, as the regions of the optical image containing the scarce sample are quickly located and characterized.

Analysis of Bottled Water

As an example of what this technique is capable of, three different commercial bottled water samples (A - 500 mL, B - 300 mL, and C - 300 mL) were analyzed using FTIR. These were obtained and used without sample pretreatment. A Whatman Anodisc filter membrane was used to capture any particulates in the water via pressure filtration; the filters were subsequently air dried.

The surface of each filter was then imaged, in this instance using a Thermo Scientific Nicolet iN10 MX Infrared Microscope with a 25 x 25 µm step size in ultrafast mapping mode and a 10 mm x 10 mm total imaged area, creating a mosaic optical image (see Figure 1A). Proprietary software recognizes any particles on the surface and obtains FTIR spectra of each (see Figure 1B).

These are then compared against the spectral library for identification (see Figure 1C). One single microparticle was identified on each filter, even for sample A, whose particle was a mere 58 x 124 µm in size (see Figure 1C and Figure 2). These findings can subsequently be interpolated back for a general contaminant concentration.

These experimental results clearly demonstrate the utility of high-quality FTIR, in combination with a spectral library and analytical algorithms, for unambiguous identification of trace microplastic contaminants in bottled water. The critical aspect of this robust analytical technique is throughput; as concentration can vary greatly, the method must be capable of analyzing comparatively large surfaces for potentially dozens of different microparticles. With their unique spectral signatures, IR spectra are a practical identifier for this process.

Additionally, while not discussed in detail here, Raman spectroscopy is equally important for the analysis of particles smaller than 10 µm in diameter. Raman is also capable of identifying inorganic plastic additives, such as titanium dioxide, whose characteristic wavelengths are outside the mid-IR range.

Together, these two techniques offer a highly specific and efficient toolset for microparticle and microplastic identification, giving researchers the tools they need to investigate this increasingly concerning pollutant. ■

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Strengthening Cybersecurity in Smart Manufacturing

A fresh look at security approaches that allow companies to protect data while connecting operations

BY **UMAIR MASUD** AND **SHERMAN JOSHUA**

Food and beverage producers are tapping into the power of smart manufacturing at a rapidly accelerating pace. They recognize the value of connectivity and the opportunities it provides to gain better insights into production processes; improve food safety visibility and practices; and resolve or help prevent food safety issues. However, with this important trend comes another, more concerning issue: vulnerabilities from insufficient cybersecurity.

Security threats now come in more forms than ever before: physical and digital, internal and external, malicious or unintentional. The truth is that no organization is immune to a security incident. And, more connected operations create more security risks—particularly the cyber variety.

There are a wide assortment of potential adversaries in the world, all with different goals and methods. Food and beverage companies could be targeted specifically with threats tied directly to food safety and the integrity of the nation's food supply. They also could be targeted as a means of testing attack methods ultimately intended for other organizations or industries. All potential threats pose significant risks to food and beverage operations, brands, and the consumers they serve.

More stringently regulated industries were forced to connect and grapple with increased security needs much earlier than other industries. For a time, the focus among many food and beverage producers remained on more traditional, physical security considerations associated with food safety and quality. Now, many companies are taking a fresh look at their security approach to make it comprehensive and cohesive in a connected environment.

Risk-Based Approach

Cybersecurity is a journey—there's no silver bullet or catch-all to create a permanently secure environment. Producers need to introduce a variety of capabilities and controls that allow them to respond and adapt to emerging and evolving threats.

A risk-based approach identifies the unique people-, process-, and technology-related risks an organization faces and implements policies and procedures to address them. This allows producers the flexibility to right-size their efforts and allocate the right resources to mitigate risk down to the acceptable level for their organization.

Done right, this approach offers value beyond the most obvious security implications—it also fuels improved productivity and helps prevent unnecessary losses. With cybersecurity programs in place, producers have better visibility into their full range of assets, as well as the ability to identify and correct issues more effectively. As an example, when engineers have remote access to a programmable logic controller (PLC) in a production environment, it's a benefit that helps sustain productivity levels. However, without the right controls in place, an engineer could access the wrong PLC, causing unnecessary disruption and inhibiting productivity.

So, how can producers evaluate their existing security program and find ways to take a more comprehensive, risk-based approach? There are three key areas to consider: the organization's cyber hygiene, a

defense-in-depth strategy, and planning across the attack continuum.

Cyber Hygiene

For food and beverage producers that have more recently introduced smart manufacturing or are in the early stages of updating their cybersecurity practices, cyber hygiene offers a natural starting point. Addressing four key programmatic areas can help an organization establish a base level of cyber hygiene.

It begins with conducting a thorough inventory of the assets connected on the plant floor, as well as their known vulnerabilities. This asset inventory must be maintained and updated regularly. Second, the organization needs to create programs to address the assets' known vulnerabilities, patch regularly, and confirm that mature processes are in place to make and track configuration changes. Third, it's important to employ backup and recovery mechanisms for all critical assets. This helps make sure a known good backup is on standby and can be accessed quickly. Finally, completing regular risk assessments allows an organization to measure and manage risk on an ongoing basis. These assessments provide the most up-to-date view of the level of risk the organization is exposed to and the resources required to mitigate it.

These are fundamental steps that build a cybersecurity foundation from which an organization can continue to build. While maintaining proper cyber hygiene is essential, a connected organization will want to go further to develop a more robust cybersecurity program implemented across all operations.

Defense-in-Depth

A security-through-obscurity approach no longer offers sufficient protection against today's wide array of threats and threat actors. An organization should build its security around the idea that any one point of protection probably can and will be defeated. A defense-in-depth strategy creates multiple layers of protection through physical, electronic, and procedural safeguards. In the event of a threat, the organization has more than one line of defense in place.

There are six primary components in a defense-in-depth strategy: 1) policies and procedures, 2) physical, 3) network, 4) computer, 5) application, and 6) device. While every organization will have a unique security strategy, each of these components will have a role to play in the effectiveness of the overall approach.

Policies and procedures address the human side of security, helping to shape employee behaviors—and to confirm that security practices are followed and technologies are used appropriately. Physical security limits facility access among both external and internal audiences. For personnel, access should be tightly controlled, limited not only in terms of areas within a facility, but also to entry points on the physical network infrastructure, such as control panels, cabling, and devices.

The network security framework should be developed through close collaboration between IT and OT, working together to identify and implement the right technologies and policies. These technologies likely will include an industrial demilitarized zone, which separates the enterprise and industrial zones and helps manage access and monitor traffic.

The computer component is vital, as software vulnerabilities represent the top means of intruder entry into automation systems. Patch management, antivirus software, application whitelisting, and host intrusion-detection systems are specific measures that help harden an organization's computer assets. At the production application level, security devices are needed to restrict both physical and digital access. Authentication, authorization, and accounting software helps restrict and monitor application access and changes.

Finally, devices represent the last area of defense-in-depth security. Organizations should consider deploying device authentication and unauthorized device identification as well as modifying default configurations for embedded devices.

Much of this defense-in-depth approach is focused on proactive, defense measures that prevent threats from fully manifesting. However, it also is important for an organization to investigate and prepare for the entire lifecycle of potential threats, including those that may escalate into a security incident.

Attack Continuum

The most robust and effective cybersecurity program addresses each phase of the attack continuum—before, during, and after an attack occurs. The steps and activities detailed above relate directly to the "before" phase, when an organization needs to focus on the identification and protection of its assets, both IT and OT. A thorough, frequently updated risk management plan and a robust cybersecurity program put an organization in the best position to minimize the occurrence of attacks.

Of course, constant vigilance is necessary in the face of the increasingly complex and evolving threat landscape. Organizations must have systems in place to monitor for and detect any network behavior that does not conform to the expected patterns or baseline, equipping them to react, adjust the system, and impede potential threats during an attack.

After an attack, the top priority is ensuring safe production and minimizing downtime as a result of the cyber-attack. An organization's risk management plan should include processes for containing an attack, eradicating its effects, and recovering rapidly. The plan also should outline steps for a post-incident investigation with the goal of identifying root causes and means of strengthening resilience.

Taking Action

For years, food and beverage producers have focused on the physical security measures that promote food quality and safety, protecting consumers and stewarding the nation's food supply. In today's connected environment, however, physical security and cybersecurity are inextricably linked. Now is the right time for organizations across the industry to confirm they have a robust cybersecurity program to mitigate the broader spectrum of potential risk and threats. Applying the same rigor across physical and cybersecurity programs best positions food and beverage producers not only to protect people, but to protect their brand, reputation, and financial interests. ■

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Data Gluttony: Too Much of a Good Thing?

Manufacturers need to stop collecting as much as they can and instead take the time to identify what data really matters

BY **DOUGLAS FAIR**

A few decades ago, food and beverage manufacturers had one strategy for data collection: paper and pencil. But plant floor operators would spend too much of their day jotting down measurements from weight scales, gauges, HMIs, etc. Despite operators' data collection efforts, paper and pencil systems were too rudimentary to provide the information that organizations needed for improving production processes and overall quality.

But now, with breakthroughs in industrial automation, servers, databases, and other IT, manufacturers no longer have to rely on paper and pencil systems. They can fully automate data collection and capture extensive amounts of data from every production line—every few milliseconds, around the clock.

However, there is a downside to all of this automation and ease. Since food and beverage manufacturers were starved for data before, many now want to gather as much as they can. Unfortunately, too much data can be difficult to digest. Manufacturers are, in effect, suffering from "data gluttony," where they gather massive amounts of data, but still lack the quality and manufacturing information they seek.

The Data Gluttony Problem

Data gluttony often results in huge expenses for organizations. After all, manufacturers have to store all of their data somewhere. If they collect both process-specific and product-specific data across each line, in multiple plants, every few seconds or milliseconds, they can fill up tons of hard drives in no time. With the added costs of databases, servers, security, and required IT support, it can all get very expensive, very fast—thereby defeating the cost-reduction focus of modern quality control strategies.

Data gluttony also hinders process improvement efforts, as food and beverage manufacturers can easily feel overwhelmed by the sheer volume of data at their fingertips. Querying millions of data values from a database can prove challenging, if not impossible. Even if massive amounts of data could be retrieved, what analysis tools can be conveniently leveraged for analyzing millions of data values? Just imagine copying a few million data values into a spreadsheet. How would you analyze it all? By themselves, massive datasets make it difficult to figure out what is truly driving quality and where to make improvements—such as how to cut waste and giveaway. It's like trying to find a needle in a haystack.

Breaking Through the Noise

To overcome data gluttony and find clarity in the noise, food and beverage manufacturers need to recognize that not everything needs to be measured. They have to stop collecting as much as they can and instead take the time to identify what data really matters. What purpose do these data serve? Why do we need to gather these data? How will these data show us how to improve our quality and operations?

Data sampling is equally important. Some organizations think if they do not capture every possible measurement in production, they will somehow "miss out." For instance, a food producer might say, "We want to collect cooking temperatures every few milliseconds for food safety monitoring." But temperatures will not significantly change in just a few seconds. The producer would just end up with a mountain of numbers that add no value or additional understanding to what is already known. It is better to form rational sampling plans, with reasonable data collection frequencies, focusing on how much data are needed, not how much are wanted.

Interrogating the Data

In truth, what manufacturers need is not data, but information. This is where statistical techniques and data analysis come into play. Only by regularly aggregating, summarizing, and analyzing their data can manufacturers uncover the actionable intelligence needed to make the right process improvement decisions. Without strategically planning to perform such analyses, data collection efforts can prove meaningless—and expensive.

The most successful organizations are ones that take a step back and analyze their data on a frequent, regular basis. They schedule time to interrogate their datasets using a variety of statistical tools and techniques—all in order to uncover new insights into how they can improve operations. Sometimes the most valuable information can come from innocuous datasets or even "in-spec" data.

For example, one beverage company that I worked with thought that, since everything was in spec, there were no opportunities for improving fill levels. After convincing them to gather fill volume data, we confirmed that no bottles were underfilled or overfilled. While that was good news, we also found that fill levels varied widely and that, overall, bottles were overfilled by a significant amount. Data analysis revealed operational differences between shifts, and big inconsistencies between fill heads and bottle types. Using these insights, the company made a variety of improvements, resulting in $1.1 million in annual savings—on just one of their 20-plus production lines. Without interrogating the data they would never have enjoyed these savings.

Ultimately, having data for the sake of having them does not lead to improvements. Extracting meaningful intelligence out of the data is what generates results—and organizations do not need every single measurement coming off their lines to do so. Instead, using intelligent sampling tactics, data collection activities can be both effective and efficient.

And now, thanks to the advent of software-as-a-service (or SaaS) technologies, there are even greater opportunities for improvement that extend beyond the four walls of a plant and across the entire enterprise. Using a centralized cloud-based repository, food and beverage manufacturers can easily consolidate quality data from multiple plants, regions, vendors, and even ingredient suppliers. Organizations can conduct the same regular data interrogation—but on a grander scale—and reveal greater opportunities to improve quality, reduce costs, and ensure standardization and consistency across the entire value chain, setting the stage for an exponential return on investments in quality. ■

INFINITYQS

Sometimes the most valuable information can come from innocuous datasets or even "in-spec" data.

Fair is chief operating officer at InfinityQS International, Inc. Reach him at dfair@infinityqs.com.

Food Service & Retail

STOCK MANAGEMENT

Sustainable Approaches to Product Management

Efficiently reducing waste to improve upon the safety of restaurants and grocery stores

BY **MATTHEW S. HOLLIS**

How a restaurant or grocery store disposes of its waste can truly impact the safety of the facility and the health of the people who work and visit there. It is imperative that stores effectively manage their waste production and removal in order to keep the space clean and safe for employees and consumers alike.

Here are several ways to efficiently reduce waste, keeping food service and retail establishments as sanitary as possible.

Product Ordering

The cycle begins with product acquisition and proper ordering. It is important for restaurants and grocery stores to have an accurate gauge of how much product they should be ordering, with the goal being to have nothing left over as waste once food has been bought or consumed. Over-ordering can result in financial pressure to serve food that may be past its expiration date, but still "consumable" to some. This is a dangerous trap for a grocery store or restaurant to fall into, as outdated food can cause health and safety issues.

In order to steer clear of this, make sure the food distributor fully understands the trends in consumption: Do fewer people purchase a certain vegetable on certain days? Is there a season where a particular fruit is extra popular, like watermelon in the summer? All of these nuances should be part of the conversation. If something is quick to go bad, which can create waste or other hazards, order conservatively. If there are other uses for a certain food, feel free to purchase a bit more generously, knowing that it will all be put to use before it expires.

Food Storage

Next, and equally as important, is how this food is stored. Of course, not everything that is purchased will be used or bought by consumers immediately, so store all products carefully. Below are some basic tips from FDA to prevent foodborne illnesses.

- Anything perishable should be refrigerated or frozen immediately. These items (meat, poultry, seafood, eggs, produce) should not be left at room temperature for more than two hours. This also applies to items such as leftovers, which may be used in the following day's production.
- When putting food away, don't crowd the refrigerator or freezer so tightly that air can't circulate.
- Refrigerator temperatures should be at or below 40 degrees Fahrenheit (4 degrees Celsius). The freezer temperature should be at 0 degrees Fahrenheit (-18 degrees Celsius).
- Check canned goods for damage upon delivery and periodically during its shelf life. Look for swelling, leakage, punctures, holes, fractures, extensive deep rusting, or crushing or denting severe enough to prevent normal stacking or opening with a manual, wheel-type can opener. Stickiness on the outside of cans may indicate a leak.
- Keep food away from any cleaning products and chemicals.
- For a premade mix or recipe, create labels that show the date it was made and when it will expire. (Use the soonest expiration date of the most perishable ingredient.) Tape this in a very visible area of the container, and be sure to use it before that date.

Adhering to these tips will not only keep food safe, but will also provide a longer shelf life, allowing ample time to use all purchased products.

As mentioned, a great way to reduce excess product waste from purchased and stored items is to find new uses for those items, whether it's in a restaurant's menu item or in a grocery store's deli, bakery, hot bar, or meat counter. Choose versatile products that can be used in different instances. For example, say the staff over-ordered carrots intended for a particular dish your organization offers that uses carrots. Is there a way to create a new side to get rid of the excess carrots—perhaps dice them up and use them in a soup to sell for the remainder of that week? Some of the most versatile veggies and fruits include cauliflower, zucchini, sweet potatoes, avocado, and plantains. The uses for these items knows almost no limits. Be sure the quantity of an item is proportionate to the uses a kitchen is able to get out of it.

Waste Removal

The last part of this whole process is the sanitary removal of waste and excess food. While it is easy to take measures to reduce waste as much as possible, this is an inevitable step, so do it responsibly to avoid contaminating your kitchen or grocery areas. There are a few ways to make this as sustainable, safe, and effective as possible.

First is through donation. If you have cooked or ready-to-eat perishable ingredients, ensure they go to a responsible organization that can distribute them to be consumed before their expiration date. A local shelter or food pantry is a great place to take these goods to—many of them accept donations daily. This is also a good route for meats, bread, and other items that will go bad if they are not consumed.

Almost every natural ingredient in the kitchen or store can be composted.

Another avenue is composting. This is the process of breaking down organic materials so they can return to soil. Almost every natural ingredient in the kitchen or store can be composted. All that is needed are four components to get the process going:

1. Carbon—the microbial oxidation of carbon produces the heat (high carbon items tend to be brown and dry);

2. Nitrogen—to grow and reproduce more organisms to oxidize the carbon (high nitrogen materials tend to be colorful and wet, such as fruits and vegetables);

3. Oxygen—for oxidizing the carbon, the decomposition process; and

4. Water—in the right amounts to maintain activity without causing anaerobic conditions.

Before starting a composting program, contact a waste hauler to confirm it has a collection program for organics. Most businesses may use a hauler to collect items for compost, but some may want to compost on site if local regulations allow. Reach out to the waste hauler to set up the proper containers and signage. Once you confirm your waste hauler has a collection program for organics, find the right equipment and supplies needed to compost. Obtain a proper size bin and empty it daily.

This touches on the last component to keeping waste and safety top of mind for your restaurant or store: your supply chain partners. From distributors to waste haulers, select trusted and thorough vendors who understand the needs and goals of the business in both safety and sustainability. Make sure to have ongoing conversations about operational needs and how to effectively move product without creating waste or sanitation hazards. It takes a lot of thought and planning, but with the right tools in place, food service and retail establishments can seamlessly eliminate waste and create a safer environment. ■

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Agricultural Water *(Continued from p. 25)*

requirements around agricultural water," says Dr. McEntire. "In California and Arizona, most producers are part of the Leafy Greens Marketing Agreements. Those water testing requirements go above and beyond the requirements in the Produce Safety Rule."

Dr. LaBorde considers various factors that come into play, such as the increasing public appetite for raw produce, as well as the practice of irrigating with overhead sprayers, which douse produce in water.

"There are lower risk types of application methods such as drip or burrow irrigation," he says, "which can be designed such that it wouldn't contact the crop, reducing a lot of risk. That's possible in very large farms. A lot of people who use drip irrigation here in Pennsylvania are small- or medium-size farms."

Dr. LaBorde is also paying attention to studies on time-before-harvest, which aim to determine whether leaving produce in the sun will kill off enough pathogens to get produce down to safe levels. "That's not always practical either because sometimes you have to water the crop just before harvest."

He's open to any new ideas about irrigation safety, but that openness is tempered by a clear understanding of how many factors come into play in trying to keep agricultural water safe. Dr. LaBorde—and many others—are as quick to dismiss silver-bullet thinking with real-world challenges.

The problem with irrigation safety, Dr. LaBorde concludes, is, "There aren't a lot of easy answers." ■

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Hydroponics in Hot Water (Continued from p. 13)

they are all bound by a common set of regulations," she said.

The controversy has not been limited to the U.S. Organic certification of hydroponics is not permitted in Canada, Mexico, or the European Union. In April 2018, the European Parliament voted to end the importation of hydroponically grown organic produce into the EU as well as the organic certification of hydroponically grown products within the EU. Similarly, Canada and Mexico do not allow organic certification of hydroponics and bar the import of organically certified hydroponically grown foods.

These actions "show the organic industry is not injured by banning organic certification of hydroponically grown products," the CFS complaint states. "Organic standards for Americans should not be lesser than, and must be equivalent to, those of other countries' organic standards. USDA should also take immediate action to follow these countries and ban organic certification of hydroponics."

Given the Trump Administration's expressed aversion to additional federal regulation and USDA's longstanding hands-off approach to the issue, many observers consider it highly unlikely that hydroponically grown crops will be decertified from the organic label anytime soon. ■

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Labels *Do* Define You (Continued from p. 21)

harvesting, packing, and distribution involving many entities and individuals resulting in issues with no clear solutions and explanations.

When another romaine lettuce outbreak occurred in the fall of 2018 causing 62 reported illnesses in 16 states, FDA decided that the origin of the romaine lettuce as based on the harvest region and the date of harvest should be declared on the label. Not knowing where and when the romaine lettuce was harvested affected public health and FDA proposed that this information be declared on the product label.

Recommendations

To date, the legally permissible responsibility statements are "Manufactured for/by __," "Packed for/by __," or "Distributed for/by __," but many versions have appeared on packages, sometimes without the required information as in "Made in USA" or "Product of (country)." It is important that the name and address of the *actual* manufacturer, co-packer, or grower be mandated, as Dr. Bruhn and I recommended in our study. Thus, the resulting responsibility statement could be "Manufactured for __ by __," "Packed for __ by __," or "Distributed for __ by __," or other formats with the required information.

In the case of romaine lettuce, it is recommended that FDA instruction be expanded to include *all fresh produce* and declare on the label the name and address of the *actual* co-packer or grower, identifying the growing region and harvest date, as in "Grown by __ for __ (date)," "Harvested by __ for __ (date)," or "Packed by __ for __ (date)," or other formats with the information. Details of where the information would be added are not proposed here.

Although the responsibility statement primarily advises consumers where to find the manufacturer, distributor, or packer, its role may be expanded to include traceability that may impact public health. Misbranding is serious and the food industry should use accurate words, names, locations, and vignettes on labels to maintain credibility and consumer trust. Changes to the responsibility statement must occur and compliance be strictly monitored just as for other food label parts. ■

Dr. Saulo is a professor and extension specialist in food technology at the University of Hawaii at Manoa. Reach her at aurora@hawaii.edu.

Basic Sanitation: Identifying 'Hot Spot' Areas (Continued from p. 31)

The Sanitation Checklist

Having a list and checking it twice isn't just for holiday gift shopping. It is an essential element in a facility's sanitation program. Here is a top-line overview adapted from Truman's Scientific Guide to Pest Management Operations of what a sanitation checklist should include:

- ☑ Exterior Areas (garbage disposal areas, drainage, weed control, pest breeding and harborage areas, etc.)
- ☑ Building Exterior (pest-proofing/exclusion, lighting, etc.)
- ☑ Building Interior (walls, floors, ceilings, floor drains, plumbing, ventilation, lighting, etc.)
- ☑ Food Storage
- ☑ Packaged and Dry Food Storage (proper storage practices, good sanitation, etc.)
- ☑ Damaged Goods Storage (segregation, repackaging, good sanitation, etc.)
- ☑ Returned Goods
- ☑ Refrigerated Areas (condensation, cleaning, etc.)
- ☑ Food Preparation Areas (access to enclosed areas, under equipment, surface areas, etc.)
- ☑ Dishwashing Areas
- ☑ Garbage and Recycling Areas (proper containers, containers covered, etc.)
- ☑ Toilet and Locker Room Areas (lockers regularly cleaned and emptied, etc.)
- ☑ Lunch/Breakroom (cleaned regularly, trash taken out regularly, etc.)
- ☑ Vending Machines (accessible for cleaning, etc.)
- ☑ Utility Areas (accessible for cleaning, no pest-conducive conditions, etc.)
- ☑ Office Areas (trash removed regularly, no food stored in desks, etc.)

—S.M.

NEW PRODUCTS

WiFi Data Loggers

The TR-7wb Series of WiFi-connected data loggers are now equipped with Bluetooth to improve accessibility with mobile devices through the T&D Thermo dedicated mobile app. The series supports multiple sensors and comes in four models: TR-71wb, TR-72wb, TR-72wb-S, and TR-75wb. Temperature and humidity data measured by the loggers can be automatically uploaded, stored, and viewable on mobile devices anytime and from anywhere. The compact, battery-powered devices retain all of the features of the original TR-7wf Series and can be deployed in virtually any quantity to form a unified data reporting network connected to the internet via Wi-Fi or through a smart device. **T&D Corp., www.tandd.com.**

Product Security Solution

The ProLinc SaaS-based security solution provides universal traceability at the component, product, and batch level to its clients for product authentication, manufacturing system insight, and regulatory and tax compliance throughout the product lifecycle. Designed for rapid scalability and granular insight, the software offers manufacturers precise authentication and traceability at every stage of the supply chain—from raw material, through production, distribution, retail, end user, and beyond. By enabling stakeholders to scan items at key points in the product lifecycle, the company says ProLinc builds an incorruptible genealogy for every product in circulation. This data can then be securely accessed via a blockchain-enabled database by approved stakeholders across the supply chain, including the consumer.**Ashton Potter, 716-633-2000, www.ashtonpotter.com.**

Recall Management Functionality

CMX Recalls can provide automated identification of issues and trends. It offers support for a variety of event types and progressions including investigation, hold/release, withdrawal, and voluntary/mandatory recalls from initiation to resolution. The module also supports the execution of "mock" events with full functionality. Automated communication and response management allows customers to communicate product identification, disposition, and replacement instructions to thousands of supply chain partners and locations simultaneously via email, voice, and text. The module automatically manages reminders and escalations, and tracks responses and product recovery effectiveness. It allows for crisis management teams to record notes, attachments, risk evaluation, event strategy, related product incidents, and it automatically records all actions taken from initiation to resolution for all involved parties. **ComplianceMetrix, 858-866-8888, sales@compliancemetrix.com, www.compliancemetrix.com.**

Flow Modulator

The FLUX flow modulator option for routine GCxGC analysis is ideal for users who want to perform robust GCxGC analysis, but do not need the sensitivity of standard quad jet thermal modulation. Ideal samples are complex, but relatively concentrated. It does not require cryogens to carry out GCxGC. Method development is also simplified, as there are only two parameters for the user to manage; the flows are handled by software so users do not have to set these themselves. The flow modulator is available for purchase with Pegasus BT 4D. Users may also upgrade their existing Pegasus BT system to GCxGC with FLUX. **LECO, 269-985-5496, info@leco.com, www.leco.com.**

Ice Buckets and Pans for Cryogenic Chilling

The PolarSafe EVA Ice Buckets and Pans are designed for benchtop chilling needs, especially cryogenic applications. They do not sweat or leak. No puddles of condensation or cryogenic media will accumulate onto the workspace. The buckets and pans are made from ethylene vinyl acetate, a thick nontoxic foam compatible with ice, dry ice, liquid nitrogen, alcohol, and saline solutions. Ergonomic handles on the base and lids make them easy to pick up even when wearing cryogenic gloves. Convenient pour spouts provide easy use and cleanup. A variety of sizes and colors are available. **Cole-Parmer, 800-323-4340, sales@coleparmer.com, www.coleparmer.com.**

(Continued on p. 44)

 (Continued from p. 43)

Hemp Analyzer

The Hemp Analyzer is a high-performance liquid chromatograph that is a complete turnkey analyzer for quantitative determination of cannabidiol (CBD) and cannabinoid content. It includes all required hardware, software, consumables, and analysis workflow to enable the operator to run samples in the shortest possible time. The three included method packages address high sample throughput, enhanced sensitivity, and high resolution. The high throughput method is designed for analysis of CBD and nine other commonly requested cannabinoids in under eight minutes. The high sensitivity method includes THCV in the target analyte list, with an instrument cycle time of under 10 minutes. According to the company, the short analysis time produces the sharpest chromatographic peaks for the best overall sensitivity. The high resolution method presents full baseline resolution for all 11 compounds and an analysis time under 30 minutes. This method is preferred for research purposes or when additional compounds must be added to the analysis in response to new state regulatory requirements. **Shimadzu Scientific Instruments, 800-477-1227, www.ssi.shimadzu.com.**

Media Bottle with Multiport Closure System

The KIMBLE GLS 80 Media Bottle and Multiport Cap System helps accommodate a range of sample sizes from 250 mL to 20 L. The wide neck simplifies transfer of samples in any form, including powders, pastes, granules, and liquids. Spoons, spatulas, tweezers, and large funnels are easily manipulated through the opening. The bottle is manufactured from 33 expansion low extractable borosilicate glass in conformance to the USP Type I standard for neutral glass. It can withstand temperatures as high as 500°C. Three bottle versions are available: a clear version with greater than 90% light transmission from 380 to 700 nm, a version with an amber-coated exterior for light sensitive materials, and a version with a KimCote safety coating for assurance of protection in the event of damage. **DWK Life Sciences, 800-225-1437, US.CustomerService@DWK-LifeSciences.com, www.dwk.com.**

Ultra-High-Power X-ray System

The Xpert Heavy Duty system has 900W of X-ray power. It is specifically designed with a large aperture width and height to accommodate big cases, boxes, bags, and trays. The trapezoidal, top-down X-ray beam is 770 mm wide at the belt and 525 mm wide at the 300 mm aperture height. Its mechanical design stands up to daily washdown and it has a water-cooled ceramic X-ray tube for long life. The inspection system enables food manufacturers with difficult applications to easily detect a wide range of physical contaminants in large packages and dense, heavy products like cheese blocks, cases of spices, and boxes containing various meat products. **Thermo Fisher Scientific, 866-356-0354, www.thermofisher.com.**

Quality Management System Software

The Reliance 2019 is an enhancement to ETQ's flagship offering. ETQ Reliance 2019 includes an entirely new user interface and several features that improve personalization and collaboration. Seven integrated SaaS solutions that support the precise needs of customers' unique quality programs and workflows include: Quality by Design, Nonconformance Handling, Supply Chain Quality, Complaints Management for Life Sciences, Health and Safety, Environmental Management, and Enterprise Risk Management. The 35 automated processes include best practices and deep functionality to shorten an organization's time-to-value. **ETQ, 800-354-4476, www.etq.com.**

Impingement Freezing Process

Linde's new approach to impingement freezing with an enhanced design can help improve yields and maintain product weight. According to the company, the impingement freezer reduces dehydration losses by up to four or five times that of mechanical methods and up to two or three times that of conventional cryogenic freezers. The process can handle a wide variety of products, and is ideal for items such as marinated chicken, formed products, fish fillets, and cookies. **Linde Group, 800-755-9277, www.lindeus.com.**

In Other News

Dynamic Systems releases SIMBA 2019, which provides meat and poultry processors a production, inventory, and traceability system that records information on the plant floor in real time.

3M Food Safety's Petrifilm Rapid *E. coli*/Coliform Count Plate earns the Official Methods of Analysis (OMA method No. 2018.13) validation by AOAC.

Kerry officially launches Acryleast, a non-GMO yeast for reducing acrylamide levels with no impact on taste or texture.

ARM & HAMMER launches two poultry solutions: Finalyse SAL with phage technology to control *Salmonella* during processing and CLARIFECT to disinfect poultry drinking water lines and remove biofilm deposits in water transfer lines.

NSF International launches its Global Animal Wellness Standards to address the full lifecycle of all key species and establish best practices for how animals are kept, raised, and responsibly managed.

NSF and **SGS** achieve accreditation by ANSI to certify foreign food suppliers under FDA's Accredited Third-Party Certification Program of FSMA.

ProcessPro enhances API integration with Genesis R&D, the food formulation and labeling software from ESHA Research, to generate Nutrition Facts Panels, ingredient and allergen statements, and barcodes.

AIB International's new augmented reality training concept, in the pilot stages of development, features customizable simulation with real-world images and video and includes a testing component.

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Events

MAY

6-7
International conference on Plant Physiology and Biotechnology
Prague, Czech Republic

Visit https://plantbiotech.conferenceseries.com.

6-9
Food Safety Summit
Rosemont, Ill.

Visit https://www.foodsafetystrategies.com/food-safety-summit.

21-22
Dairy Plant Food Safety Workshop
Baraboo, Wis.

Visit https://www.idfa.org/events/dpfsw#baraboo.

21-23
Food Microbiology Short Course
University Park, Pa.

Visit http://agsci.psu.edu/foodmicro or call 877-778-2937.

JUNE

2-5
IFT19
New Orleans

Visit https://www.ift.org/.

10-12
United Fresh 2019
Chicago, Ill.

Visit www.unitedfreshshow.org or call 202-303-3400.

11-13
Food and Airborne Fungi & Mycotoxin Short Course
University Park, Pa.

Visit https://bit.ly/2FNgSZ7 or call 814-865-8301.

17-18
22nd World Congress on Nutrition and Food Sciences
Brisbane, Australia

Visit www.nutritionalconference.com.

17-19
Better Process Control School
New Brunswick, N.J.

Visit http://www.cpe.rutgers.edu/courses/current/lf0703cb.html, email ocpe@njaes.rutgers.edu, or call 848-932-9271.

18-20
53rd Annual Microwave Power Symposium (IMPI 53)
Las Vegas

Visit http://impi.org/symposium-short-courses/, call 804-836-7125, or email molly.poisant@impi.org.

JULY

21-24
IAFP
Louisville, KY.

Visit http://www.foodprotection.org/annualmeeting/, email info@foodprotection.org, or call 800-369-6337.

AUGUST

19-23
Introduction to Food Science Course
New Brunswick, N.J.

Visit http://www.cpe.rutgers.edu/courses/current/lf0201ca.html, email ocpe@njaes.rutgers.edu, or call 848-932-9271.

SEPTEMBER

8-11
AOAC Annual Meeting & Expo
Denver, Colo.

Visit www.aoac.org, email AOAC@aoac.org, or call 800-379-2622.

OCTOBER

8-11
PROCESS EXPO
Chicago, Ill.

Visit www.myprocessexpo.com or call 703-663-1212.

30-31
China International Food Safety & Quality Conference
Beijing City, China

Visit www.chinafoodsafety.com.

NOVEMBER

6-8
Dairy Practices Council Annual Conference
Portland, Maine

Visit www.dairypc.org/dpc-conferences or email dairypc@dairypc.org.

JANUARY

28-30
International Production & Processing Expo
Atlanta, Ga.

Visit http://ippexpo.com/, email info@ippexpo.org, or call 770-493-9401.

Have an Upcoming Event to Promote?

If you have an upcoming industry event that you would like considered for inclusion in our online and print listings, go to www.foodqualityandsafety.com/events/ for info or contact Bob Zander at bzander@wiley.com.

SCIENTIFIC FINDINGS

For access to complete journal articles mentioned below, go to "Food Science Research" in the April/May 2019 issue at www.foodqualityandsafety.com/issue/april-may-2019, or type the headline of requested article in website's search box.

ARTICE: Stress Effects on Meat Quality—A Mechanistic Perspective

When animals are transported from the farm to slaughterhouse, the transport and confinement of the animals will inevitably lead to stress. The effects of stress on the behavioral and physiological status and ultimate meat quality have been well documented. However, reports on the mechanism of stress effects on physiological and biochemical changes and their consequent effects on meat quality attributes have been somewhat limited. Also, the causes of variability in meat quality traits among different animal species, muscle fibers within an animal, and even positions within a piece of meat in response to stress are still not entirely clear. This review summarizes the primary stress factors, including heat stress, preslaughter handling stress, oxidative stress, and other stress factors affecting animal welfare, carcass quality, and eating quality. The review further describes potential stress-induced pathways or mediators. **Comprehensive Reviews in Food Science and Food Safety, Volume 18, Issue 2, March 2019, Pages 380-401.**

ARTICLE: Trends in the Application of Photodynamic Inactivation for Microbiological Food Safety

Photodynamic inactivation has the potential to cause microbial inactivation using visible light. It works on the principle that photosensitizers within the microbial cell can be activated using specific wavelengths to trigger a series of cytotoxic reactions. In the last few years, efforts to apply this intervention technology for food safety have been on the rise. This article offers a detailed commentary on this research. The mechanism of photodynamic inactivation are discussed as are the factors that influence its efficacy in food. Efforts to inactivate bacteria, fungi, and viruses are analyzed in dedicated sections and so are the application of this technology to specific product classes such as fresh produce, dry fruits, seafood, and poultry. The challenges and opportunities facing the application of this technology to food systems are evaluated and future research directions proposed. This review is intended to provide insights for researchers and industry personnel looking for a novel solution to combat microbial contamination and resistance. **Comprehensive Reviews in Food Science and Food Safety, Volume 18, Issue 2, March 2019, Pages 402-424.**

ARTICLE: Use of Efficient Drying Methods to Improve the Safety and Quality of Dried Fig

The safety risk in figs naturally dried, such as the presence of mycotoxins, is a major concern. Likewise, the quality of the fig dried by this traditional method is very heterogenic, being highly conditioned by weather conditions. Until now, there is scarce information about alternative methods to natural drying of figs. This study discusses several drying strategies evaluating safety and quality aspects. Fresh figs were dried by different artificial methods and compared to traditional sun drying as the control. The microbial counts were monitored after drying and throughout storage. The fungal population was isolated and identified, and their capacity to produce mycotoxins was evaluated. Quality parameters such as moisture, weight loss, firmness, total soluble solids, titratable acidity, and sensory quality were also assessed. The study findings would be helpful in developing specific technologies for dried fig production. **Journal of Food Processing and Preservation, Volume 43, Issue 1, January 2019, e13853.**

ARTICLE: Wine Astringency Reduces Flavor Intensity of Brussels Sprouts

The bitterness of vegetables is a leading reason why they are avoided by children and some adults. Bitterness is perceived via TAS2R receptors located on the tongue. In contrast, astringency is a mouthfeel rather than a taste, and is perceived as a dry, puckering sensation. To date, few reports have suggested any interactions between the two processes even though they often occur simultaneously in many foods. In this study, brussels sprouts were used as an exemplar bitter vegetable and the influence of different interventions on perceived intensity were examined. Subjects rated the intensity of brussels sprouts before and after three interventions: gravy, red wine, and water. By using astringency to affect salivary proteins, the authors suggest they may play a role in the detection of bitterness. This may be through helping to transport bitterness compounds to the taste bud receptors or a separate mechanism. Potentially, this also opens up new ways to block bitterness. **Journal of Texture Studies, Volume 50, Issue 1, Special Issue: Saliva and Food Oral Processing, February 2019, Pages 71-74.**

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