

Produce Safety – Farm to Table

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Contamination Sources

■ **PRE-HARVEST**

- Green/improperly composted manure
- Water for Irrigation/Pesticide Application
- Windblown Contamination
- Animals – wild and domestic
- Insects
- Workers



Contamination Sources

■ **POST-HARVEST**

- Workers – field and in processing
- Harvesting equipment
- Transport Containers
- Wild and domestic Animals/Insects
- Windblown Contaminants
- Sorting, Packing, Cutting, Conveying & other processing equipment



Contamination Sources

- Ice
- Process Water (Wash Water not maintained)
- Transport Vehicles
- Improper Storage Temperatures
- Packaging
- Handling at Retail or after purchase by consumer



Critical Controls in Produce Production

- Pre-Harvest Field Sanitation
 - Field Preparation/Manure Application
 - Fully composted **OR**
 - Incorporated into soil at least 90 days prior to harvest.
 - Avoid crossover of pathogens between new compost pile and older
 - Clean compost turning equipment between uses to avoid re-establishing pathogens
 - Pathogen survival
 - Depends on moisture and temperature
 - Colder temperatures/higher moisture equal longer survival



Critical Controls

- Irrigation Water Quality/Cleanliness – coliform free, preferably drinking water
- Water for Pesticide Application – Drinking Water Quality – use according to label directions
- Animal Exclusion (source of enteric pathogens)
- Insects – pathogen source and produce damage



Irrigation Water

- Infiltration: Bacteria present in the soil or in contaminated irrigation water can enter lettuce through roots (or tomato blossom).
- Internalization: Bacteria can enter the lettuce (or tomato) through small cracks in the skin, or the stem scar.
 - (inaccessible to sanitizer)

“I can always wash the produce before I eat it or sell it”

- Preliminary studies in strawberries and apples indicate that once the fruit is contaminated, the pathogens are difficult to remove.
- Prevent contamination.
- Control multiplication.





Harvest Considerations

- Importance of Sanitation Overall
 - Minimizes the likelihood of contaminating the produce
 - Contributes to worker health
 - Contributes to the quality of the product
 - Adds value to the product



Harvest Considerations

- Remove as much dirt from produce outside facility as possible
- Outdoor packers should be aware of airborne contaminants (from poultry, livestock, manure storage areas)
- Cooling Water/Ice from potable source
- Packing shed maintained in sanitary condition



Harvest Considerations

- Employee Sanitation and Hygiene
- OSHA Field Sanitation Standard 1928.110
 - Readily available, accessible potable drinking water for all employees
 - One toilet and hand-washing facility for every twenty employees (must be within ¼ mile walk of each worker)



Pallets, Bins, Containers

- **Clean pallets, containers or bins before using to transport fresh produce.**
- Operators might set aside an area in the receiving yard to clean pallets and containers used for whole fresh fruits and vegetables. Containers used for ready-to-eat fresh produce should be cleaned and sanitized. Care must be taken when packing produce in the field not to contaminate containers or bins by exposure to soil and manure.

Worker Hygiene & Health

- Ill Workers – should be excluded from harvesting produce
- Handwashing – prevents transfer of pathogens to harvested product & contributes to health of co-workers





About Handwashing.....

- Most effective means of preventing contamination by workers.
 - Many steps in the process where pathogens can be passed from worker to produce.
 - Handwashing generally removes about three logs of organisms from hands (thousands)
 - Hand sanitizers are not a substitute



Packing Containers

- **Protect unused cleaned and new packing containers from contamination when in storage.**
- Packing containers and other packing materials that are not used right away should be stored in a way that protects them from contamination by pests (such as rodents), dirt, and water condensing from overhead equipment and structures. If packing containers are stored outside the packing facility, they should be cleaned and sanitized before use.



One of the challenges to the industry will be to minimize “disinfectant demand” introduced by field soil on cartons, totes and pallets.





Facility Maintenance

- Maintain facility in a clean condition
- Equipment should be designed to be easily cleanable
- Keep equipment as clean as practicable
 - Equipment which comes in contact with fresh produce can serve as a means to spread contamination



Maintenance

- Clean and Sanitize the washing, grading, sorting, packing lines to minimize the potential for contamination of fresh produce daily
 - (Wash, rinse, sanitize – prevent biofilms)
- Inspect cooling equipment, remove debris and clean as necessary when in use

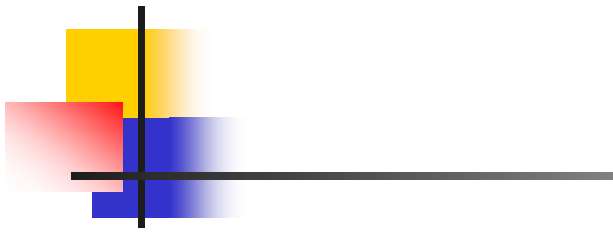


Maintenance

- Inspect equipment such as knives, saws, blades, boots, aprons, smocks, should be inspected for defects which make them uncleanable – Replace as needed.
- Equipment may be a source of cross-contamination
- Some organisms form bio-films on equipment (Protective Mechanism for bacteria)
Requires cleaning (physical action), sanitizers, rinsing for removal of organisms.



Bin dump and sorter





Conveyor

Lettuce Processing/Critical Steps

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.

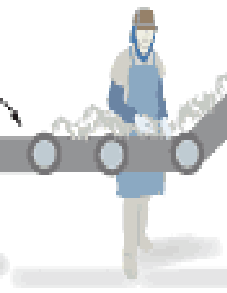


Packaged lettuce
Lettuce is cut at stem and its core and outer leaves are removed in the field before it is refrigerated and sent to processing.

Processing lettuce for packaging



After being chopped, the lettuce is submerged in water.

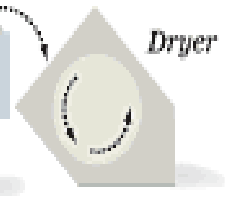


Workers inspect and remove any unwanted parts.

Chlorinated wash bins



Chopped lettuce is washed three more times.



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

Source: *Western Growers Assn. Graphics reporting by RONG-GONG LIN II and CHERYL BROWNSTEIN-SANTIAGO*

LORENA IRIQUEZ *Los Angeles Times*

Lettuce Processing





Pest Control

- Establish a Pest Control Plan to reduce the risk of contamination of produce by rodents, insects and other pests
- Conduct regular and frequent monitoring of facility for evidence of pests



Produce Process Water

- Dump tanks, flumes, hydro-coolers
- Common industry practice to use chlorine – either as sodium hypochlorite (6% or 12%) or Calcium hypochlorite
- Generally 100 – 150 ppm strength and water pH 6.8 - 7.2
- EPA regulations allow up to 200 ppm maximum if there is no final clear water rinse when washing produce.
- 2004 salmonella outbreak linked to tomato packer in Fla. Chlorine levels not appropriately maintained.



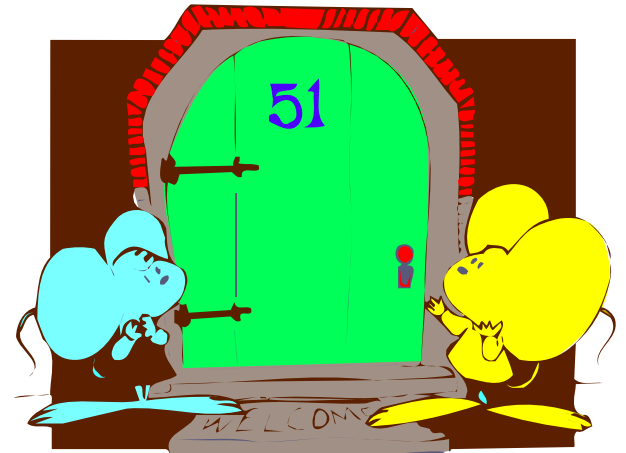
Processing Water

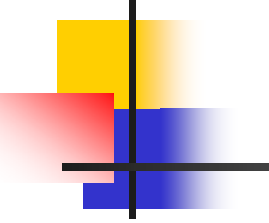
- Chlorine helps prevent build-up of biofilms
- Prevent proliferation of microorganisms in wash water
- Produce has better quality/longer shelf-life
- Temperature of wash water influences infiltration of bacteria (water should be 10 degrees warmer than produce)
 - Too warm reduces quality of produce, too cold – infiltration of contaminants – importance of pre-chilling/hydrocooling





Doors, windows, and loading docks shall be tight-fitting and kept closed at all times when not in use, or adequately screened during normal operating hours to prevent entry of rodents, birds, or other pests.





Handwashing Facilities





Pest Control

- Maintain the grounds in good condition:
 - Remove garbage and produce waste
 - Cut vegetation near building to discourage the breeding, harboring, and feeding of pests, such as rodents and reptiles. (known carriers of salmonella, typhus)
 - Remove unnecessary or unused equipment which could act as harborage



Pest Control

- Clean daily to remove product or product remnants that attract pests around the facility where product is stored
- Maintain adequate surface drainage to eliminate breeding areas for pests



Pest Control

- Remove dead or trapped birds, insects, rodents, and other pests promptly
- Clean surfaces soiled by birds or other wildlife
- Block access of pests into facilities
- Use a pest control log



Get Growing!



THE END