



# Module 3: **Packing Facility Sanitation (GHPs)**

## Acknowledgments

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Wilson County Cooperative Extension Service, Commercial Horticulture

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## Module 3: Packing Facility Sanitation

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**Estimated duration:** *2 hours*

### **Instructional objectives:**

Recognize potential sources of contamination during the grading, packing and storing of fresh produce.

- Equipment, supplies and materials needed:
- Laptop and LCD projector
- PowerPoint (PPT) presentation on CD
- Nametags, pens

### **Preparation needed:**

- Review Module 3 and PPT prior to the day of the workshop; become familiar with Good Agricultural Practices (GAPs) programming—how each module is an integral part of the other modules.
- Secure a laptop computer with PowerPoint capability and an LCD projector. Save a copy of the presentation (from CD) on computer.
- Make copies of workshop activities, pre-test and post-test (if applicable) for all participants.
- Obtain, easels, flip charts and markers, if needed.
- Prepare room to accommodate participants and projector. Prepare sign-in sheet and nametags, as applicable.



**Module 3**  
**Packing Facility Sanitation**  
**(GHPs)**

Dr. Chris Gunter, Assistant Professor, Vegetable Production Specialist,  
Horticultural Science, N.C. State University  
Billy Little, Commercial Horticulture,  
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**Learners' Objectives**

- Recognize potential sources of contamination during the grading, packing and storing of fresh produce.



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**Topics**

- Packing House Water
- Pest Management
- Sanitation



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## Module 3

### Welcome

Have participants make nametags and introduce themselves

### PPT 3-1: Module 3: Packing Facility Sanitation (GHPs)

No notes

### PPT 3-2: Learners' Objectives

### PPT 3-3: Topics

No notes

## Packing House

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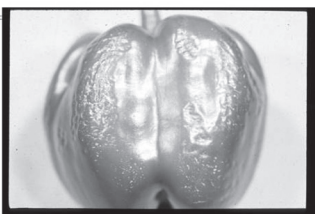
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### PPT 3-4: Packing House

No notes

## Avoid Mechanical Injury



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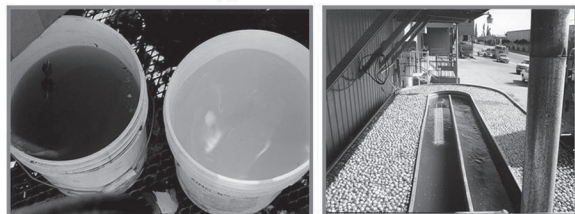
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### PPT 3-5: Avoid Mechanical Injury

Mechanical injuries may allow microbes to enter fruit or vegetable tissues, where the microbes are inaccessible to sanitizing chemicals.

## Post-harvest and Processing Water

Poor management at a critical point is capable of magnifying an error in sanitation or hygiene control.



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### PPT 3-6: Post-harvest and Processing Water

If contamination occurs at a single critical point, the contamination can spread throughout the whole process stream.

### Areas to Monitor

- Dump or soak tanks
- Washing lines



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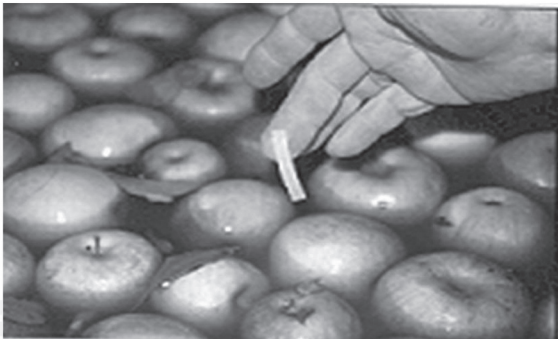
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### PPT 3-7: Areas to Monitor

Two of the most important places from which to select water samples are the dump or soak tanks, and washing lines. Temperature needs to be monitored and must be specific for the commodity. Processing water needs to be treated.

### Wash-water Quality



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### PPT 3-8: Wash-water Quality

Perhaps the most critical step in handling fresh produce is using high quality water to wash the produce.

### Wash Water and General Chlorine Recommendations

- Water in direct contact with produce should meet U.S. EPA MCLG microbial drinking water quality standards.
  - Generic *E. coli* negative test or below detection limit
- Maintain free chlorine levels between 100 to 150 parts per million.
- Maintain pH between 6.5 and 7.5.
- Drain tanks often (e.g., daily) and refill with clean water.
- Use self-cleaning screens in dump tanks to remove large debris and organic matter.

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### PPT 3-9: Wash Water and General Chlorine Recommendations

So far we have seen that for effective sanitation we must:

- keep chlorine concentrations between 100 and 150 ppm
- keep pH of the solution between 6.5 and 7.5
- keep organic matter out of water used in processing.

## Pest Management

- Pest control traps and bait stations should be stationed inside and outside the facility at key locations.
- Measures are taken to exclude animals/pests from facilities.
- Established pest-control program with service reports will be maintained.

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### PPT 3-10: Pest Management

More detailed information is available in the trainer manual.

## Bird Droppings on Belt



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### PPT 3-11: Bird Droppings on Belt

No notes

## Can You Use These?



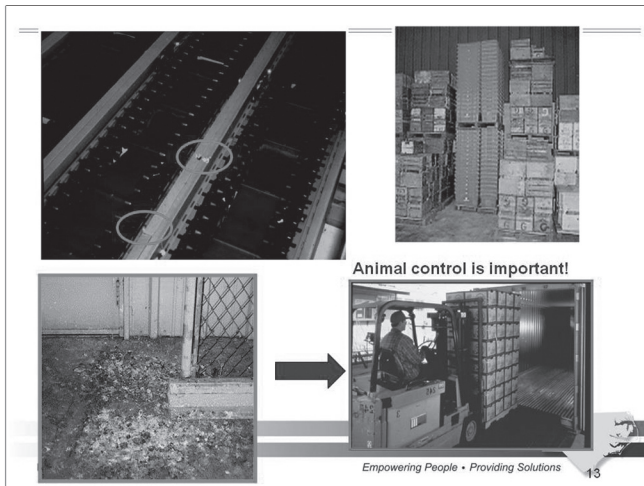
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### PPT 3-12: Can You Use These?

No notes



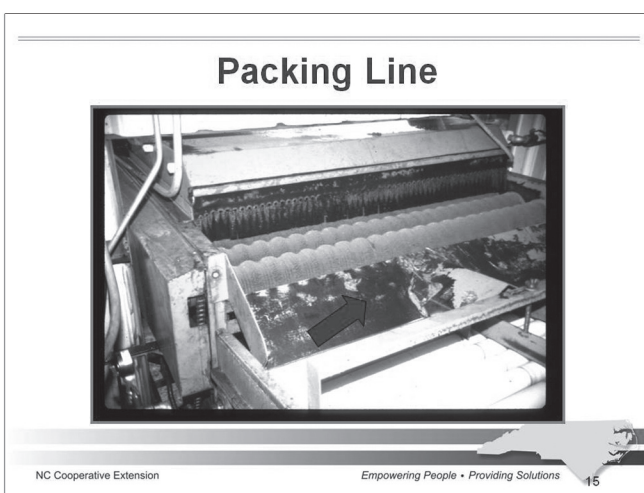
### **PPT 3-13: Animal Control Is Important**

It may not be practical to totally exclude animals from packing houses, but good sanitation practices should be used to prevent accumulation of animal wastes.



### **PPT 3-14: Pest Control Trap Placement**

No notes



### **PPT 3-15: Packing Line**

Plant residues like these must not be allowed to remain on the packing line.

## Sanitation in the Packing House: Accumulated Pathogens

- Microbes survive and grow on surfaces that remain wet (brush/sponge rolls; floors).
- When plant material is in contact with surfaces:
  - waxes and plant sap accumulate.
- Partially decayed plant material:
  - sticks to surfaces
  - is loaded with microbes.
- Use of dump tanks:
  - Pathogens can accumulate during packing.

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## PPT 3-16: Sanitation in the Packing House: Accumulated Pathogens

Be aware that there are many, many potential sources of produce contamination in a packing house.

## Biofilms

- Biofilms are sticky to slimy accumulations of fungi and bacteria that accumulate on wet surfaces.
- Plant residues + moisture + microbes + warm temperatures = biofilms .
- Sanitizers will prevent their formation, but do not penetrate existing biofilms.

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## PPT 3-17: Biofilms

Biofilms must be removed or prevented from forming:

- Biofilms are sticky-to-slimy accumulations of fungi and bacteria that accumulate on wet surfaces.
- Plant residues + moisture + microbes + warm temperatures = biofilms.
- Sanitizers will prevent their formation, but they do not penetrate existing biofilms.

## Sanitation in the Packing House

- Maintain constant sanitizer levels in dump tanks and spray washers.
  - Regularly check automated equipment during packing.
- Sanitize facilities and equipment regularly.
  - Daily: Change dump tank water, packing line equipment (particularly areas that remain wet), floors, drains and breakrooms/bathrooms.
  - Monthly or between loads in the cold room: floors, walls, ceilings, refrigeration coils, doors and curtains.

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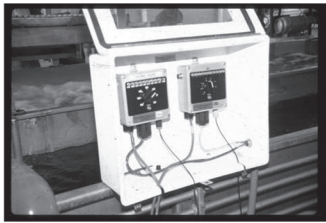
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## PPT 3-18: Sanitation in the Packing House

Packing-house sanitation is mostly common sense. Details of cleaning and sanitizing packing houses are located in the trainer manual.

## Pathogen Control in Packing House



Chlorine/ORP System

Ozone System



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### PPT 3-19: Pathogen Control in Packing House

Automated systems, like these, can be used for pathogen control in the packing house.

## Sanitation in the Packing House

- Discard fruits and vegetables that fall on the floor.
- Exclude animals (domestic or otherwise) from packing house.
- Prepare cartons **only** as needed.

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### PPT 3-20: Sanitation in the Packing House

Automation won't be truly effective if these items are ignored.

## Sanitation in the Packing House (cont'd)

- Remove fruit and vegetable culls and debris promptly.
- Provide restrooms and hand-washing stations.
- Maintain sanitation records.

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### PPT 3-21 Sanitation in the Packing House (cont'd)

Besides using common sense, keep records.

## Use Gloves on the Packing Line



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### **PPT 3-22: Gloves on the Packing Line**

Proper use of gloves while handling fruits and vegetables on the packing line also helps to prevent produce contamination by workers.

## Temperature Management

- Low temperatures supplement good sanitation practices.
- Avoid delays that postpone cooling.
- Consider:
  - time from harvest to packinghouse
  - time from arrival to cooling of produce
  - speed of cooling and final temperature.

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### **PPT 3-23: Temperature Management**

Keeping produce cool is one of the most effective food-safety strategies.

## Packing in Cold Room



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### **PPT 3-24: Packing in Cold Room**

Low temperature slows the growth and spread of microbes.

## Temperature Management (cont'd)

- Cooling method
  - forced-air, hydrocooling, vacuum cooling, package and top icing
  - 7/8 cool (7/8 of field heat removed before storage or transport).
- Proper hydrocooler management
  - water sanitized continuously
  - incomplete cooling = wet, warm produce = ???

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### PPT 3-25: Temperature Management (cont'd)

There are many ways to cool produce.

## Temperature Management (cont'd)

- Storage and transport temperatures:
  - Optimum temperatures for fruits and vegetables range from 32°F/0°C to 59°F/15°C.
  - Most human pathogens grow slowly or not at all below 45°F/7°C.
  - *Listeria monocytogenes* is a special concern in refrigerated environments.
- Maintain records of temperature management.

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### PPT 3-26: Temperature Management (cont'd)

The optimum temperatures for food safety are well-known.

## Procedures for Cleaning Room and Equipment

- Empty and sweep cold rooms.
- Pre-rinse equipment or walls.
- Visually inspect surfaces.
- Apply appropriate cleanser.
  - Scrub from top, downward.
- Do not allow cleanser to dry on surfaces.
  - Rinse from top, downward

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### PPT 3-27: Procedures for Cleaning Room and Equipment

Surfaces in cold rooms need just as much cleaning attention as surfaces on the packing line.

### Procedures for Cleaning Room and Equipment (cont'd)

- Visually re-inspect surfaces.
- Apply a high level sanitizer according to label directions.
  - Let stand for 20 minutes.
  - Rinse with potable water.
- Apply regular level sanitizer according to label directions.
  - Rinse with potable water.

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### PPT 3-28: Procedures for Cleaning Room and Equipment (cont'd)

For instance, here are some recommended procedures:

Quaternary ammonia is not approved for direct fruit contact. Quaternary ammonia residues have been found to be injurious to fruits (200 to 400 ppm). To reduce potential injury, rinse bins with fresh water after quaternary ammonia treatments in the packinghouse. Alternatively, sanitize bins with 200 ppm chlorine (pH between 6 and 7.5) instead of using quaternary ammonia.

### Final Steps

- Clean and put away supplies.
- Document cleaning practices.
- Periodic QA inspection/swabs.
- Have regular training for employees.



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### PPT 3-29: Final Steps

Follow these steps to assure that no contamination occurs in the packing house.

### Cleaning and Sanitizing the Packing Line



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### PPT 3-30: Cleaning and Sanitizing the Packing Line

Microbiological testing can also document the effectiveness of the sanitation program used on packing-house equipment.

## Cleaners and Sanitizers

- Major classes of cleaning agents:
  - Steam
  - Hot Water
  - Radiation (UV, gamma, x-ray, e-beam)
  - Chemicals
    - Halogens (chlorine, iodine, bromine)
    - Quaternary ammonium compounds (quats)
    - Acid sanitizers
    - Hydrogen peroxide
    - Ozone
    - Impregnated surfaces.

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### PPT 3-31: Cleaners and Sanitizers

No notes

## Good Agricultural Practice (GAPs) # 8: Manage

Accountability—someone in charge at all levels (field, packing facility, distribution center, transport operation)—is essential for a successful food safety program.

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### PPT 3-32: Good Agricultural Practice (GAPs) # 8: Manage

No notes

## Reduce Vulnerability

- Identify crops & procedures most likely associated with food-borne illness.
- Develop procedures that will reduce the risk of an outbreak of food-borne illness.
- Monitor procedures to keep produce safe.
- Verify your produce is consistently safe.

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### PPT 3-33: Reduce Vulnerability

No notes

## Summary

- Avoid Mechanical Injury
- Monitor Water Quality
- Pest Management
- Packing House and Line Sanitation
  - Biofilms
  - Plant Residues
- Sanitation While Working on the Line
- Cold Room Sanitation and Temperature Management
- Cleansers and Sanitizers

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### PPT 3-34: Summary

- Avoid Mechanical Injury
- Monitor Water Quality
- Pest Management
- Packing House and Line Sanitation
  - Biofilms
  - Plant Residues
- Sanitation While Working on the Line
- Cold Room Sanitation and Temperature Management
- Cleansers and Sanitizers

## Resources

- "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruit and Vegetables," USDA 1998.
- 2002 NCSU. "Series of Good Agricultural Practices for the Production and Handling of: Guides."
- "Commodity Specific Food Safety Guidelines for the Production and Harvest of Lettuce and Leafy Greens," May 24, 2007.
- "USDA Good Agricultural Practices & Good Handling Practices."
- "Audit Verification Checklist," USDA.
- "Chlorine Use In Produce Packing Lines," University of Florida IRREC, 1999.
- "Testing/Monitoring/Sanitation Equipment & Supplies," Fresh Produce GAPs/GMPs Workshop, University of Georgia, 2004.
- "Fresh Produce Food Safety Training Program for the Southeast," University of Florida, 2001.

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### PPT 3-35: Resources

#### Resource List:

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- 2002 NCSU. "Series of Good Agricultural Practices for the Production and Handling of: Guides."
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### Module 3: Packing Facility Sanitation (GHPs)

#### Pre-Test/Post-Test

ID Number/Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Biofilms are a sticky-to-slimy accumulation of fungi and bacteria. .... True or False
2. The temperature at which most human pathogens will either grow slowly or not at all is:
  - ☐ Below 45 degrees F
  - ☐ Above 48 degrees F
  - ☐ At 55 degrees F
3. A major class of cleaning agents includes the use of hot water. .... True or False
4. Critical control points in the packing house essential to monitor for possible contamination include:
  - ☐ Dump or soak tanks
  - ☐ Washing lines
  - ☐ Worker hygiene
  - ☐ All of the above
5. What is one of the most effective food-safety strategies?
  - ☐ Employ mechanical labor
  - ☐ Keep produce cool
  - ☐ Sweep the packing facility
  - ☐ Field pack produce
6. What is the generally accepted amount of free chlorine to use in dump tanks?
  - ☐ 50-75 ppm
  - ☐ 75-100 ppm
  - ☐ 100-150 ppm
  - ☐ 150-200 ppm
7. Avoiding mechanical injuries to produce are important for food-safety measures as injuries may allow microbial pathogens to enter produce tissues..... True or False
8. Fruits and vegetables that have fallen on the production floor should be picked up and placed into the beginning of the packing line for cleaning..... True or False
9. Establishment and documentation of a pest-management program that excludes animals from packing house is essential to GAPs. .... True or False
10. Using gloves on the packing line can help to prevent produce contamination by workers. .... True or False

### Module 3: Packing Facility Sanitation (GHPs)

#### Pre Test/ Post Test Answers

1. Biofilms are a sticky-to-slimy accumulation of fungi and bacteria. .... **True** or False
2. The temperature at which most human pathogens will either grow slowly or not at all is:
  - ✓ **Below 45 degrees F**
  - ☐ Above 48 degrees F
  - ☐ At 55 degrees F
3. A major class of cleaning agents includes the use of hot water. .... **True** or False
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  - ☐ Washing lines
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10. Using gloves on the packing line can help to prevent produce contamination by workers. .... **True** or False