Barry A. Eisenberg
Vice President Technical Services
River Ranch Fresh Foods

Chairman United Fresh Produce Association Food Safety and Technology Council

Chairman California Grower Shipper Association Food Safety Committee
<table>
<thead>
<tr>
<th>DOING IT RIGHT</th>
<th>DOING THE RIGHT THING</th>
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<td>DOING IT RIGHT</td>
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<td>DOING IT WRONG</td>
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Lettuce stomata

*E. coli* within a lettuce leaf stomate

(Seo and Frank, 1999)

Attachment of *Salmonella* to surface of lettuce,
Frank & Takeuchi, 2001
Postharvest Operations

Practices: Postharvest Cooling
Industry Food Safety Programs

Good Agricultural Practices (GAP)

- Simple to follow
- Fool-proof
- Documented
- Auditable
- Easy to communicate

Good Manufacturing Practices (GMP)

Hazard Analysis of Critical Control Point (HACCP)

Industry Metric Guidelines
The Lettuce & Leafy Greens Category

- Iceberg Lettuce
- Romaine Lettuce
- Green Leaf Lettuce
- Red Leaf Lettuce
- Butter Lettuce
- Baby Leaf Lettuce (i.e., immature lettuce or leafy greens)
- Escarole
- Endive
- Spring Mix
- Spinach
- Cabbage
- Kale
- Arugula
- Chard

RACs Vs Value-Added Vs RTE
Food Safety Programs
Control, Reduce or Eliminate Hazards

Fence

HAZARD

FOODBORNE ILLNESS/DEATH
Lettuce & Leafy Greens Product Flow Diagram
CHANGES IN LAST 3 YEARS

- Food safety #1 concern
- Industry issues no longer a single company
- Customers demanding more
  - Pathogenic testing
  - Their specific audit
- Proliferation of audits
  - California Leafy Green Marketing Agreement
- Focus on risk management
- Food safety budgets up 50%
- Better education and training programs
  - Hartnell College
- Increased government involvement
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<thead>
<tr>
<th></th>
<th>POSTHARVEST</th>
<th>QUALITY</th>
<th>CHEM. RESIDUES</th>
<th>FOOD SAFETY</th>
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<tr>
<td>20 YEARS AGO</td>
<td>25 %</td>
<td>30 %</td>
<td>35 %</td>
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<td>15 YEARS AGO</td>
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<td>5 YEARS AGO</td>
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<tr>
<td>Mandatory GAP Protocols</td>
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<tr>
<td>1 Enhanced Trace-ability</td>
<td>1.64%</td>
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<td>2 Raw Material Testing</td>
<td>14.71%</td>
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<td>3 Buffer Zone compliance</td>
<td>63.91%</td>
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<td>4 Audit Compliance</td>
<td>6.54%</td>
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<tr>
<td>5 Sanitation / Security / QA</td>
<td>13.20%</td>
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<td><strong>Total</strong></td>
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What are the sources of contamination?
FOCUS ON RISK ASSESSMENT THAT COULD LEAD TO CONTAMINATION

- Water Usage
  - Irrigation
  - Dust abatement
  - Postharvest applications
- Compost
  - Process
  - Handling
- Worker Hygiene
  - Clothing
  - Hand washing
  - Illness awareness
- Animal Intrusion
Own their fields

Contract
- Paid price for the field
- Paid price for pounds

Spot purchases
- Weather issues drive most of this
Field Program

Grower Approval
- GAP
- Documentation

Field Approval
- Risk Assessment

Approve to Harvest
- 1 to 4 days Before Harvest

Conduct
- Audits
- Training
- Education
- Data Feedback

Harvest
- Quality Check

Transport to Plant
Hand Harvest

Contact with Soil

- Evaluate appropriate measures that reduce, control or eliminate the potential introduction of human pathogens through soil contact at the cut surface after harvest
- Avoid stacking soiled bins.

Worker Hygiene

- Use appropriate preventive measures outlined in GAPs such as training in appropriate and effective hand washing, glove use and replacement and mandatory use of sanitary field latrines to reduce, control or eliminate potential contamination.
- Prohibit eating, drinking or smoking in the field to reduce the potential for product contamination.
Machine Harvest

- Establish appropriate measures that reduce, control or eliminate the potential introduction of human pathogens at the cut surface during and after mechanical harvest operations.

- If re-circulated rinse or antioxidant solutions are used on the cut surface, ensure that they do not become a source of contamination.

- Use materials and construction that facilitate cleaning and sanitation of equipment contact surfaces.

- Establish the frequency of equipment cleaning and sanitation by development of Sanitation Standard Operating Procedures (SSOPs) and a sanitation schedule for machine harvest operations.

- Locate equipment cleaning and sanitizing operations away from product and other equipment to reduce the potential for cross contamination.

- Establish equipment storage and control procedures when not in use. Establish policies and sanitary design options that facilitate frequent and thorough cleaning and sanitizing of food contact surfaces.

- Develop and implement appropriate cleaning, sanitizing, storage and handling procedures of all food contact surfaces to reduce, control or eliminate the potential for microbial cross contamination.
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PROCESSING OVERVIEW

- Incoming inspection
- Sorting
- Cut the product
- Wash in sanitized water
  - Chlorine
  - Peroxyacetic acid
- Dried
  - Spinners
  - Air Fans
- Bagged
  - Modified atmosphere
    - Iceberg, Romaine, Broccoli, Cauliflower, Green Leaf
  - Normal Atmosphere
    - Spinach, Spring Mix
- Shelf-life
  - 14 – 17 days
BUSINESS OF LOGISTICS

- CROP PRODUCTION
  - Spinach crop cycle 20 to 35 days
- Control time from harvest to cooling
- Inventory controls
  - Sugar snap peas
    - Harvest to our plant 2 to 13 days
- Run times
  - Allergen complications – last to run
- Stop time for proper sanitation
  - VA plant and now field
- Customer
  - Last minute order changes
  - Pick-up schedules
- 17 day shelf-life
  - Retailer wants 10 days once arrives at the retail store
- Product testing
Food Safety is Like Sex

- About everyone is in favor of it
- With practice you get better
- It is difficult to explain your entire approach to someone, but they generally get it
- And if something goes wrong you can blame someone else
IN SUMMARY – OUR FOCUS

- Stopping consumer illnesses related to fresh produce
- Process management
- Satisfying our customers
- Meeting government guidelines/regulations
- Targeted research
  - Center for Produce Safety
- Education and training
- Utilizing industry associations to drive priorities
BEST STORY
WE HAVE TODAY