Food Safety:
What Walnuts Growers Need to Know

Linda J. Harris, Ph.D.
Specialist in Cooperative Extension and Department Chair
Food Science and Technology
Western Center for Food Safety

Dr. Javad Barouei (currently Prarie View University)
Dr. Tyann Blessington (currently FDA CORE)
Adam Cobert M.S. (currently RXBar)
Dr. Gordon Davidson (currently FDA produce processing division)
Dr. John Frelka Ph.D. (currently Terramino Foods)
Chris Theofel, M.S. (UC Davis)

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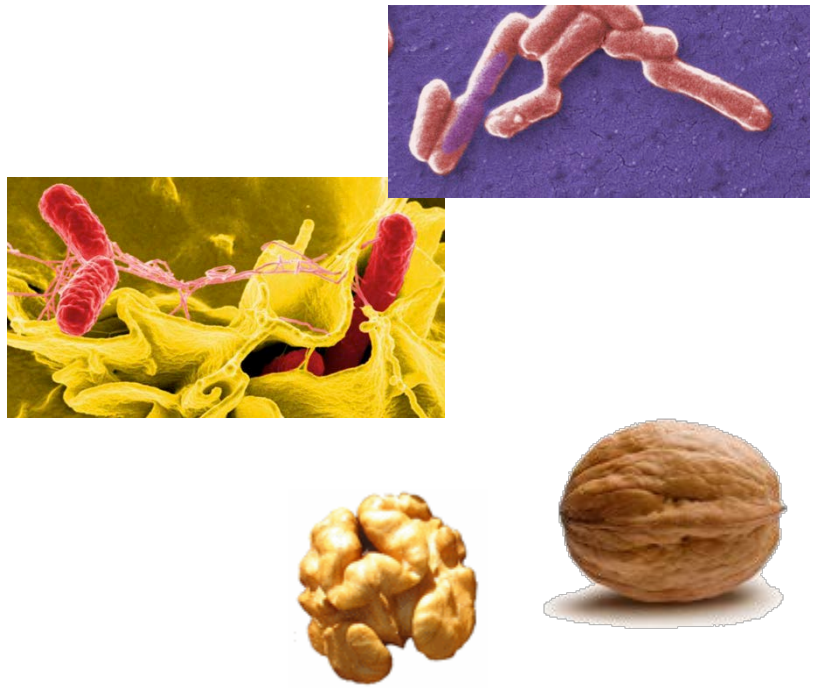
Outline

- Produce Safety Rule
  - Background
  - Overview
  - Timeframe
- Food Safety in Walnuts
  - What do we know?
  - Where do we go from here?
- Summary

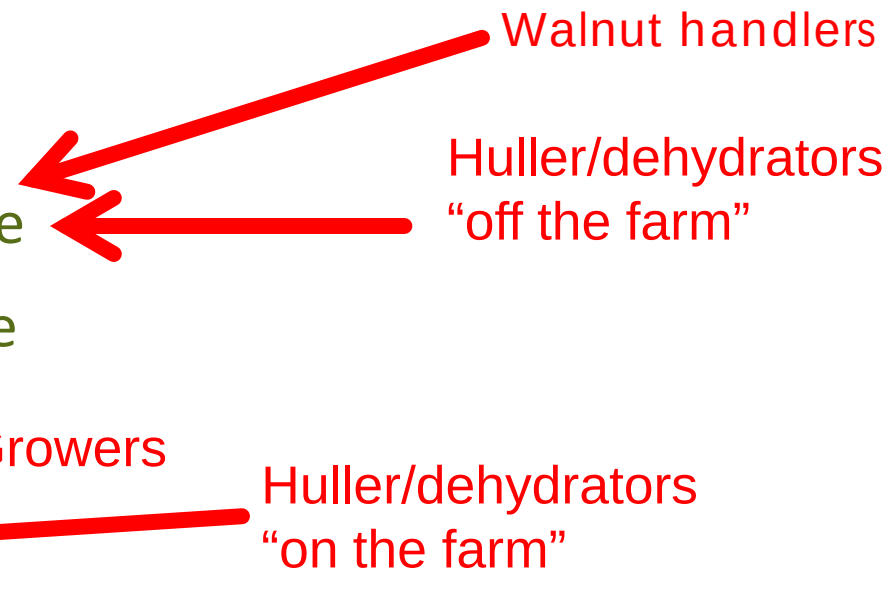
FDA FOOD SAFETY MODERNIZATION ACT



Bacteria photo credits: CDC

Food Safety Modernization Act January 4, 2011

- FINAL RULES 9/17/2015
  - Preventive Controls for Human Food Rule
  - Preventive Controls for Animal Food Rule
- FINAL RULES 11/27/15
  - Produce Safety Rule
  - Foreign Supplier Verification Rule
  - Accreditation for 3rd Party Auditors



Preventive Controls for Human Food Rule

FSPCA
FOOD SAFETY PREVENTIVE CONTROLS ALLIANCE

http://www.iit.edu/ifsh/alliance/

Produce Safety Rule

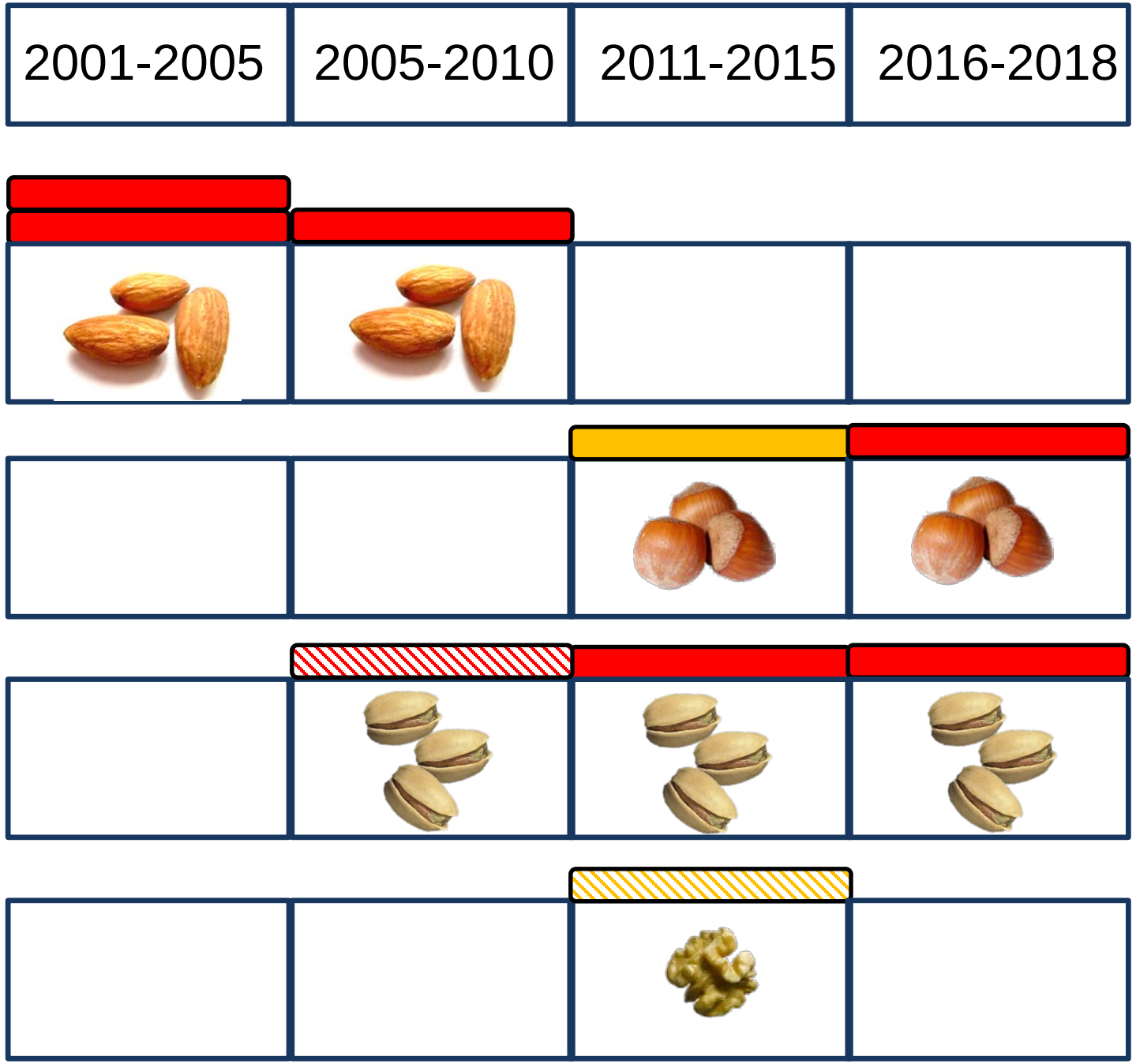
Produce Safety
ALLIANCE

http://producesafetyalliance.cornell.edu

Standardized curriculum training began 2016.
Walnut or tree-nut specific training has been available through the Walnut Board.

Why are treenuts included in the produce rule?

Foodborne Outbreaks Linked to U.S. Tree Nuts



Salmonella

E. coli O157

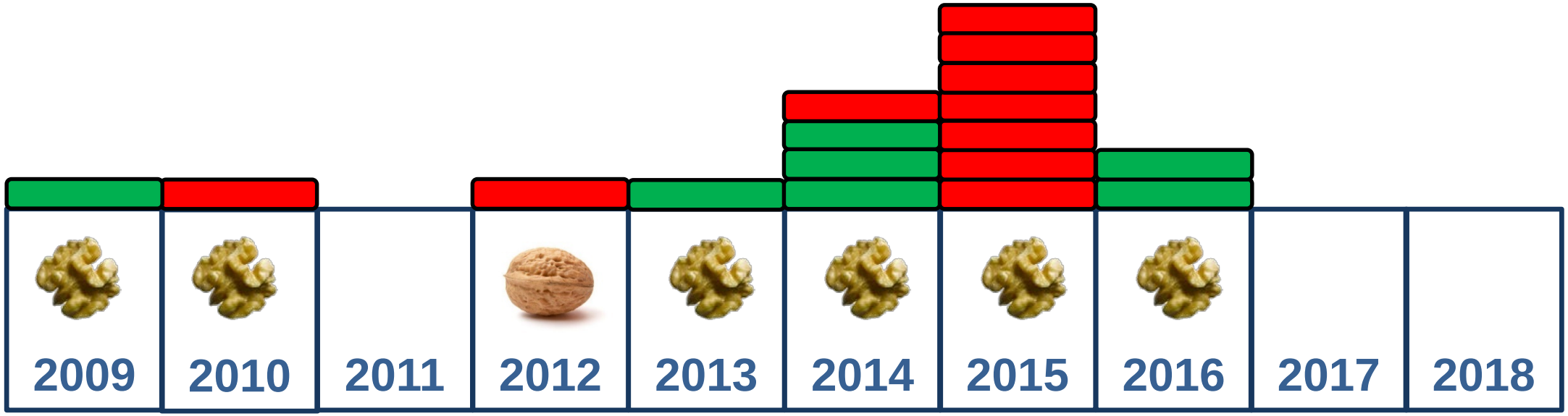
2001-2005	
2006-2010	
2011-2015	
2016-2018	

U.S. Foodborne Outbreaks Imported Treenuts

Salmonella

Nut butters represent a separate but active category

Walnut Recalls in the US



Salmonella

Listeria

Salmonella prevalence on inshell California walnuts

Survey year	Sample Size	No. of samples	No. of samples positive for *Salmonella*	Prevalence of *Salmonella* (%)	*Salmonella* serovars isolated
2010	100 g	935	0	<0.11	NA
2011	375 g	905	2	0.22	Muenchen
					Saintpaul
2012	375 g	998	1	0.10	Enteritidis
2013	375 g	1,000	1	0.10	Bovismorbificans

Davidson et al., 2015. *JFP.* 78:1547-1553

Average annual prevalence of *Salmonella*

- Almond kernels: **0.98%**
  (14,949 samples of 100 g; 95% CI, 0.83 – 1.2%)

- Inshell pecans: **0.95%**
  (4,641 samples of 100 g; 95% CI, 0.71 to 1.3%)

- Inshell walnuts: **0.14%**
  (2,903 samples of 375 g; 95% CI, 0.054 – 0.35%)

- Walnut kernels: **1.22% (FDA retail survey)**
  (658 samples of 375 g; 95% CI, 0.53 – 2.4%)

Harris et al., 2018 http://ucfoodsafety.ucdavis.edu/Nuts_and_Nut_Pastes

Potential for walnut kernel contamination

- Harvest
  - Shaking to the ground, sweeping
- Postharvest handling
  - Huller – rock tank
  - Dehydrator
  - Silo
- Processing
  - Cracking
  - Post cracking handling

Potential Contamination Sources

Humans

Soil

Produce

Preharvest

Animals

Buildings
Equipment
Tools

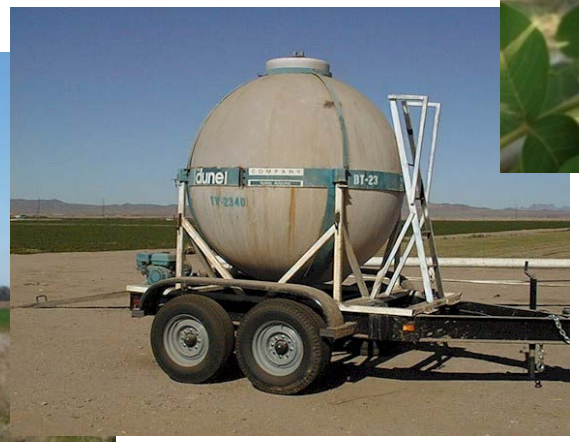
Water

Postharvest

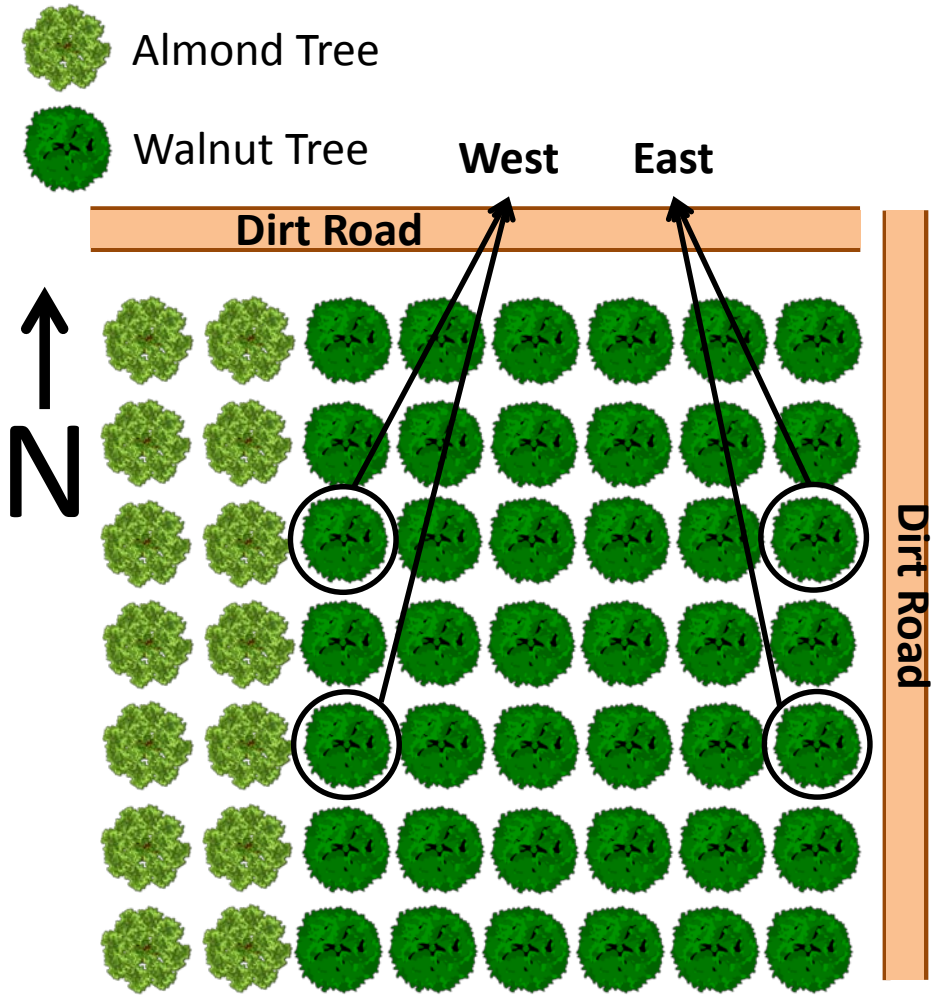
Produce Safety Rule

- Science-based minimum standards for the safe growing, harvesting, packing, and holding of produce on farms.
- New standards in the following major areas:
  - Agricultural Water
    - orchard; huller
  - Biological Soil Amendments of Animal Origin
    - orchard
  - Domesticated and Wild Animals
    - before and during harvest
  - Equipment, Tools, and Buildings – including sanitation controls
    - harvest, hulling, dehydration
  - Worker Training and Health and Hygiene
    - hulling

Agricultural Water: Contacts the Harvestable Portion of the Crop



Survival of *E. coli* on Walnuts



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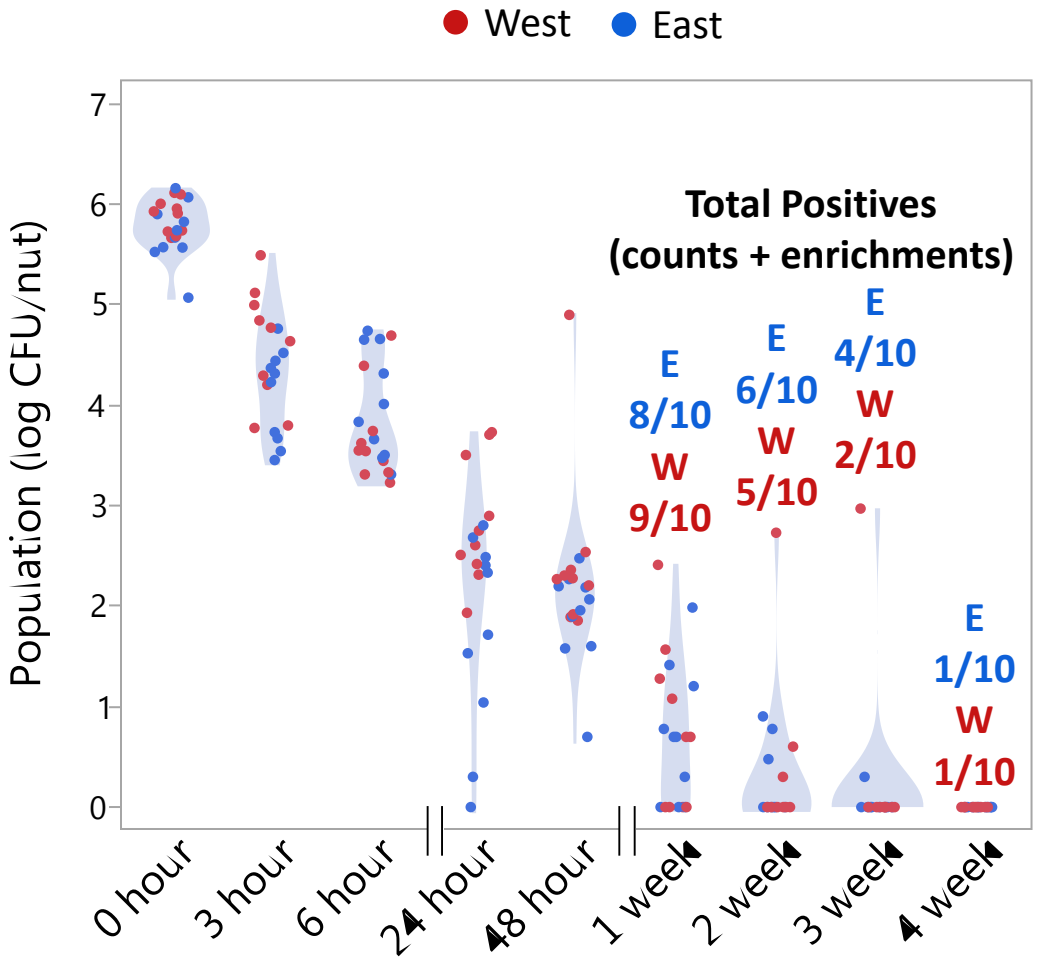
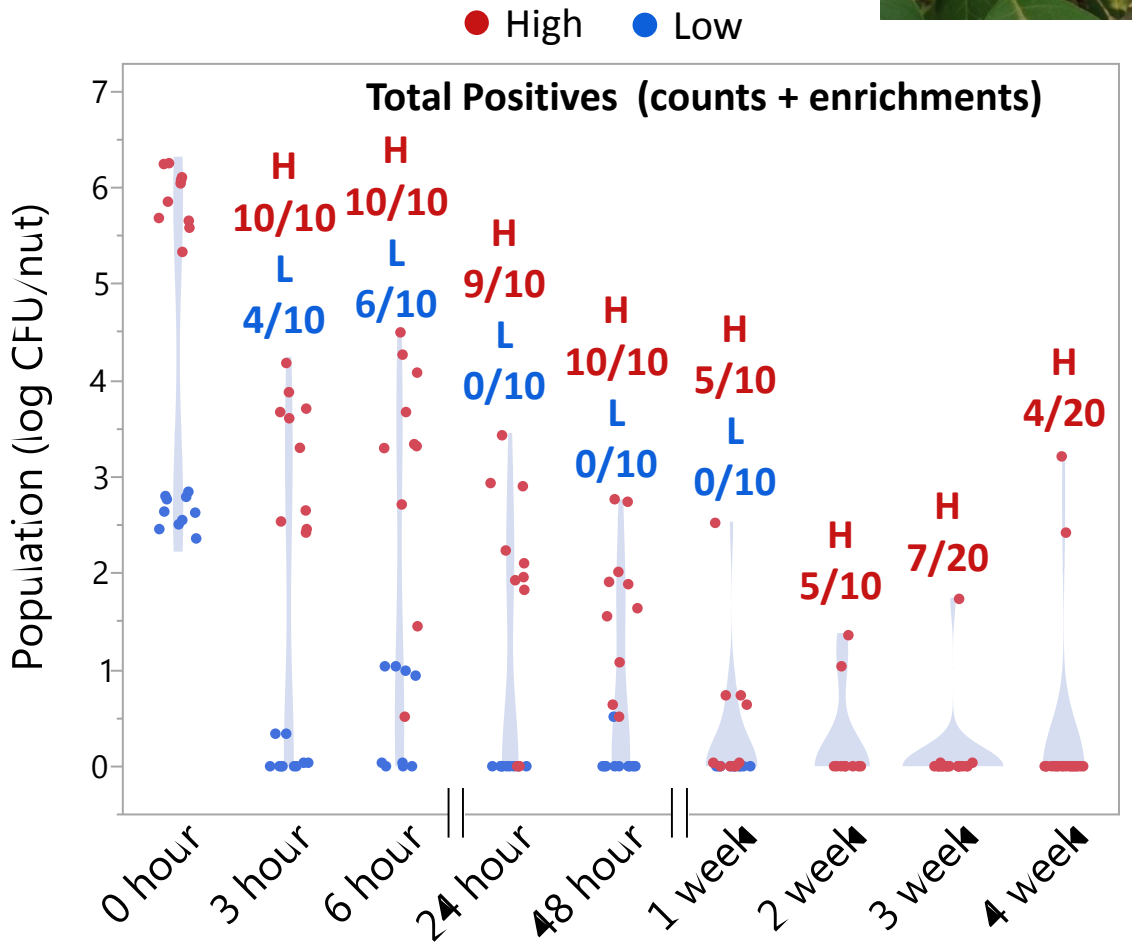
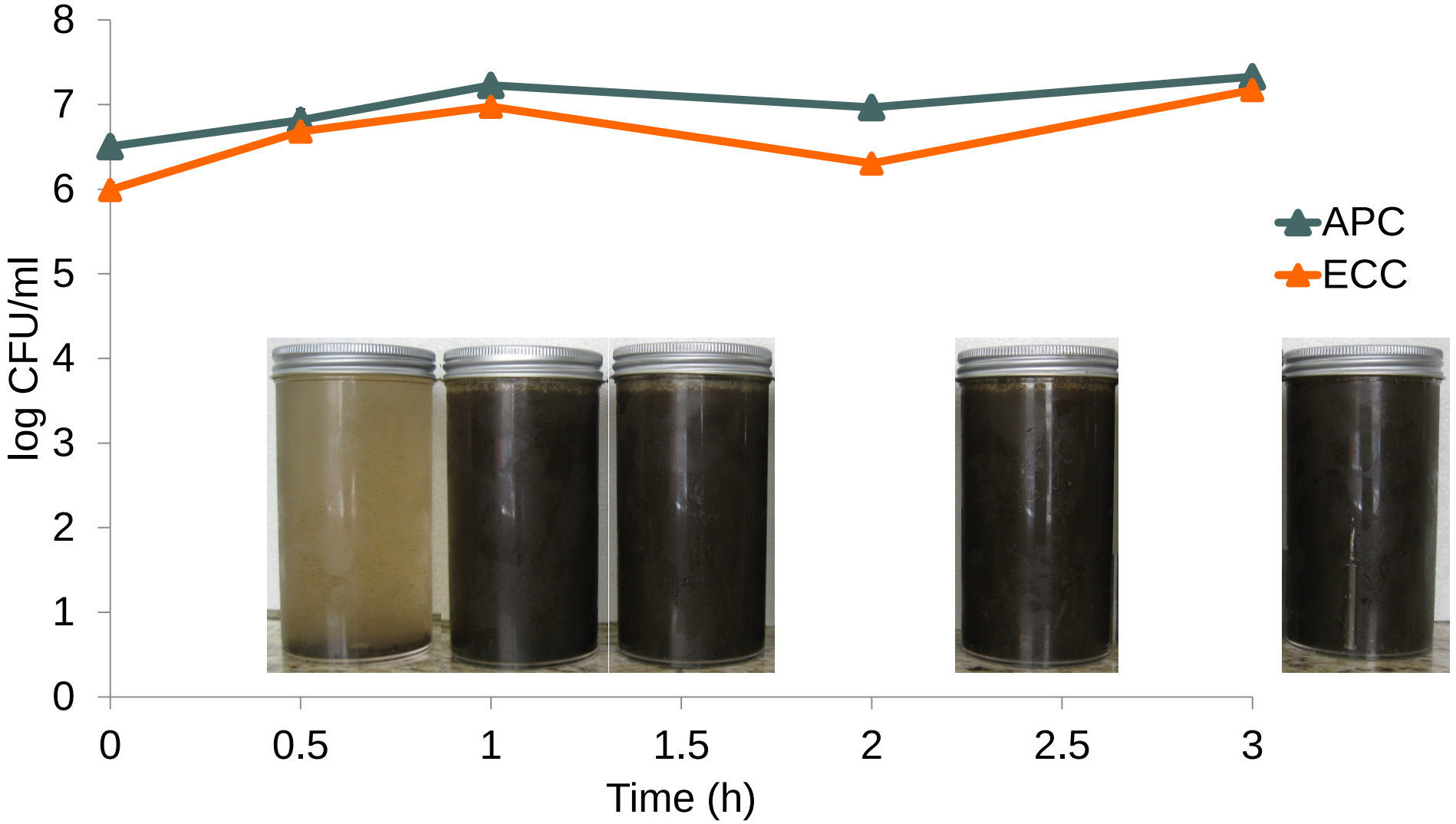




Float Tank Water Contacts All Incoming Walnuts

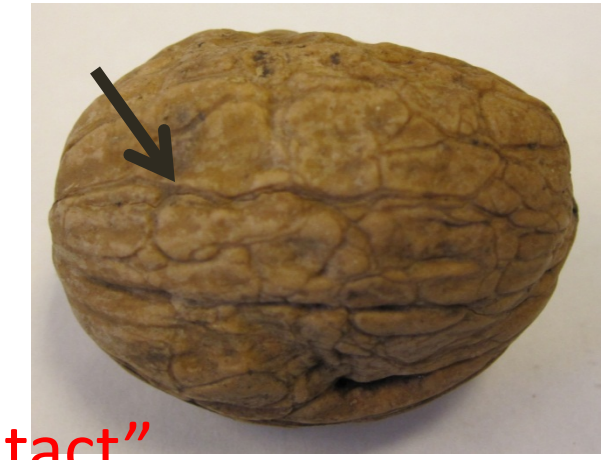
Efforts to sanitize this water were not successful under commercial conditions



An intact shell can protect from contamination

0

1



"Intact"

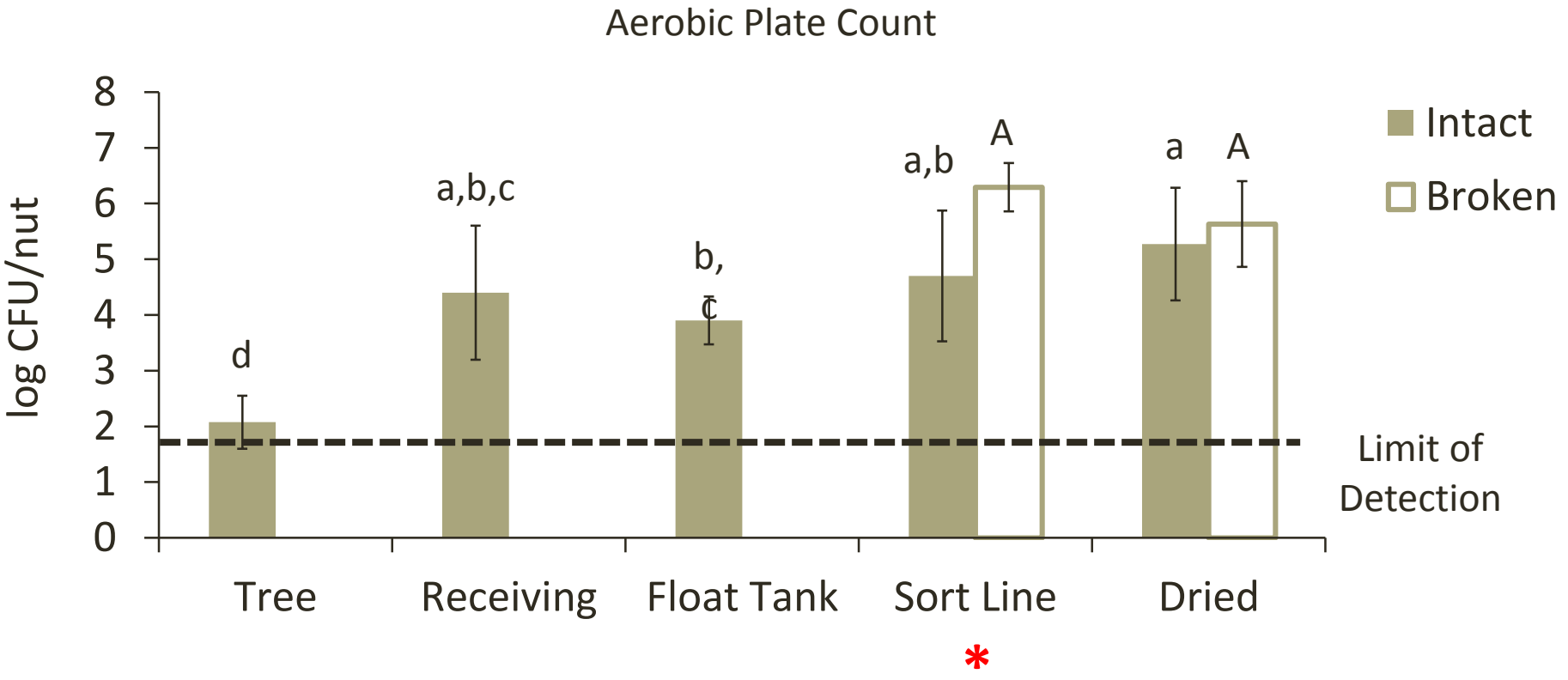
2

3

4

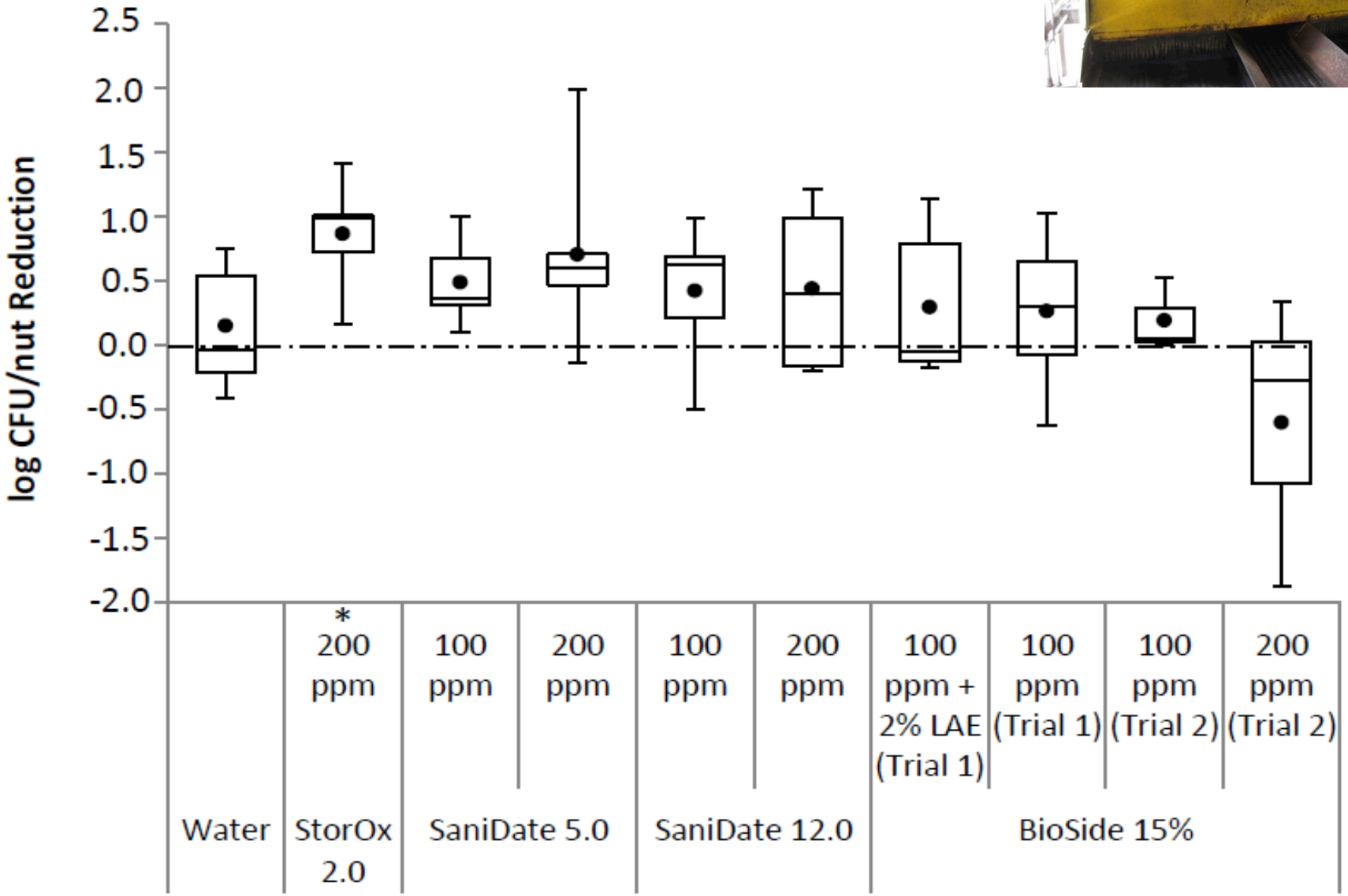
5

Microbial Loads – Kernels

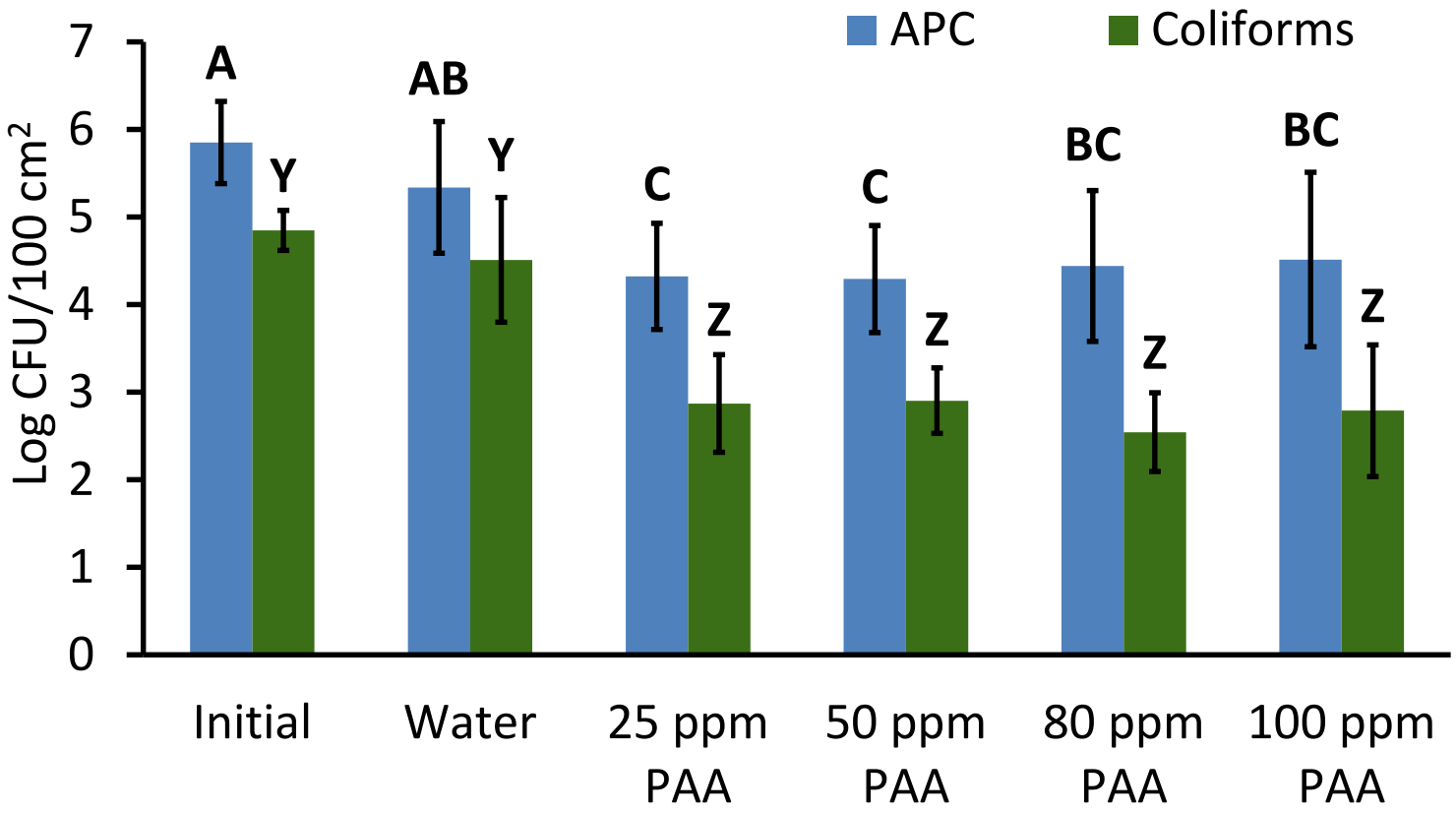


Columns denoted with the same letter are not significantly different (P<0.05). Lowercase letters are used for intact and uppercase letters are used for broken.
Stars (*) indicate intact/broken pairs which are significantly different (P<0.05)

Application of a post-hulling sanitizer spray does not significant decrease Aerobic Plate Counts on inshell walnuts



25 ppm PAA spray significantly reduces APC and coliforms on huller conveyor belts



Davidson et al., *In Press*

Incorporating an Antimicrobial Spray System at Walnut Huller?

Pros

- Continual sanitation of equipment
  - Reduce cross-contamination?

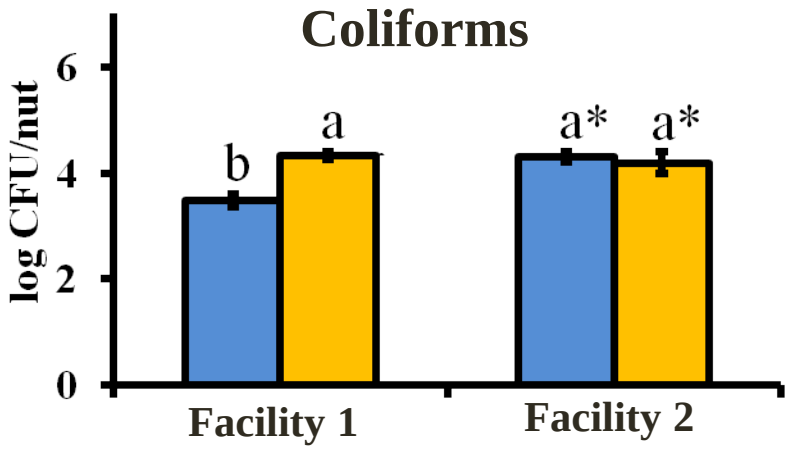
Cons

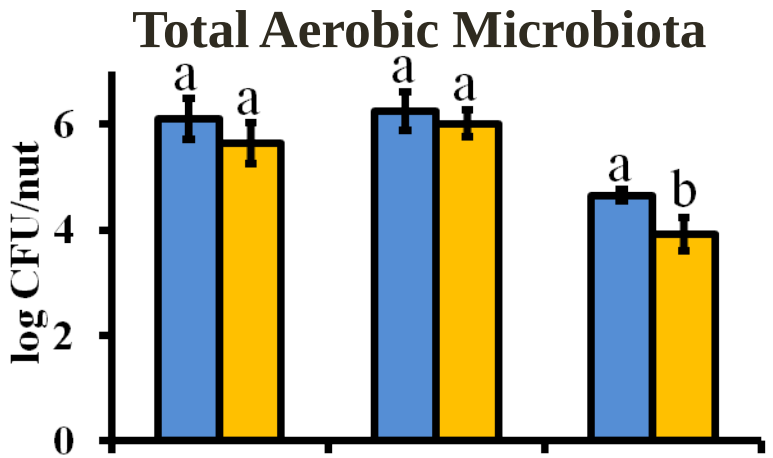
- Employee discomfort
  - Location and concentration dependent
    - eye and respiratory irritation
- Added cost?
  - Financial analysis
  - Volume of PAA used
    - Formulation dependent
  - Impacts on equipment?

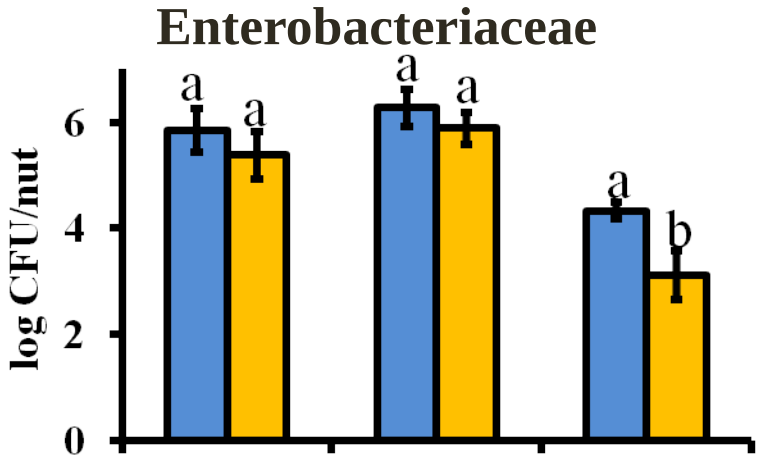
Dehydration does not significantly reduce microbial loads

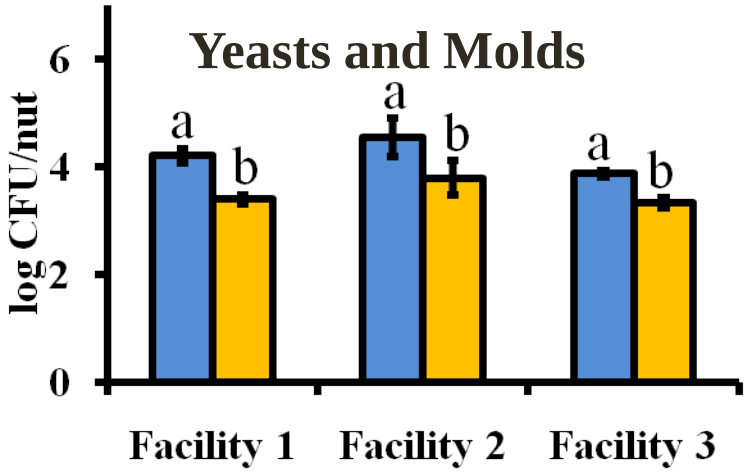
Before dehydration

After dehydration

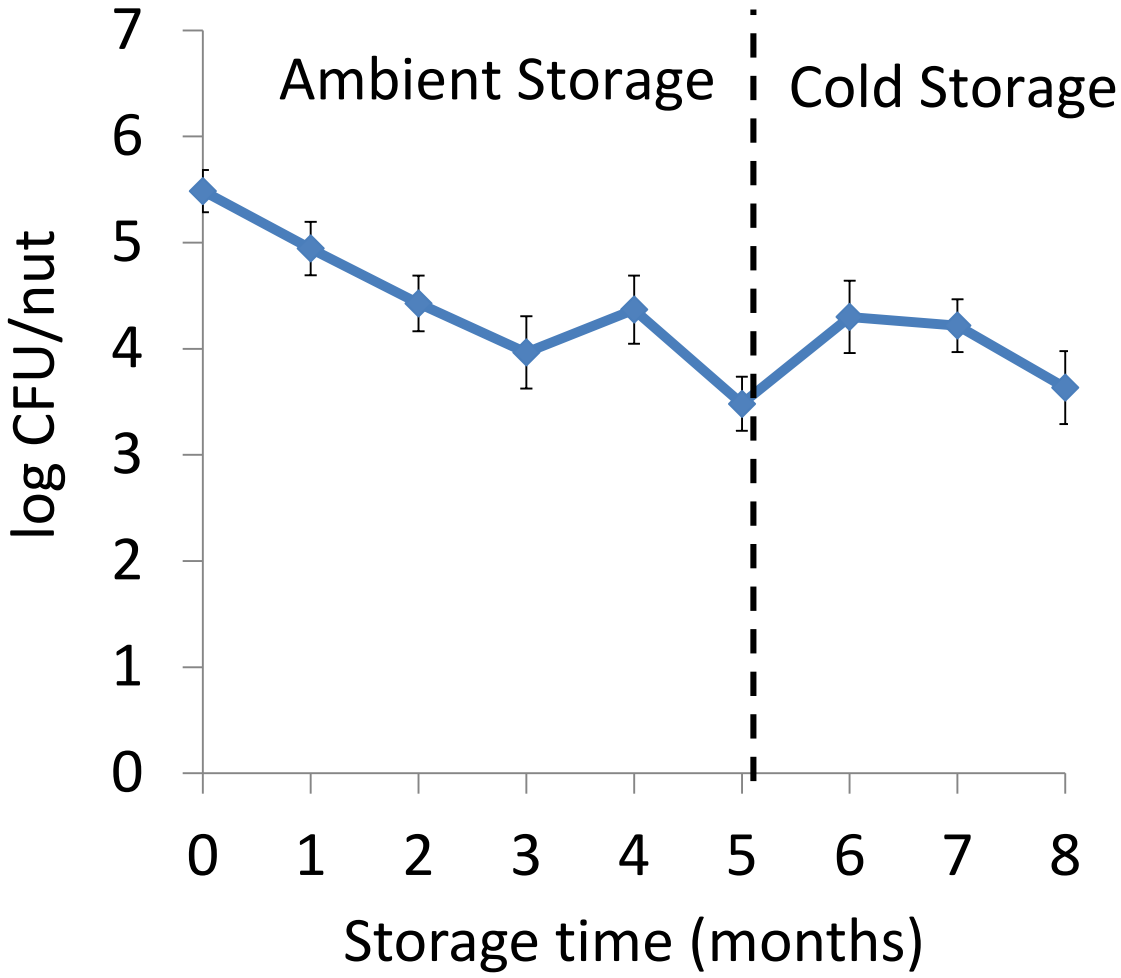




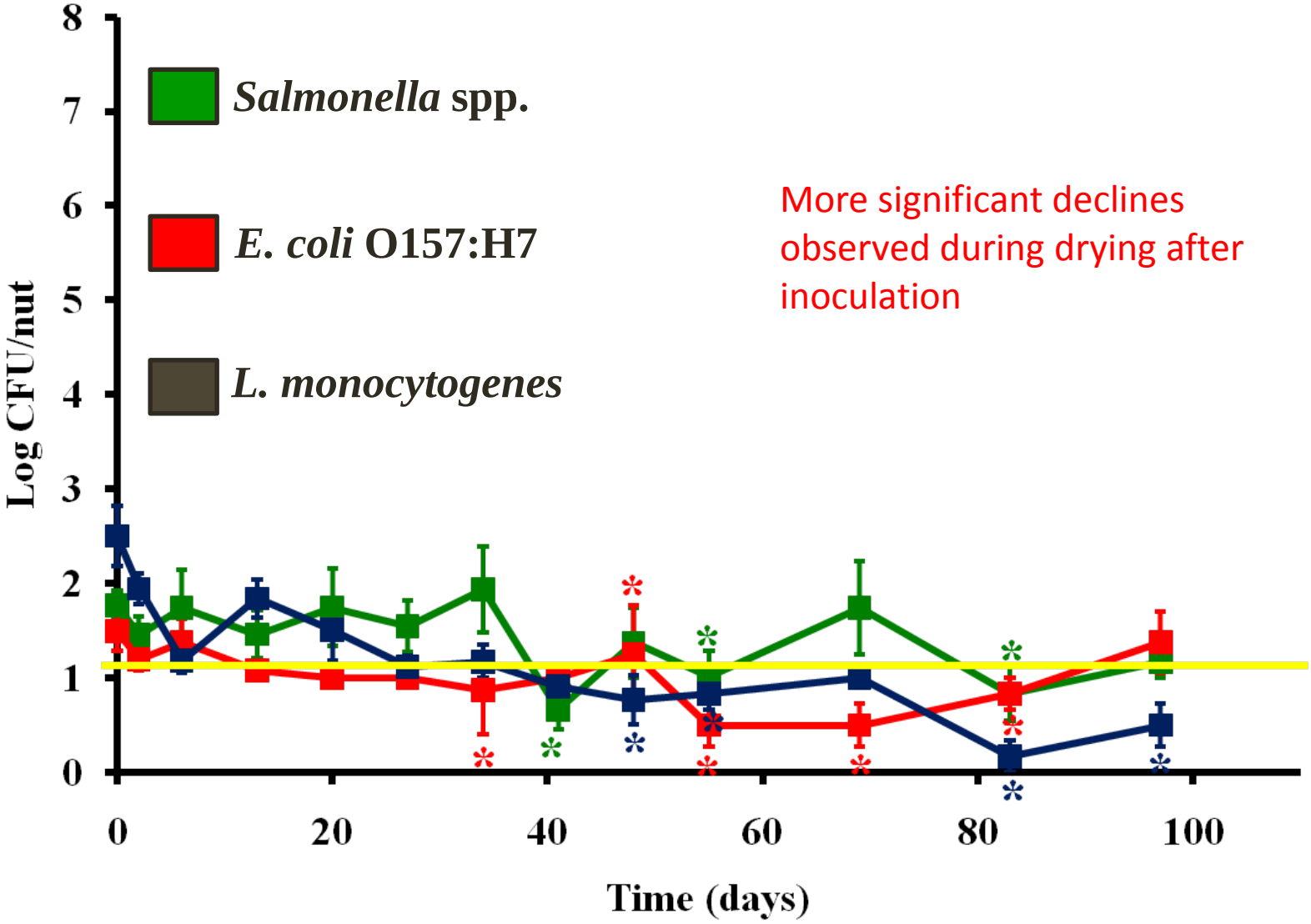




Microbial loads (APC) initially decline during storage

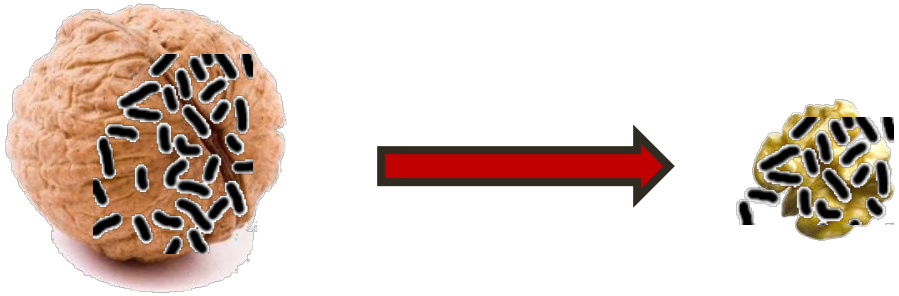


Salmonella, *E. coli* O157:H7, and *L. monocytogenes* slowly decline on inshell walnuts stored at ambient conditions



More significant declines observed during drying after inoculation

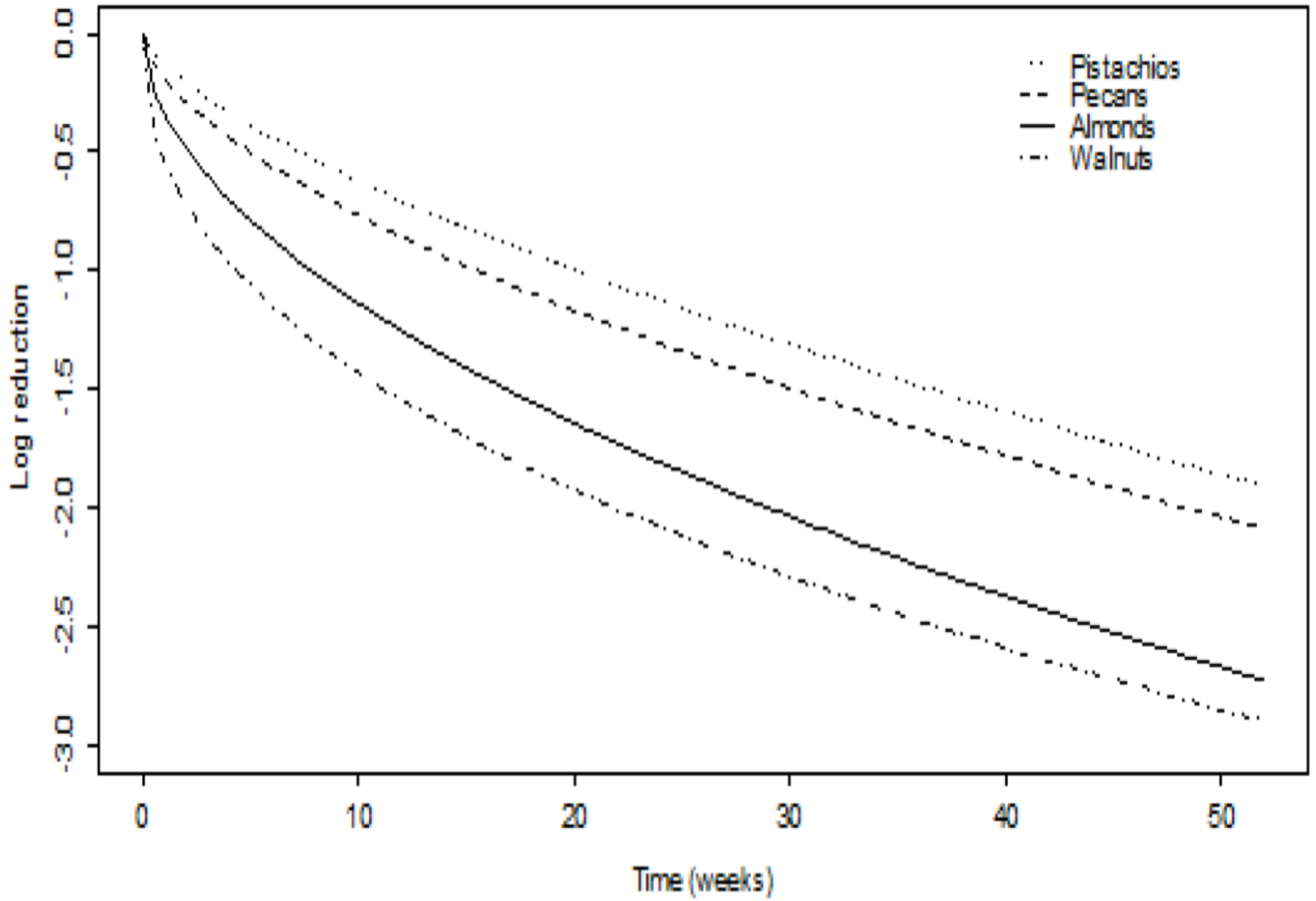
Influence of cracking?



Does transfer occur?

To what extent?

Survival of *Salmonella* on treenuts

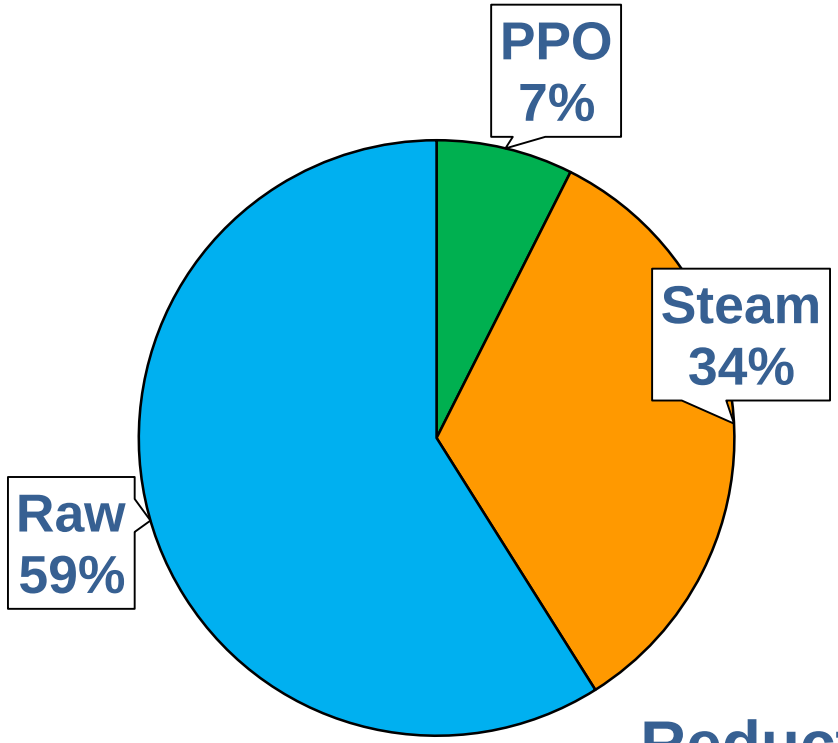


Santillana Farakos et al., 2016. *Int. J. Food Microbiol.*

Kernel Domestic shipments

CWB Survey (9/2016 – 8/2017)

8 handlers with a domestic share 58.42%



Reduction rates:

- PPO: 5 log
- Steam: 4.6 log

Produce Safety Rule Compliance §

Business Size	Years to Comply After Effective Date (1-26-16)*
All other businesses (>$500K)	2
Small businesses (>$250K-500K)	3
Very small businesses (>$25K-250K)	4

**Compliance dates for certain aspects of the agricultural water requirements allow an additional two years beyond each of these compliance dates.*

Water quality testing compliance dates extended to 2022

https://www.cdfa.ca.gov/producesafety/

Inspection to begin Spring 2019

Summary

- Strong evidence that *Salmonella* and other foodborne pathogens can be found on treenuts including walnuts
- Farm management practices may influence contamination
- Produce Safety Rule
- Good Agricultural Practices

University of California, Division of Agriculture and Natural Resources

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Nuts and Nut Pastes

http://ucfoodsafety.ucdavis.edu/Nuts_and_Nut_Pastes/

Food safety information for nuts and nut products.

General Food Safety Information

- Bibliography: Containing a comprehensive list of references pertaining to microbial safety of nuts and sesame seed. Publications on the Microbial Safety of Nuts and Sesame Seeds (updated 7-23-18) (PDF 274 KB)
- GMA Equipment Design Checklist for Low Moisture Foods (2-9-10) (will open as MS Excel spreadsheet.)
- Inactivation of Microorganisms in Nuts and Nut Pastes: Table and References (updated 7-23-18) (PDF 114 KB)
- Outbreaks from Tree Nut, Legume, and Seed Pastes: Table and References (updated 1-29-18) (PDF 65 KB)

A sincere thanks to the walnut industry collaborators who provided my team with guidance, access to facilities, and materials. This work would not be possible without you.