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Processing may spread E. coli; Some food safety experts say the mixing of greens for packaging may increase the risk of contamination.

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Three recent outbreaks of food-borne illnesses traced to bagged spinach or lettuce from California have led some scientists and **food safety** advocates to suggest that packaging greens might contribute to the spread of a lethal strain of **E. coli** bacteria.

In particular, the centralized processing of fresh greens can increase the risk of more widespread contamination, just as tainted beef from one steer can find its way into hundreds of packages of ground meat, said Dr. David W.K. Acheson, chief medical officer at the U.S. Food and Drug Administration's Center for **Food Safety** and Applied **Nutrition**.

"If you have a single head of [tainted] lettuce that winds up in someone's home, makes the family sick, chances are it'll never get on the radar screen," Acheson said. "If you take the same lettuce, process it ... one head may contaminate multiple bags. Then you've got an outbreak."

The way some greens are harvested also has raised concerns, said Michael Doyle, director of the University of Georgia's Center for **Food Safety**, who was recently hired by Taco Bell to review its safety guidelines.

"I quit eating bagged lettuce years ago," Doyle said. "After seeing how bagged lettuce was harvested and prepared, my impression was it's not very sanitary."

Doyle referred specifically to bagged iceberg lettuce, which has been investigated in the simultaneous but separate Taco John's and Taco Bell outbreaks of Escherichia coli O157:H7 that sickened more than 150 customers in the Midwest and on the East Coast in November and December.

Officials have linked those outbreaks to farms in the Central Valley and possibly on the coast south of Salinas.

The illnesses occurred only months after another leafy green, spinach, was blamed in an outbreak that killed three people and sickened more than 200 in late August and early September. That outbreak was traced to bagged spinach from the Greater Salinas Valley, which was sold in stores nationwide.

The upshot is that pre-washed and packaged produce, a $3-billion industry created to improve both safety and convenience, is under a cloud. Though the individual consumer's risk of illness remains small, experts said, the only practical way to ensure that greens are free of **E. coli** is to thoroughly cook them -- not a desirable option for lettuce.

E. coli is commonly found in healthy cattle and shed through their feces. Federal and state officials believe that produce outbreaks occur when bacteria-carrying **manure** gets into fields via livestock, water, birds or other wildlife.

Iceberg lettuce intended for packaging is vulnerable to contamination in part because it is often cut and initially processed in the field, Doyle said. The core is cut out of the head and discarded, as are the protective outer leaves.

"When you've chopped that product, you've created a lot more avenues for bacteria to enter, especially if you're doing it in the fields," said Bob Martin, general manager of Rio Farms in King City. Once the bacterium "is locked into that cut edge of lettuce, then it's really difficult for your chlorine bath to kill it."

Processing plants wash leafy greens three times in chlorinated water before bagging them. They also employ other safety measures, including guidelines for field-cored lettuce, said Jim Gorny, senior vice president for **food safety** and technology at United Fresh Produce Assn., a trade group.

He said the harvested heads are put on a conveyor belt, sprayed with cooled, chlorinated water, placed in a bin with a plastic liner and shipped to the processing plant.

By discarding the core and outer leaves in the field, Gorny said, "you're actually bringing in a microbiologically cleaner product into your sterilized plant."

Spinach is harvested by machines like lawn mowers. Contamination in the field is possible but less likely than with iceberg lettuce, Doyle said.

But both lettuce and spinach destined for packaging generally are trucked to centralized processing plants, where tainted and untainted leaves can be mixed during chopping, washing and bagging. By contrast, greens that are not bagged are not chopped up and mingled.

Although washing in chlorinated water should kill **E. coli** bacteria, it takes only a small amount to make someone sick -- about 10 organisms, or 2% of the space on the head of a pin.

The bagged greens industry has consolidated so much that a single contamination problem can threaten the entire industry, said Timothy York, chief executive officer of Markon Cooperative Inc., a Salinas-based produce purchaser for food service distributors. According to the Produce Marketing Assn., nearly 90% of the retail market for packaged salads is controlled by only two companies: Dole Fresh Vegetables and Fresh Express.

The wide reach of the processor that bagged the tainted spinach -- sold under more than 30 brand names -- caused the FDA to temporarily issue a warning against eating the fresh greens nationwide. That warning was later lifted after probable contamination sources were identified.

Similarly, iceberg lettuce is mixed during processing and sent nationwide.

"Bagged lettuce is facing the same problem that meat grinders faced with **E. coli** O157," said Caroline Smith DeWaal, **food safety** director for the Center for Science in the Public Interest in Washington, D.C. She was referring to the outbreak in the 1990s that involved tainted hamburger served at Jack-in-the-Box restaurants.

"They're this linchpin in the safety system because they're taking produce in from a wide variety of sources and mixing it and redistributing it," she said. "The bagged salads are increasing the likelihood that outbreaks will be larger and widespread."

The comments of experts like Acheson make sense in principle, said Marty Ordman, a spokesman for Dole Food Co., whose packaged spinach was implicated in last fall's outbreak. But Ordman said that tests have shown no particular problems with coring lettuce in the field. In addition, Ordman said, outbreaks had been linked to non-bagged greens as well.

"It's the whole process -- from the lettuce being planted, to the management of the field, the water that's used, your harvesting practices, making sure the product is kept at the appropriate temperature," Ordman said. "Everyone is reviewing, from A to Z, every process."

Samantha Cabaluna, a spokeswoman for Natural Selection Foods based in San Juan Bautista, Calif., which processed the tainted spinach for Dole, agreed with Acheson that the processing of fresh greens permits tainted produce to be distributed over a wider geographical area.

But she said the industry is learning from the recent outbreaks and is following the lead of the beef industry, which came under scrutiny after the Jack-in-the-Box outbreak.

She cited recent changes in **food safety** at Natural Selection, including holding produce for 12 to 16 hours for bacterial testing before it enters the processing facility and testing it again after processing. Discussion of **food safety** efforts is occurring throughout the produce industry, she said.

"We are trying to come together to really raise the bar on these **food safety** protocols," Cabaluna said.

Not everyone agrees that packaged greens are a problem. Christine Bruhn, director of the Center for Consumer Research at UC Davis, said she believes that buying bagged, pre-washed greens is safer than buying head or loose lettuce and washing it yourself.

"Most of us don't do triple washing in chlorinated water," she said, adding that research confirms that neither home nor restaurant cooks diligently follow all sanitary practices.

"Do they scrub the sink with cleanser and then sanitize it with a bleach solution before they start their washing?" she asked. "Do they thoroughly wash their hands with a brush, getting under their fingernails and using a clean towel to dry?"

Prepackaged produce was seen as a safety innovation when it was introduced in fast-food restaurants in the 1980s, Gorny said.

"It took production of fresh fruit and vegetables out of chaotic kitchens in restaurants where you have frequently changing employees," Gorny said. Restaurant chains worked with food processors to develop stringent standards, including the triple wash.

As sales to fast-food restaurants mounted, processors tried selling packaged products in retail stores. Growth took off in the 1990s. Fresh-cut salad sales tripled from 1997 to 2005.

The industry's very success could be one of the reasons behind recent outbreaks. People are eating more fresh produce, including the bagged variety, than ever before, and in doing so, they are increasing their risk of exposure to bacteria.

Moreover, outbreaks are being detected earlier and traced more precisely. Bagged greens may have been implicated in the last three outbreaks because, with a brand name and a lot number, they are easier to trace than a single head of lettuce.

That, of course, is not exactly a relief for consumers. Linda Harris, associate director of research at the UC Davis Western Institute for **Food Safety** and Security, said processors needto do all they can to restore consumer confidence.

"The industry needs to reinvent itself," she said. "What can be done in the field and in the processing unit? Today we don't have all the answers, but look back at the beef industry 10 years ago. It didn't either."

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A factor in **E. coli**'s spread?

Some scientists and safety advocates see an increased risk of more widespread contamination in the centralized processing of iceberg lettuce. Others say the process increases safety because the lettuce is washed in chlorinated water.

In the fields

Unpackaged lettuce

- Lettuce is cut at stem, placed in bin, refrigerated and shipped as a whole head.

Packaged lettuce

- Lettuce is cut at stem and its core and outer leaves are removed in the field before it is refrigerated and sent to processing.

Processing lettuce for packaging

Chopped lettuce

- After being chopped, the lettuce is submerged in water.

Inspection

- Workers inspect and remove any unwanted parts.

Chlorinated wash bins

- Chopped lettuce is washed three more times.

Dryer

- A centrifugal dryer is the last step before packaging. Lettuce is then boxed for distribution.

Source: Western Growers Assn. Graphics reporting by Rong-Gong Lin II and Cheryl Brownstein-Santiago

GRAPHIC: A factor in **E. coli**'s spread?;CREDIT: LORENA INIGUEZ Los Angeles Times;PHOTO: BIG SELLERS: The popularity of prepackaged salad greens has grown rapidly since the 1990s.;PHOTOGRAPHER: Justin Sullivan Getty Images;PHOTO: AT THE SOURCE: Workers near Watsonville pack lettuce. Some initial processing is done in the field.;PHOTOGRAPHER: Robert Durell Los Angeles Times

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Towns bet on water for ethanol

180

BY BILL HORD
WORLD-HERALD BUREAU

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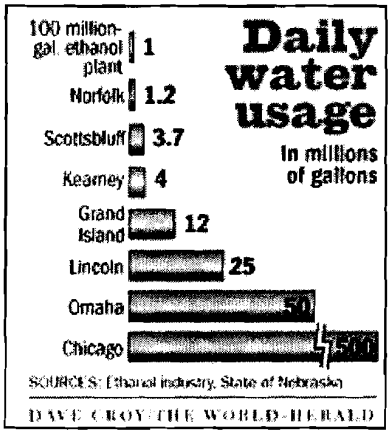
LINCOLN - An ethanol plant under construction in Cambridge, Neb., will consume two or three times more water than all of the 1,000 or so residents in this drought-plagued community.



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Even though water is in short supply in southwest Nebraska, Cambridge lured the new plant with tax incentives and broad community support. New water wells to supply the plant were placed across the Republican River, miles from the community wells, to minimize the impact.

Like many towns in rural states, Cambridge is anteing up a portion of its water resources for the prospect of a better economic future. Small towns are betting that water will be available for everything - ethanol, residents, livestock, irrigation, wildlife and business.

Scientists say that while the issue is one of concern, not crisis, states and cities cannot afford to ignore the impact of ethanol production on water supplies.

As a result of a 2004 Nebraska law, ethanol refineries and other new water users face increased scrutiny in how they will affect stream flows. But wells are a different story. Of the 23 natural resources districts that regulate water pumping, only one requires that developers of ethanol plants study their potential impact on neighboring water wells.

Iowa has even less scrutiny.

"Somewhere lurking in the background is the question of whether we are going to have enough water, especially if you want to make ethanol work in the long run," said Robert D. Libra, a geologist with the Iowa Department of Natural Resources.

It is a question that has moved to the forefront in Nebraska, where Gov. Dave Heineman has proposed that Nebraskans spend $128 million over the next 12 years to address water shortages. A portion of the money would be used to pay farmers to stop or reduce irrigation, but the plan doesn't place a value on how much it would cost to do so.

The addition of ethanol plants into the equation means irrigation would have to be reduced even more. There are 12 ethanol plants in Nebraska, plus nine under construction and 37 planned. If all were operating, they would use about two-tenths of 1 percent of total water pumped in the state, based on estimates by the U.S. Geological Survey.

A large ethanol plant uses the same amount of water annually as it takes for four center-pivot irrigation systems to water a section of land. In water-short areas, some ethanol developers are buying land that already has irrigation wells, and converting the water use from irrigation to ethanol production.

"I think this is a major issue," said Ann Bleed, director of the Nebraska Department of Natural Resources. "But that doesn't mean we can't resolve the issue and still build ethanol plants."

The most efficient ethanol plants have reduced water consumption from 4 or more gallons of water per 1 gallon of ethanol to 3 gallons of water. Newer systems are being developed that will cut that requirement in half, to $1\frac{1}{2}$ gallons.

At the 3-to-1 ratio, it takes nearly 1 million gallons of water a day - equal to the amount used by about 15,000 people a day - to run a large, 100 million-gallon-a-year ethanol plant.

Still, ethanol production requires less than one-twelfth of the water needed to refine crude oil into energy products such as gasoline and diesel fuel.

A barrel of crude oil produces 19.5 gallons of petroleum, using 1,851 gallons of water in the