



# Working Committee 5

## Harvest

Date: 06/07/2012

Revision: Final

## Introduction

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This working committee was tasked with discussing the following areas related to the harvest of fresh fruit and vegetables. This working committee was tasked with discussing challenges beginning with the preharvest assessment for risk and ending with harvested product leaving the site.

### **Core Curriculum/Hazards & Preventive Controls — Harvest**

- 5.1. Review of Key Harvest Risk Factors
- 5.2. Preharvest Inspection
- 5.3. Harvest Methods
  - 5.3.1. Row crop – Vine Crop – Tree Crop
  - 5.3.2 Single harvest – Multiple harvest – Harvest and regrowth
  - 5.3.3 Field pack – Bulk harvest for sort and grade – Bulk harvest for value added processing
- 5.4. Water at time of harvest
  - 5.4.1. Applications in adjacent area
  - 5.4.2. Applications in adjacent lots
  - 5.4.3. Water used during harvest (source quality, monitoring, treatment, documentation)
- 5.5. Equipment (sanitation, lubricants, maintenance)
  - 5.5.1 Prevention, inspection, corrective actions
- 5.6. Container sanitation, storage and use in the field (including contact with ground)
  - 5.6.1. Harvest containers – pallets – slip sheets (multi-use)
  - 5.6.2. Field packing containers (single use)
- 5.7. Storage & transportation post packing (field accumulation, field haul, staging for postharvest)

## Working Committee Chairs

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### **Reggie Brown**

*Manager, Florida Tomato Committee*

### **Trevor Suslow**

*Extension Research Specialist, University of California, Davis*

## Meetings Held

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| <b>Date</b>        | <b>Attendance</b> |
|--------------------|-------------------|
| May 23, 2011       | 19                |
| August 10, 2011    | 11                |
| September 23, 2011 | 12                |
| October 31, 2011   | 15                |
| November 21, 2011  | 15                |
| May 31, 2012       | 13                |

**Total Meetings: 6**

**Total committee members<sup>1</sup>: 55**

<sup>1</sup> See [Appendix I](#) for full list of members

## Data Collection

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Information from committee members was collected during five teleconferences held from May 2011 to May 2012. Each meeting held was approximately one hour long with open discussion between all participants. Detailed notes were taken and submitted to the committee after the meeting so that all participants, including those unable to attend, could review the content. Completed notes were then posted online at the [PSA website](#).

From the overall outline of discussions, the committee co-chairs and members moved forward to identify priority areas for the committee's discussion and final recommendations to the PSA Executive committee. Topics which were prioritized as lower importance will be kept on file in the committee's original meeting note document.

Due to the similarity of topics covered between the ten working committees that constitute the PSA, some priority areas are covered in multiple groups. The depth to which they are covered vary between groups but all outcomes are retained and will be represented in the overall PSA documents.

## Summary

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### 5.1 Review of Key Harvest Risk Factors

- Diverse hazards potentially present during crop production may have elevated risk potential as crops mature and during harvest operations.
- Hazards that may introduce low levels of contamination to a crop take on much greater significance and risk potential if the occurrence is close to or during harvest.
- Harvesting generally exposes product wound surfaces or natural-openings not accessible during production to contamination. These areas may provide a protected surface for harmful bacteria to attach or internalize, making surfaces inaccessible to subsequent postharvest washing and disinfection treatments.
- Multiple or sequential harvests may introduce new hazards or increase the likelihood that the identified risk will be realized (e.g. cull fruit left in the field becomes a significant attractant to birds and filth flies).

### 5.2. Preharvest Inspection

- The primary focus of preharvest inspection expectations and methods should be placed on education for small farmers in hazard identification and analysis so appropriate risk factors in their operations can be self-identified.
- Education and training for preventative food safety measures will need to incorporate supporting science as well as future government guidance and/or regulations.
- In order to provide outreach and safety information to those who will be expected to meet compliance requirements, the following modalities of dissemination should be explored:
  - Case studies
  - Creation of a 'food safety' culture, rather than teaching to the test
  - Upper management commitment
  - Charts, posters, other daily reminders
- Several resources (non-exhaustive list) exist and have been identified as tools to conduct preharvest inspections:
  - United Fresh Harmonized GAPs
  - USDA GAPs Audit Program
  - On-Farm Food Safety Project (Familyfarmed.org)
  - Cornell GAPs Grower Self-Assessment

- **What are the biggest concerns all growers should evaluate prior to harvest?**
  1. Evidence of animal intrusion and fecal matter.
  2. Evidence of physical or chemical hazards that may be transferred to harvested product or harvest containers from field, adjacent areas, or farm equipment.
  3. Equipment and tool maintenance for cleanliness.
  4. Evidence of recent flooding and establishment of adequate buffering, as needed.
  5. Documentation of preharvest and harvest water quality monitoring.
  6. Placement of sanitary facilities and water for workers.
  7. Harvest containers and bin cleanliness for safe handling.
  8. Documentation of compliant pre-harvest intervals for soil amendments and pesticide applications.
  9. Preparedness to implement traceability system and lot-specific records of harvest.
  10. Safe storage and protection of product after harvest and prior to transportation.
  11. Documentation of farm worker training on personal hygiene and corrective actions that may be necessary during harvest operations.

- **Contributions to Risk Reduction**

Implementing practices for food safety during harvest can be categorized into different methods which contribute to risk reduction. The simplification of these methods to reduce risks can be described in the list below:

- Exclusion
  - E.g. Keeping wildlife out of fields; harvest often creates its own attractants.
- Inactivation
  - E.g. Sanitizing of harvest containers.
- Reduction of Exposure to Risk
  - E.g. Awareness of adjacent land activities that may contaminate harvest equipment and containers during pre-harvest staging.
- Prevention of Transfer
  - E.g. Worker training and illness policies; awareness of human and traffic paths that are risk of contamination by transference.
- Growth
  - E.g. Harvest during periods of condensation; extended pre-cooling surface wetness/plant exudates after harvest.

### 5.3. Harvest Methods

- A diverse set of harvest methods and crop types present unique challenges.
  - Row crops, vine crops, tree crops
  - Single pass or multiple pass harvest
  - Multiple harvests – mowing, clipping, and regrowth
  - Single year crop or multiple year crop
  - Direct to shipping container, hand harvest to harvest aide, full mechanical/machine harvest

- **Harvest Method Challenges**

- Risk management for product contact with surface and sub-surface soil or orchard floor.
- Multiple-use towels to wipe produce during harvest and field packing.
- Proper management of harvest aides, such as knives and clippers.
  - E.g. Washed, rinsed, and sanitized at the start and end of each work session, or as needed throughout the day; implements not taken home for personal use.
- Workers must be properly trained to identify, report, and react to risks during harvest.
  - For example, not harvesting produce with visible fecal contamination and buffering adjacent product per farm policy, reporting to the field supervisor, and taking appropriate actions to remove affected product as well as clean and sanitize containers or tools, as needed.
- Workers may have to stand in large bins while loading harvested produce.
- Workers must be trained to follow proper hygiene practices while in the field. Refer to [WC #2 \(Common Issues\)](#) for more information regarding worker training.
- Specific equipment or provisions to encourage and facilitate worker compliance with proper hygiene practices may be necessary for harvest operations.
  - E.g. Dedicated break areas; field-side hangers for clothing worn during harvest operations and removed during breaks and use of restrooms.

#### **5.4. Water at time of harvest**

*For the purposes of this document, water which is specific to postharvest operations is discussed in further detail in [Working Committee 6's \(Postharvest\)](#) summary document. However, water used during harvest and field-packing operations will be discussed in this committee.*

- **Water Standards and Testing Regimes**

- Water used for treatment of harvest wound areas to reduce postharvest discoloration, reduce water loss from product during pre-transport holding, remove dust and other surface residues during field pack, as a lubricant for field-sleeving of product, and other applications must at least meet the microbiological criteria of potable water.
  - Local chemical and other water issues should be taken into consideration and a risk assessment should be done to assure the safety of the harvested crop.
- Water used for farm access-road dust abatement must meet microbiological criteria for potable water or a validated and verifiable system to prevent over-spray and aerosol drift contact with crop, harvest containers, packing materials, and product contact surfaces.
- Documentation of source and verification of appropriate water quality must be completed for every daily and lot-specific harvest event.

- **Types of Water Used During Harvest (refer to Postharvest Handling Sec 6.2)**

- Single Pass Water
- Multiple Use Water

### **5.5. Equipment (sanitation, lubricants, maintenance, etc.)**

- Harvest equipment (e.g. tractors, trucks, trailers, mobile packing stations) must be modified, inspected, and maintained to prevent chemical and physical hazards prior to and during use.
- Harvest equipment and other vehicles with supplemental lighting that pass over un-harvested crops during harvest operations must be fitted with protective coverings in case of breakage.
- Harvest implements and product contact surfaces should be fabricated from materials that facilitate cleaning and sanitation.
  - E.g. Hard plastic handles are preferred over wood handles; polymer counter-top materials are preferred over plywood sheets for grade and sort surfaces.
- Accumulation of field or orchard soil on equipment tires that abut non-harvest areas or extend above the level of stacked harvest totes and containers require periodic removal of impacted soil.
  - E.g. An open-sided flatbed trailer pulled through the field may introduce soil, soil surface water, and debris to product.
- Grade, sort, and pack surfaces necessary or desirable for product quality (e.g. carpeting or cushioning material) should only be used for product harvested and handled dry and never cleaned with aqueous materials unless a validated sanitation process has been determined.

### **5.6. Container sanitation, storage and use in the field (including contact with ground)**

- Packaging must be appropriate for its' intended use.
  - This might be based on supplier requirement or industry standards.
  - Food contact surfaces (bins, totes, other harvest aides) should not be used for other purposes unless clearly marked or labeled as limited for that purpose.

#### **5.6.1. Harvest containers (multi-use)**

- Materials used for the harvesting of fresh produce must be realistically evaluated for risks that are specific to their use. Small growers often depend on containers to serve multiple purposes.
- Ideally, harvest containers would be used solely for fresh produce and not for other farm products (such as eggs, meat products, or soil amendments).
- Containers which come into contact with the ground may pose a risk of contaminating product stacked below it, during dumping for sort and grade, or if used in a washing and cooling process. Implemented policies that prevent direct contact of containers with soil and road surfaces must be consistent with a comprehensive food safety plan.
- The presence of organic matter on or in harvest containers may affect dump tank water quality. Minimizing dirt and non-product debris in containers facilitates the effectiveness of postharvest operations, especially in water quality management.

#### **5.6.2. Field packing containers (single use)**

- Harvest containers and packaging materials are often staged in a field, overnight, or over a few days. Ideally, packing materials are stored in a clean, dry, covered area.
  - However, if alternate methods need to be utilized, proper storage of all packaging materials should be followed to minimize contamination from birds, animals, soil, or other sources.

- Preharvest and periodic harvest inspections should verify and document that acute and dynamic changes in adjacent activities have not compromised the suitability of containers and packing or packaging materials.

### **5.7. Storage & transportation post packing**

- Accumulated harvested product should be staged for transport to a postharvest handling facility/area (field haul) or directly to a point of sale in a manner that maintains the integrity of all prior food safety preventive programs for product contamination.
- Procedures for cleaning and protective coverings for product hauled in personal vehicles (family vans) or multi-use vehicles (e.g. farm pick-ups, labor transportation vehicles) should be carefully and thoughtfully developed and documented during each use.
  - E.g. Never haul product in the pickup bed that also has ag-chemicals, lubricants, animals, or soil amendments.
- Methods to reduce product heat gain from sunlight should be designed to prevent opportunities for contamination.
  - E.g. Staging trailers with harvest product under trees or an overhang with rafters not protected from bird-nesting or perching.
- Short-term storage and transport should not create conditions that favor bacterial pathogen growth.
  - E.g. Wet, warm product in poorly vented, palletized container, or personal vehicle.
  - Routes of transport of harvested product, both on-farm and on surface roads, should take into account hazards, potential for contamination, and the need and effectiveness of tarps or other means of protection. If multiple-use coverings are utilized, a cleaning and sanitation system needs to be implemented, as necessary.



## Recommendations

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### Top Ten Best Practice Take Home Messages for Small-Growers: Harvest

1. Pre-harvest perimeter and production block inspection of area to be harvested must be conducted.
2. Evaluate potential for contamination by equipment and to equipment product-contact surfaces.
3. Store, use, and transport harvest containers or packing materials with food safety in mind.
4. Ensure sanitary facilities are properly placed, well stocked, and managed properly.
5. Implements (such as hand tools) and containers must be cleaned and sanitized.
6. Harvest water source must meet drinking water standards and approved antimicrobials should be added to maintain the integrity of the source in application distribution systems and to assist in preventing cross-contamination.
7. For water which comes in contact with the harvested produce, monitor antimicrobial dose and related water quality parameters (e.g. pH, suspended solids/turbidity) at intervals consistent with established need based on product and conditions.
8. Review food safety expectations with harvest foreman and crew and implement a policy and system to identify and exclude ill-workers from contact with product or product contact surfaces and materials.
9. Document any decisions and implementation regarding observations that require a corrective action to maintain food safety.
10. Ensure record-keeping and traceability tracking systems are being implemented and are functional at all times, including accurate farm and field maps.

## APPENDIX I

### Working Committee Members (55)

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1. Aller, Marion ; Assoc. of Food & Drug Officials ; FL Dept. of Agriculture & Consumer Services
2. Beckman, Edward ; CEO ; California Tomato Farmers
3. Bihn, Elizabeth ; PSA Program Director ; Cornell University
4. Biltonen, Mike A. ; Consultant ; Red Jacket Orchards
5. Blakely, Bob ; Director of Industry ; California Citrus Mutual
6. Brown, Reggie ; Association Manager ; Florida Tomato Exchange
7. Carlson, Cathy ; Food Safety Program Manager ; Community Alliance with Family Farmers
8. Chege, Peter G. ; Extension Specialist ; University of Illinois Extension
9. Danyluk, Michelle ; Assistant Professor ; University of Florida
10. Deomano, Edgar ; Technical Director ; National Wooden Pallet and Container Association
11. DeSantis, Valeria J. ; Farm Products Grading Inspector ; NYS Dept. of Agriculture
12. Dessaint, Louis ; Field Project Manager ; Brooks Tropicals, LLC
13. Eisenberg, Barry ; VP Food Safety Services ; United Fresh Produce Association
14. Fogarty-Harnish, Peggy ; Agricultural Economic Development ; Penn State Extension
15. Giclas, Hank ; Senior Vice President ; Western Growers
16. Gunter, Chris C. ; Co-chair NC Fresh Produce Safety Task Force ; North Carolina State University
17. Hajmeer, Maha ; Research Scientist IV ; CA Dept. of Public Health, Food & Drug Branch
18. Hari, Michael B. ; Auditor/Inspector ; Equicert
19. Haskins, Cynthia ; Consultant ; Illinois Farm Bureau
20. Johanson, Joy ; FDA/CFRAN ; Consumer Safety Officer
21. Johnson, Donna ; DLJ Food Consulting ; Owner
22. Kanitz, William ; ScoringAg.com ; President
23. Kahlke, Craig, J. ; Area Extension Educator ; Cornell Cooperative Extension
24. Kiger, Luana E. ; Special Assistant to STC ; USDA NRCS
25. Kline, Wesley L. ; Agricultural Agent ; Rutgers Cooperative Extension
26. Kovacs, Tricia ; Washington State Dept. of Agriculture ; Education/Outreach Specialist
27. Kramer, Andrew William ; Mgr. of Grower Communications ; California Strawberry Commission
28. Kulhanek, Ashley L. ; Food Safety Education Associate ; The Ohio State University
29. Langdon, Sue J. ; Extension Director ; North Carolina Sweet Potato Commission
30. Lanini, Sharan A. ; Raw Product Food Safety Mgr ; Chiquita Brands International/Fresh Express
31. Laughlin, Andrea ; Marketing/Food Safety Director ; Macro Plastics
32. Miele, Brendan ; Director CA Farming Ops ; Jacobs Farm/Del Cabo, Inc.
33. Miller, Bill ; Farm Prod. Grdg. Insp. 3 ; NYS Dept. of Agriculture and Markets—Div. of FSI
34. Mountjoy, Daniel ; Asst. State Conservationist ; USDA NRCS
35. Mudahar, Gurmail ; Vice President ; Taniumra & Antle
36. Nolte, Kurt D. ; Extension Agent ; University of Arizona
37. Nye, Ken ; Commodity Specialist ; Michigan Farm Bureau
38. Pandol, Andrew ; Safety Manager ; Pandol Brothers, Inc.
39. Queenan, Mark ; VP of Quality ; Backyard Farms, LLC
40. Reeves, Brian N. ; Farmer ; Reeves Farms
41. Roberts, Martha Rhodes ; Special Assistant to Dean for Research ; University of Florida

42. Rubbo, Colby ; Food Safety Manager ; Costa Farms, Inc.
43. Rushing, Jim ; Training and Program Manager ; University of Maryland
44. Sage, Bob ; Farmer ; Sage's Apples
45. Schneider, Keith ; Associate Professor ; University of Florida
46. Sharp, Adam J. ; Public Policy ; Ohio Farm Bureau Federation
47. Sullivan, Bradley W. ; Managing Attorney ; Lombardo & Gilles, LLP
48. Suslow, Trevor ; Extension Specialist ; University of CA
49. Stoltzfus, Jeff ; Ag Instructor ; ELANCO School District
50. Swiger, Joshua ; Attorney ; Weinberg, Wheeler, Hudgings, Gunn & Dial, LLC
51. Tocco, Phil ; Extension Educator ; Michigan State University Extension
52. Viazis, Stelios ; Produce Safety Staff ; USFDA
53. Wall, Gretchen ; PSA Program Coordinator ; Cornell University
54. Wiemers, Andrew ; Grower Communications ; California Strawberry Commission
55. Villaneva, Michael, L. ; Consultant ; California Leafy Greens Marketing Agreement