Food Safety and FSMA in Pistachio Production

LINDA J. HARRIS, PH.D. CFS
SPECIALIST IN COOPERATIVE EXTENSION AND CHAIR
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
CO-PI, WESTERN CENTER FOR FOOD SAFETY
Food Safety Modernization Act

Regulations

◦ Produce Safety
◦ Preventive Controls for Human Food
◦ Preventive Controls for Animal Food
◦ Foreign Supplier Verification
◦ Sanitary Transportation of Human and Animal Food
◦ Prevention of Intentional Contamination/Adulteration
◦ Accreditation of Third-Party Auditors/Certification Bodies

Focused on prevention of food safety issues and encompasses the entire food system
Why Pistachios?
Outbreaks Associated with Produce

FDA Outbreaks Linked to Produce Contamination Likely Prior to Retail: 1996–2014

- Sprouts, 43 (25%)
- Leafy Greens, 44 (25%)
- Tomatoes, 18 (10%)
- Melons (Cantaloupe and Honeydew), 17 (10%)
- Herbs (Basil, Parsley, Cilantro), 8 (5%)
- Cucumbers, 4 (2%)
- Green Onions, 3 (2%)
- Mangos, 3 (2%)
- Almonds, 2 (1%)
- Papayas, 2 (1%)
- Multiple**, 2 (1%)
- Other***, 7 (4%)
- Unknown+, 8 (5%)

*Berries*

Produce Safety Alliance
Since 2009: 12 US Recalls and 2 Outbreaks Linked to Pistachios

<table>
<thead>
<tr>
<th>Date of recall</th>
<th>Pistachio type</th>
<th>Reason given</th>
<th>Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 2016</td>
<td>Raw</td>
<td>Possible <em>Salmonella</em> contamination</td>
<td>None</td>
</tr>
<tr>
<td>June 2016</td>
<td>Raw</td>
<td><em>Salmonella</em> isolated by FDA (retail survey)</td>
<td>None</td>
</tr>
<tr>
<td>Mar 2016</td>
<td>Roasted</td>
<td>Possible <em>Salmonella</em> contamination</td>
<td>None</td>
</tr>
<tr>
<td>Mar 2016</td>
<td>Raw</td>
<td><em>Salmonella</em> isolated by FDA (retail survey)</td>
<td>None</td>
</tr>
<tr>
<td>Mar 2016</td>
<td>Roasted</td>
<td><em>Salmonella</em> (linked to outbreak)</td>
<td>11</td>
</tr>
<tr>
<td>Feb 2016</td>
<td>Raw</td>
<td><em>Salmonella</em> isolated by FDA (retail survey)</td>
<td>None</td>
</tr>
<tr>
<td>Feb 2016</td>
<td>Raw</td>
<td><em>Salmonella</em> isolated by FDA (retail survey)</td>
<td>None</td>
</tr>
<tr>
<td>Jun 2013</td>
<td>Raw and Roasted</td>
<td><em>Salmonella</em> (linked to outbreak)</td>
<td>8</td>
</tr>
<tr>
<td>Dec 2012</td>
<td>Raw</td>
<td><em>Salmonella</em> isolated</td>
<td>None</td>
</tr>
<tr>
<td>Dec 2012</td>
<td>Roasted</td>
<td><em>Salmonella</em> isolated</td>
<td>None</td>
</tr>
<tr>
<td>Aug 2010</td>
<td>Roasted and Raw</td>
<td>Possible <em>Salmonella</em> contamination</td>
<td>None</td>
</tr>
<tr>
<td>Mar 2009</td>
<td>Roasted and Raw</td>
<td><em>Salmonella</em> isolated</td>
<td>1</td>
</tr>
</tbody>
</table>
Raw Pistachio Survey 2010-2012

- 7 participating processors
  (98% of California pistachio production)
- ~ 4,000 100-g samples of inshell pistachios
  Floaters: 1,032 samples; Sinkers: 2,936 samples

**Prevalence of *Salmonella***

<table>
<thead>
<tr>
<th></th>
<th>Sinkers</th>
<th>Floaters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence (%)</td>
<td>0.37%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Level of *Salmonella***

<table>
<thead>
<tr>
<th></th>
<th>Sinkers</th>
<th>Floaters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells/100 g</td>
<td>0.47</td>
<td>1.2</td>
</tr>
<tr>
<td>Year</td>
<td>Serovar</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td><em>Salmonella Montevideo</em>?</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td><em>Salmonella Montevideo</em>?</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td><em>Salmonella Montevideo</em>, <em>Salmonella Newport</em>, <em>Salmonella Senftenberg</em></td>
<td></td>
</tr>
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<td><em>Salmonella Montevideo</em>, <em>Salmonella Senftenberg</em></td>
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<td><em>Salmonella Senftenberg</em></td>
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<tr>
<td>2016</td>
<td><em>Salmonella Montevideo</em>?</td>
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Narrow range of *Salmonella* in pistachios
Possible Contamination Sources

**Preharvest**
- Before harvest
- During harvest

**Postharvest**
- During postharvest handling
- Before pasteurization
- After pasteurization/roasting

Produce Safety Rule
Preventive Controls For Human Foods
Pistachio Harvest Choreography

Climate/time of harvest

Harvest Crews

Harvest Equipment

Trucks

Trailers

Processing Capacity

Year


Harvest Volume (millions lbs)

0 200 400 600 800 1,000
Salmonella can grow in harvested pistachios

Moussavi and Harris, unpublished
Contamination Sources

Humans

Animals

Produce

Buildings

Equipment

Tools

Soil

Water

Preharvest

Postharvest
Soil – Soil Amendments
Humans
Animals
Birds Recognized as an Agricultural Pest of Pistachios Since 1986

Bird damage to pistachios

Crows are the primary culprits followed by ravens and jays

Scope of the problem

We received 165 responses (23%) from the 664 surveys mailed. 71 (12.7 percent) were excluded from the analysis because the orchards were not in production, were outside California, or were managed by another service agency. The remaining 94 indicated 13 pistachio losses due to one or more of the following:

3-1-1986

BIRD PROBLEMS IN CALIFORNIA PISTACHIO PRODUCTION

A. Charles Crabb
Crop Science Department, Cal Poly, San Luis Obispo, California

Terrell P. Salmon
Wildlife Extension, University of California, Davis, California

Rex E. Marsh
Wildlife and Fisheries Biology, University of California, Davis, California
Equipment
What is in the tree is in the bin.

What is on the orchard floor is transferred.
Water Requirements

Production Water

- Water used in contact with produce during growth
  - Irrigation, fertigation, foliar sprays, frost protection

- “Agricultural water is defined in part as water that is intended to, or is likely to, contact the harvestable portion of covered produce or food-contact surfaces”

Harvestable is not yet clearly defined

Pistachios – foliar sprays
Requirements for Public Water Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Testing Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Water Supply</td>
<td>Copy of test results or current certificates of compliance</td>
</tr>
</tbody>
</table>

- With appropriate documentation, there is no requirement to test water that meets the requirements for public water supplies.
**Microbial Water Quality Profile:**
Survey of Ground Water Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Initial and Annual Testing Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td>4 or more times during the growing season or over the period of a year 1 or more samples rolled into profile every year after initial year</td>
</tr>
</tbody>
</table>

- Profile samples must be representative of use and must be collected as close in time as practicable to, but before, harvest.
Microbial Water Quality Profile: Survey of Surface Water Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Initial and Annual Testing Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>20 or more times over a period of 2 to 4 years</td>
</tr>
<tr>
<td></td>
<td>5 or more samples rolled into profile every year after initial survey</td>
</tr>
</tbody>
</table>

- Profile samples must be representative of use and must be collected as close in time as practicable to, but before, harvest
Produce Safety Rule Compliance  
*Except Agricultural Water*

<table>
<thead>
<tr>
<th>Business Size</th>
<th>Years to Comply After Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>All other businesses (&gt; $500K)</td>
<td>2 (1-26-18)</td>
</tr>
<tr>
<td>Small businesses (&gt; $250K-500K)</td>
<td>3 (1-26-19)</td>
</tr>
<tr>
<td>Very small businesses (&gt; $25K-250K)</td>
<td>4 (1-26-20)</td>
</tr>
</tbody>
</table>

72 days from today
# Produce Safety Rule Compliance

## Agricultural Water

*Proposed 9-2017

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<tr>
<th>Business Size</th>
<th>Years to Comply After Effective Date (1-26-16)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All other businesses (&gt;$500K)</td>
<td>2 (1-26-20/22*)</td>
</tr>
<tr>
<td>Small businesses (&gt;$250K-500K)</td>
<td>3 (1-26-21/23*)</td>
</tr>
<tr>
<td>Very small businesses (&gt;$25K-250K)</td>
<td>4 (1-26-22/24*)</td>
</tr>
</tbody>
</table>

2 to 4 years and 72 days from today

CAUTION: Needs 2 to 4 years to prepare
Steps Towards Produce Safety

1. Assess Produce Safety Risks
2. Implement Practices
3. Monitor Practices
4. Use Corrective Actions
5. Keep Records
Produce Safety Rule

At least one supervisor from the farm must complete food safety training at least equivalent to the standardized curriculum

- The Produce Safety Alliance training satisfies this FSMA requirement
Pistachio Research Board Grant

• Produce Safety Alliance (PSA) curriculum training relevant to California pistachio production practices.

• Next course Bakersfield, CA
  – November 27/28, 2017
Pistachio Grower Resources

Agricultural Water

Farm Food Safety Plan Resources

- [Decision Trees: Farm Food Safety Decision Making Made Easy](http://example.com) (Cornell University)
- [Food Safety Plan](http://example.com) (Colorado State University Ext.) (PDF 383 KB)
- [Write a Food Safety Plan](http://example.com) (Pennsylvania State University Extension)

Grower Training Manual

- [Produce Safety Association / Cornell University's Grower Training Manual References and Links](http://example.com)