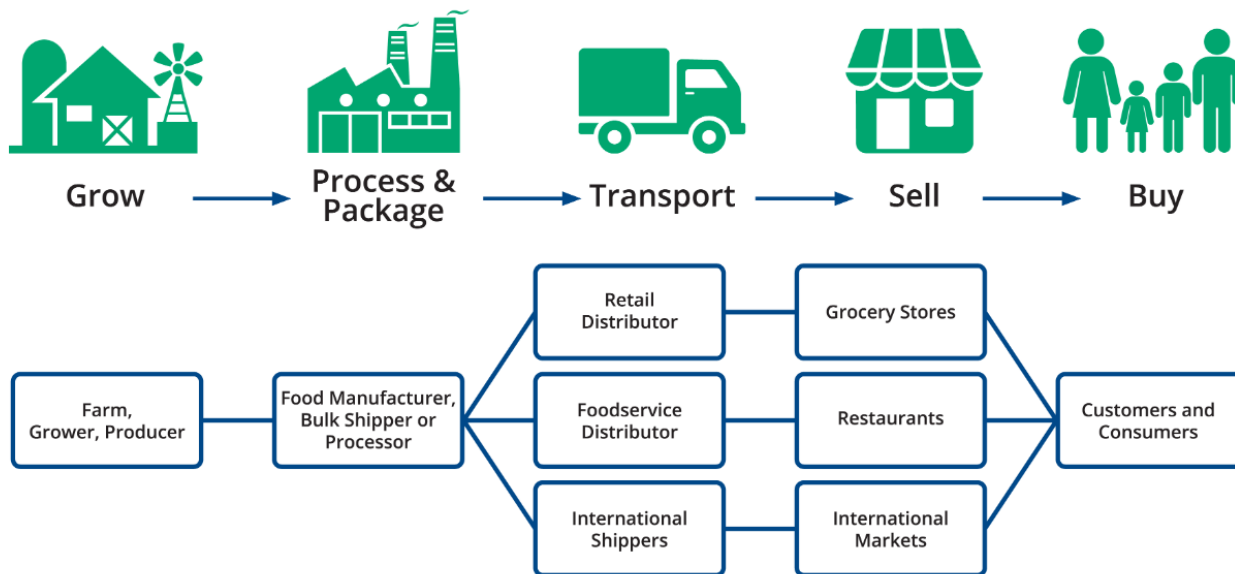


# Food Safety and Health: The Good, the Bad and the Ugly

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# Routes of pre and post-harvest contamination



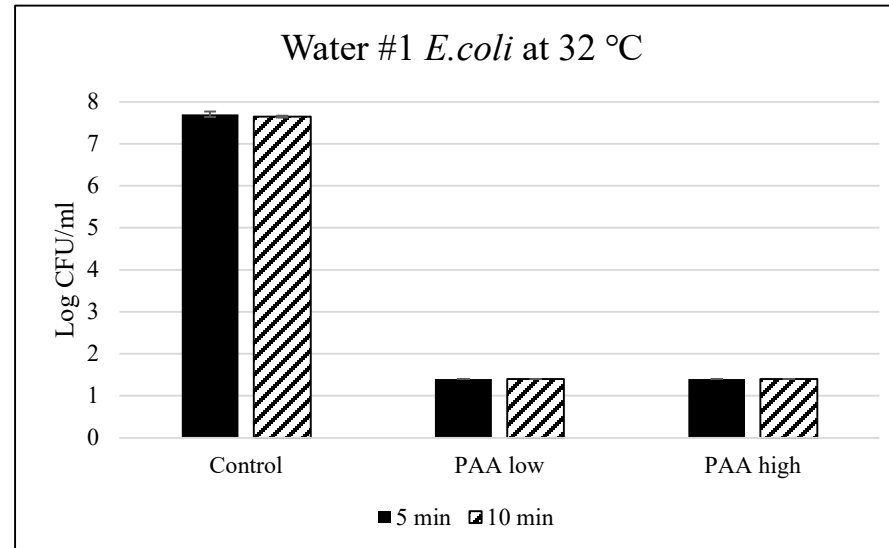
- Irrigation water
- Animal intrusion in field
- workers
- Contaminated equipment including knives and cutting boards
- Storage containers/coolers
- Ice or water supply
- Post-harvest wash water
- Cross contamination with other produce
- Transportation
- Retail
- Food handling personnel/consumers

Decontamination of irrigation water using low cost validated technologies

# Decontaminating the harvested rainwater for irrigation of fresh produce in an urban farm

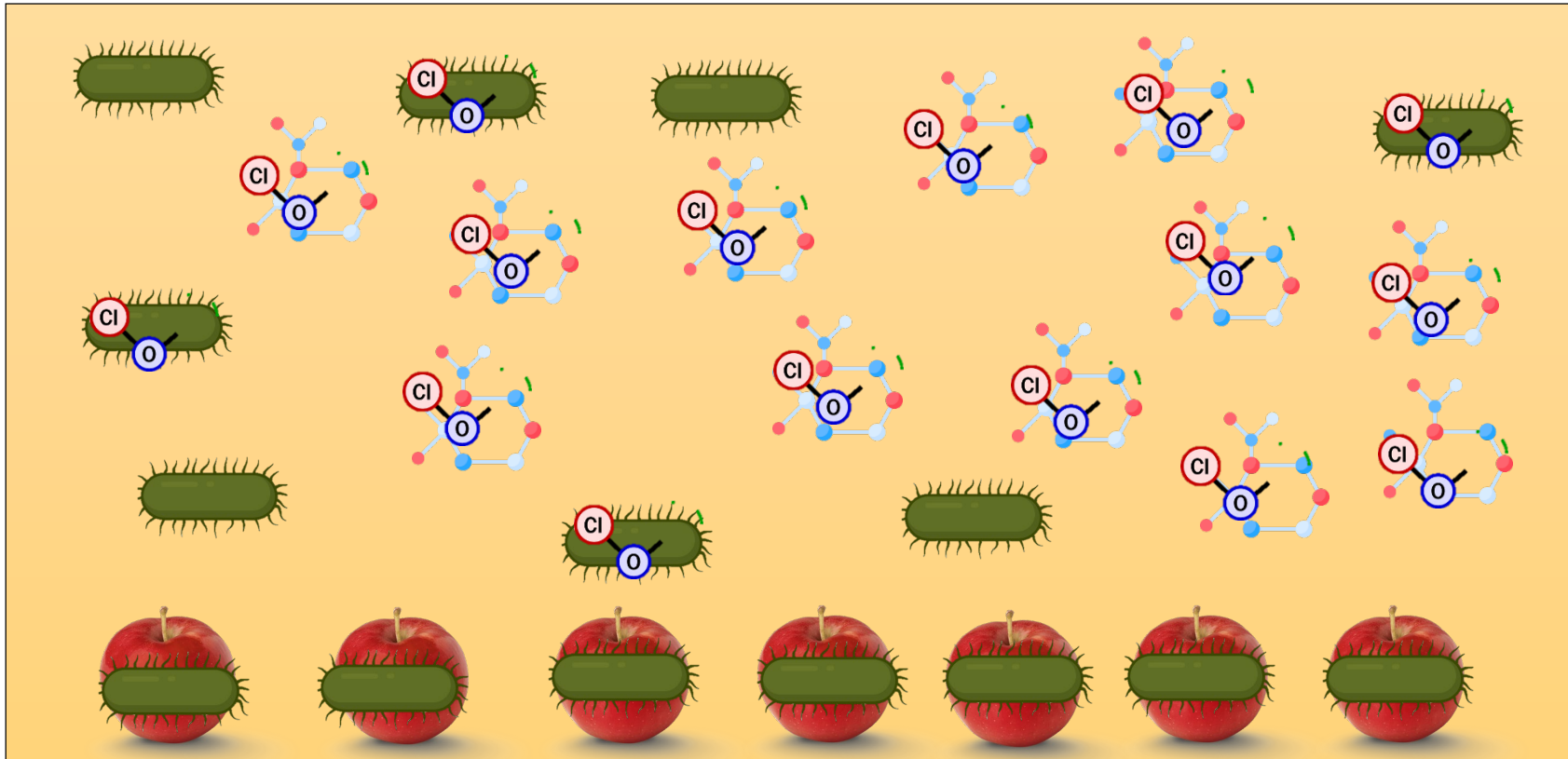


	#1-Ground water	#2-Surface water
Air temperature (°C)	18.0	33.5
Water temperature (°C)	17.4	30.6
pH	8.13	8.01
Conductivity ( $\mu$ s)	353	182.7
Total coliform (CFU/mL)	<1	101
Turbidity (NTU)	0.65	4.82



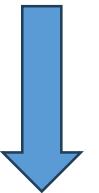
Reducing the risk of cross-contamination by validating sanitizer concentrations during washing of fresh produce

# Potential cross-contamination event under high sugar conditions



Initial concentration:  
100-150 ppm

Free chlorine levels



## Washing the produce reduces ‘some’ of the bacterial load

Sanitizer	COD (mg/L)	0 ppm	20 ppm	40 ppm	80 ppm
PAA	300	<b>6.5</b> ± 0.3aA	5.3 ± 1.4aB	3.9 ± 3.0aBC	<b>2.7</b> ± 1.2aC
	2500	6.8 ± 0.6aA	6.0 ± 0.9aA	5.8 ± 0.8bA	2.9 ± 2.8aB
NaOCl	300	6.5 ± 0.3aA	5.9 ± 0.7aA	6.0 ± 0.6bA	5.1 ± 0.5bB
	2500	<b>6.8</b> ± 0.6aA	5.7 ± 0.5aBC	6.8 ± 1.2bAB	<b>5.3</b> ± 0.8bC

Table 1: Levels (Log MPN/leaf) of *E. coli* TVS353 found on inoculated leaves after washing. Values are expressed as mean ± standard deviation. Means with different lower-case letters within the same column are significantly different ( $p < 0.05$ ). Means with different upper-case letters within the same row are significantly different ( $p < 0.05$ ). The lower detection limit is -0.52 Log MPN/leaf.

$10^{6.5} = 3,162,278$  Bacterial cells per leaf

$10^{6.8} = 6,309,573$  Bacterial cells per leaf

$10^{2.7} = 501$  Bacterial cells per leaf

$10^{5.3} = 199,2500$  Bacterial cells per leaf

## In the absence of sanitizer, contaminated produce will contaminate uninoculated produce

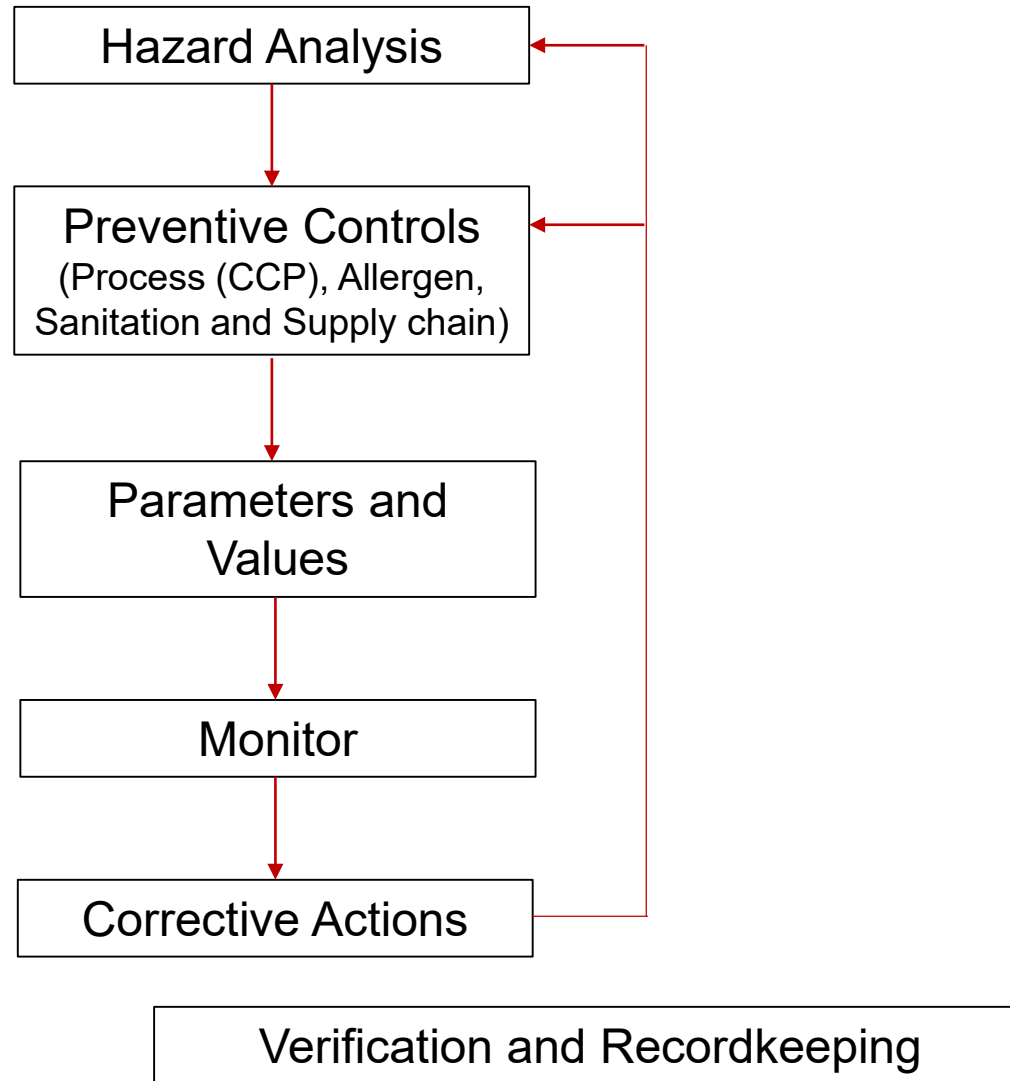
Sanitizer	COD (mg/L)	0 ppm	20 ppm	40 ppm	80 ppm
<b>PAA</b>	300	4.8 ± 0.4aA	2.6 ± 1.0aB	0.4 ± 0.5aC	0.3 ± 0.2aC
	2500	5.3 ± 0.2bA	3.2 ± 0.8aB	2.0 ± 0.9bC	0.2 ± 0.1aD
<b>NaOCl</b>	300	4.8 ± 0.4aA	2.6 ± 1.1aB	1.8 ± 1.0bBC	1.1 ± 1.0aC
	2500	5.3 ± 0.2bA	2.5 ± 0.8aB	3.1 ± 0.8cB	0.3 ± 0.3aC

Table 4: Levels (Log MPN/leaf) of *E. coli* TVS353 found on uninoculated leaves after washing. Values are expressed as mean ± standard deviation. Means with different small letters within the same column are significantly different ( $p < 0.05$ ). Means with different capital letters within the same row are significantly different ( $p < 0.05$ ). The lower detection limit is -0.52 Log MPN/leaf.



Scientific underpinning food key food safety regulations: A Food Safety Plan

## Process of a Food Safety Plan



# Where to find credible food safety information?

## Recalls, Market Withdrawals, & Safety Alerts

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The list below provides information gathered from press releases and other public notices about certain recalls of FDA-regulated products. Not all recalls have press releases or are posted on this page. See [Additional information about recalls](#) for a more complete listing.

The Recalls, Market Withdrawals & Safety Alerts are available on FDA's website for three years before being archived. To search archived content, visit [Search FDA Archive](#) and input the name of the product and/or company name in the Search terms box as well as the year to get the most inclusive search results. To scroll through archived Recalls, Market Withdrawals & Safety Alerts content by year, see the [Recall and Safety Alerts Archive](#).

 [Sign up to receive Recalls, Market Withdrawals and Safety Alerts](#).  
\* FDA Employees: Use Chrome to Subscribe until further notice.



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Your Gateway to Food Safety Information

Get the latest news, alerts, and tips on safely handling and storing food to prevent food poisoning.

Learn More Recalls

SPOTLIGHT

Shopping at the Farmers Market with Food Safety in Mind

When shopping at the farmers market, it's important to learn

More Ground Cinnamon Products Added to FDA Public Health Alert Due to Presence of Elevated Levels of Lead

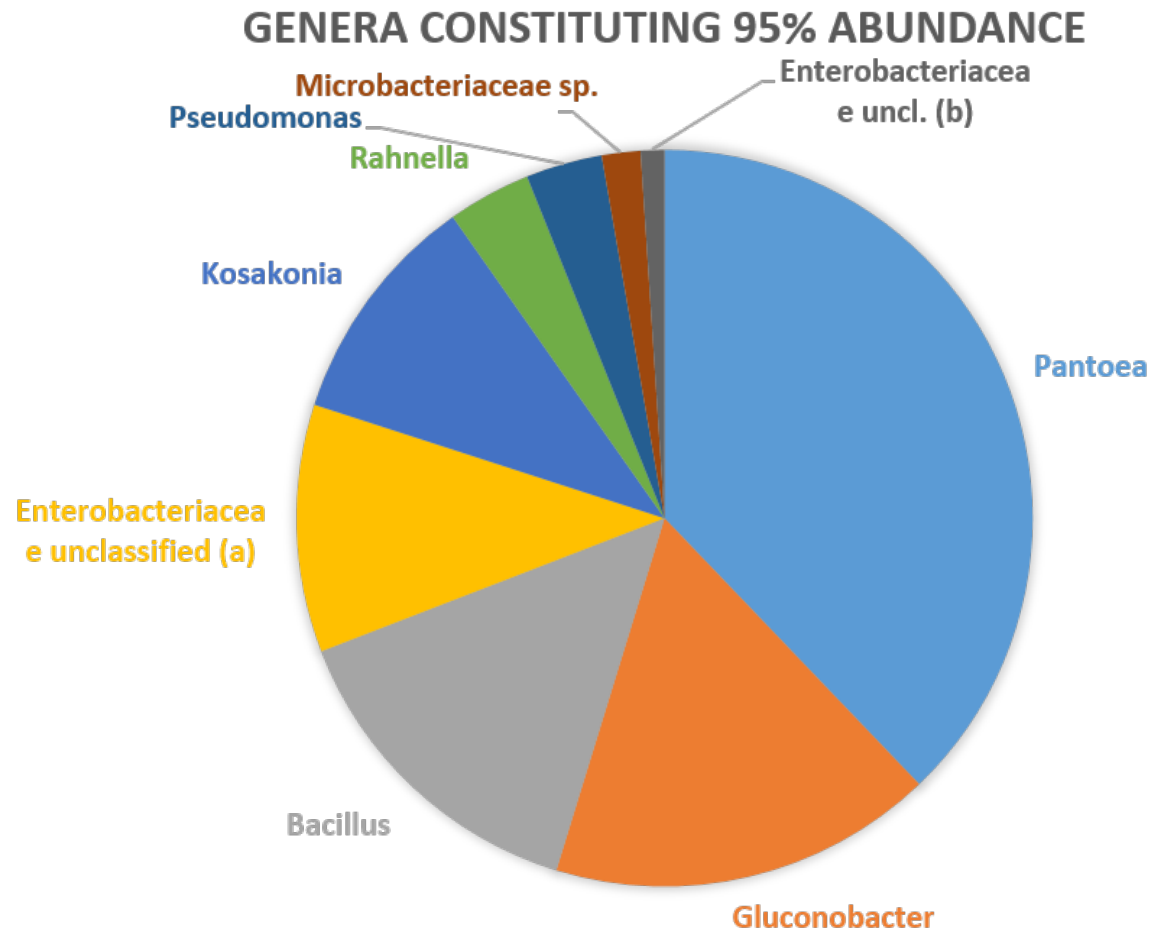
DIAMOND Investigation of Illnesses Diamond Shrumz-Brand Chocolate Bars, Cones, & Gummies

LISTERIA OUTBREAK Listeria Outbreak Linked to Meats Sliced at Delis

<https://www.foodsafety.gov/>

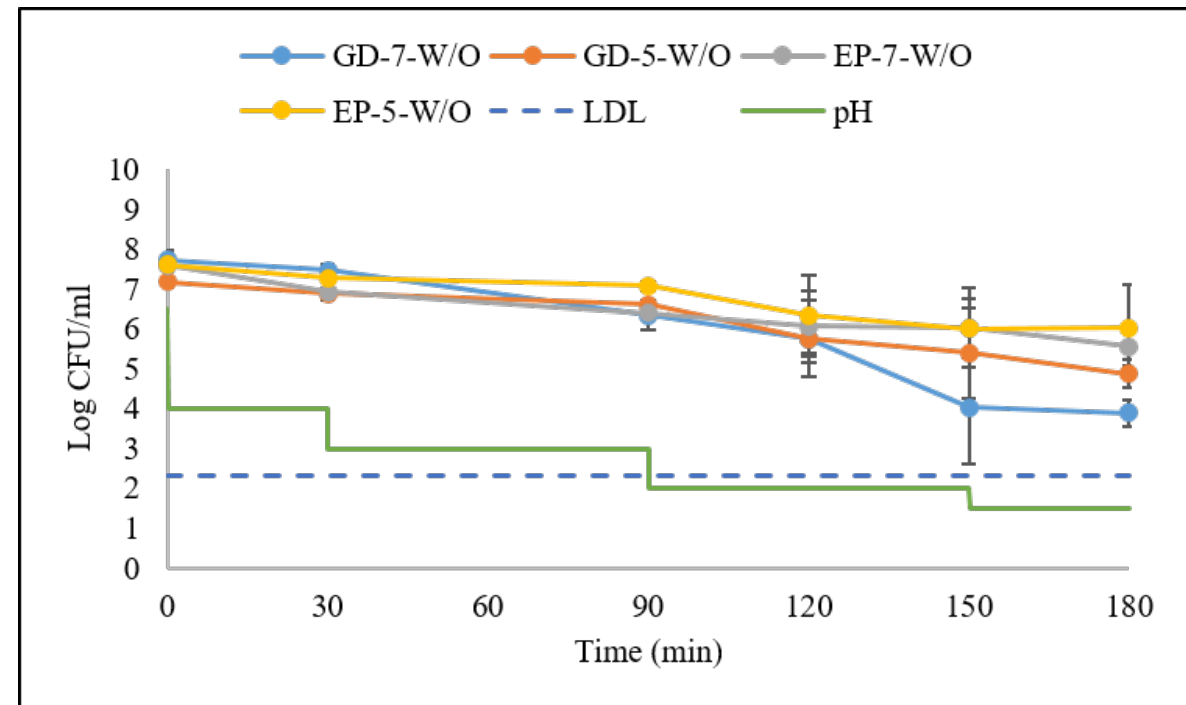
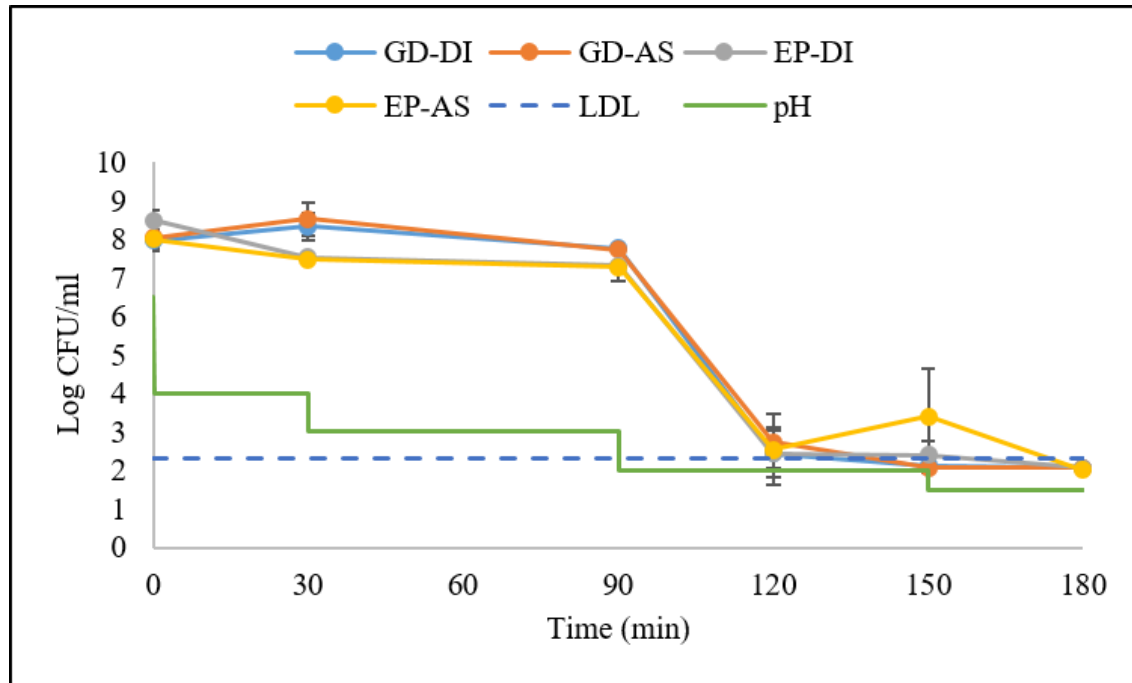
Are there any beneficial bacteria in raw fruits and vegetables?

## We a large variety of aerobic bacteria in apples grown at a local Orchard: Golden Delicious and Empire



**Remaining 5% abundance composed of:** Lactococcus, Streptococcus, Erwinia, Lysinibacillus, Sarcina, Curtobacterium, Xanthobacteraceae uncl., Clostridium sensu stricto 1, Gaiella, Acidobacteria Subgroup 6, Solirubrobacter, Sphingomonas, Micrococcaceae uncl., Gaiellales sp., Lactobacillus, Burkholderiaceae uncl., Leuconostoc

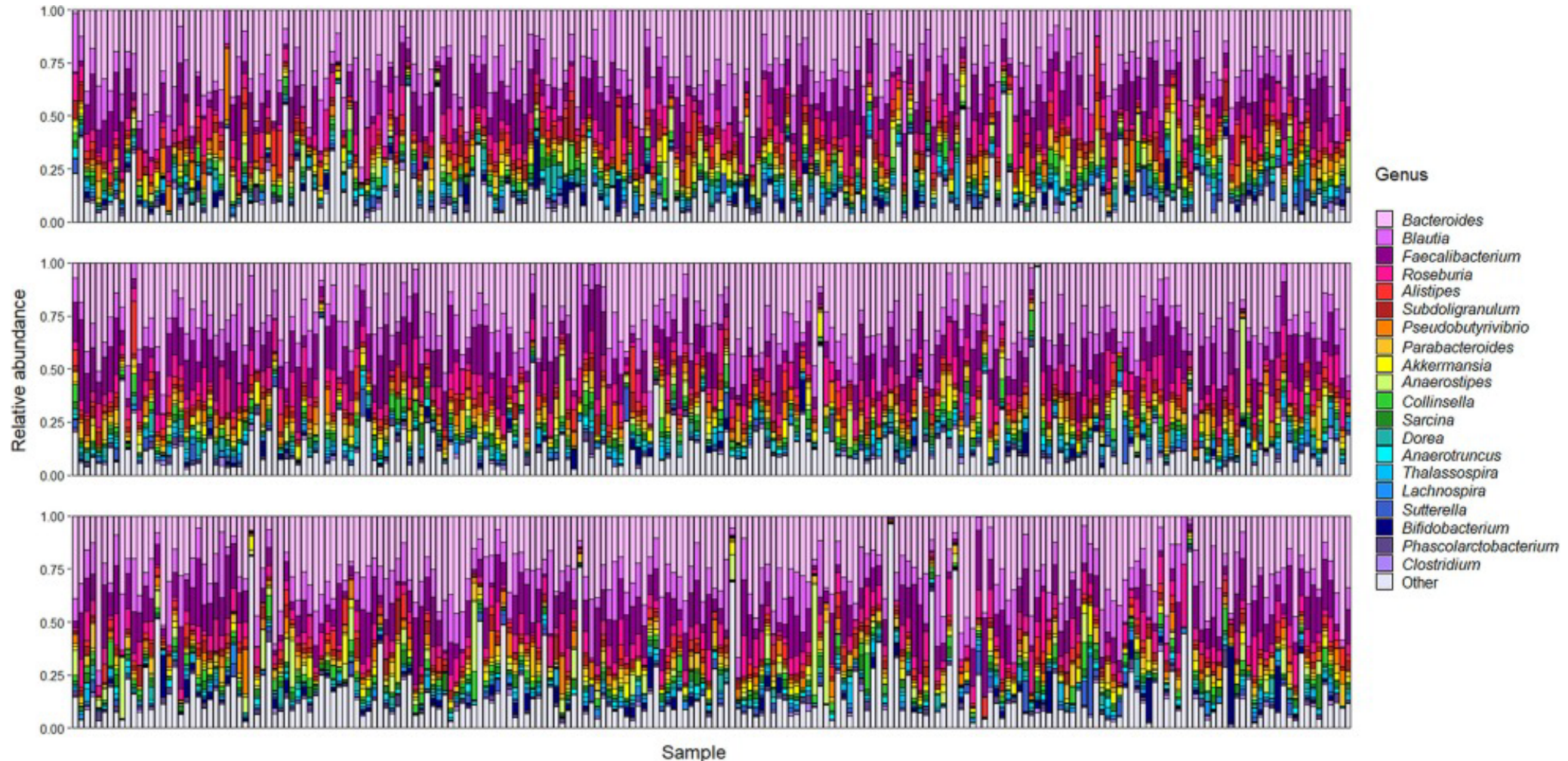
## Can these bacteria survive gastric digestion?



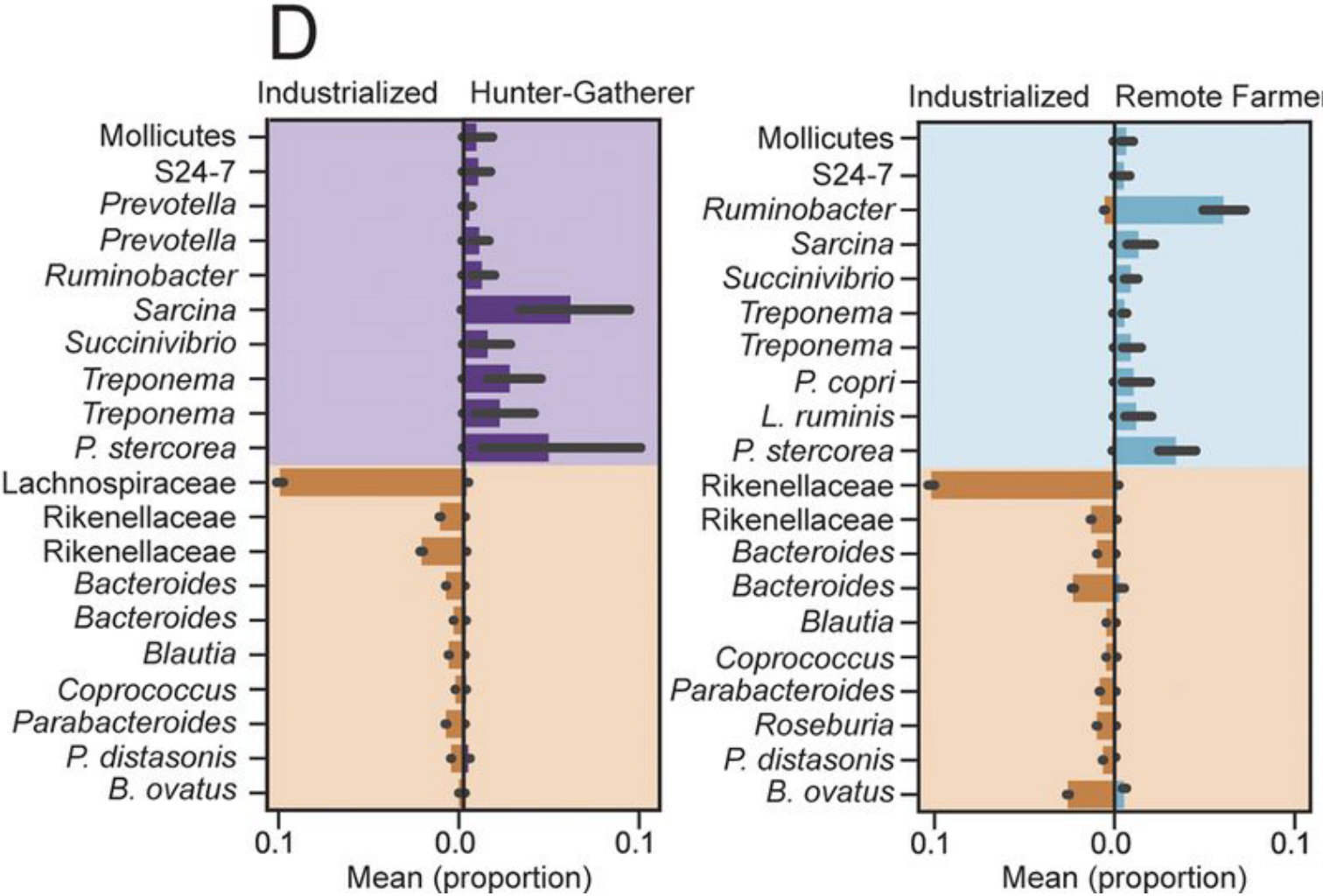
They do, to some extent. So what?

# Surviving microbes can interact with or incorporate within 'Gut Microbiome' of human intestine

Gut microbiome composition and diversity correlates with many diseases, including chronic diseases as well as positive health outcomes

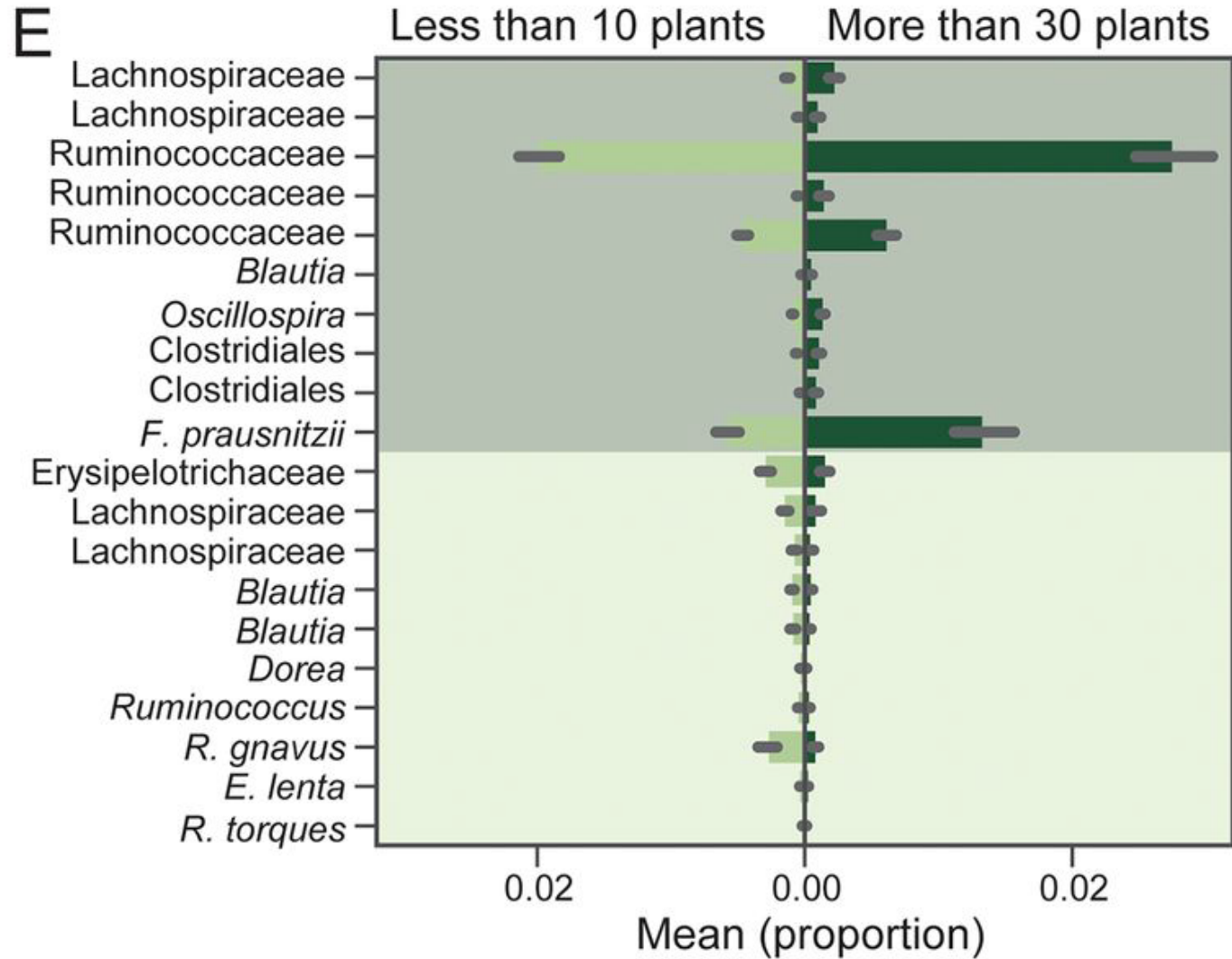


The Microsetta Initiative: UC San Diego: A global Citizen Science project to understand human gut microbiome across various populations





Diverse foods, with a variety of fruits and vegetables are recommended to maintain healthy gut microflora



Organic or Conventional?

# Pesticide Data Program Annual Summary

Calendar Year 2022



Samples from 9 states collected throughout the year



> 7500 samples of fresh produce, grown domestically/ imported

State	BB	CE	CR	GB	GR	MU	PC	PE	PO	PU	SS	TO	WS	Total Fresh
California	100	155	39	117	154	155	97	156	117	121	117	156	156	1,640
Colorado	16	24	6	17	24	24	11	24	18	20	18	24	23	249
Florida	59	84	21	63	84	84	50	84	63	77	63	84	84	900
Maryland	36	47	12	34	48	48	28	48	36	39	36	48	47	507
Michigan	53	72	18	54	72	72	37	72	54	64	54	72	72	766
New York	72	108	27	81	108	108	63	108	79	93	80	108	108	1,143
Ohio	39	72	18	54	72	72	41	72	54	65	54	72	75	760
Texas	71	95	24	74	96	96	67	96	72	74	72	96	96	1,029
Washington	36	49	12	36	48	48	25	48	36	40	36	49	48	511
<b>TOTAL</b>	<b>482</b>	<b>706</b>	<b>177</b>	<b>530</b>	<b>706</b>	<b>707</b>	<b>419</b>	<b>708</b>	<b>529</b>	<b>593</b>	<b>530</b>	<b>709</b>	<b>709</b>	<b>7,505</b>

# Key findings from the report

In 2022, over **99%** of samples had residues **below the tolerances** established by the EPA with **27.6%** having no detectable residue.

Residues **exceeding the tolerance** were detected in **0.53%** (56 samples) of the total samples tested (10,665 samples). Of these 56 samples, 19 were domestic (33.9%) and 37 were imported (66.1%).

Domestic samples accounted for 70.0% of all samples (excluding grain, which were 100% domestic), while 29.2 % were imports, 0.8% were of unknown origin, and less than 0.1 percent were of mixed national origin

Questions?