

# Produce Safety

ALLIANCE

## Grower Training



Cornell University







# Produce Safety ALLIANCE

Welcome

## Welcome



Cornell University





# Produce Safety

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### **Welcome to the Produce Safety Alliance Grower Training Course!**

This curriculum has been specifically designed to provide a foundation of Good Agricultural Practices knowledge that includes emphasis on co-management of food safety and environmental management goals, while outlining the requirements in the Food Safety Modernization Act (FSMA) Produce Safety Rule. Though the development of this curriculum was focused on small farms, the need to understand and reduce microbial risks during the production of fruits and vegetables should be important to every grower. The farming environment naturally has many microbial risks, so to protect the fruits and vegetables that are grown and packed on the farm, every grower needs to know how to identify and reduce risks. In addition, buyer demand for food safety practices and the first ever regulation of fresh produce outlined in the FSMA Produce Safety Rule, make knowledge about produce safety important to overall farm viability.

Many growers, researchers, extension educators, produce industry members, and state and federal regulatory personnel have worked with the Produce Safety Alliance team to develop and finalize the curriculum. It is our sincere hope that you enjoy the experience and gain knowledge that helps you improve food safety on your farm, meet buyer expectations, and learn how to comply with new regulations that are part of the FSMA Produce Safety Rule. Be sure to engage with the trainers as well as other participants, share your experiences, and ask questions. Attending this training is just the beginning, so identify resources that will help you as you progress and know the Produce Safety Alliance will be available to help you along in your produce safety journey!

### **Electronic Public Release Version**

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# Produce Safety Alliance

## Grower Training Course Information

### Who Should Attend

Fruit and vegetable growers and others interested in learning about produce safety, the Food Safety Modernization Act (FSMA) Produce Safety Rule, Good Agricultural Practices (GAPs), and co-management of natural resources and food safety practices. The PSA Grower Training Course is one way to satisfy the FSMA Produce Safety Rule requirement outlined in § 112.22(c) that requires *'At least one supervisor or responsible party for your farm must have successfully completed food safety training at least equivalent to that received under standardized curriculum recognized as adequate by the Food and Drug Administration.'*

### What to Expect at the PSA Grower Training Course

The trainers will spend approximately seven hours of instruction time covering content contained in these seven modules:

- Module 1: Introduction to Produce Safety
- Module 2: Worker Health, Hygiene, and Training
- Module 3: Soil Amendments
- Module 4: Wildlife, Domesticated Animals, and Land Use
- Module 5-1: Agricultural Water Part I: Production Water
- Module 5-2: Agricultural Water Part II: Postharvest Water
- Module 6: Postharvest Handling and Sanitation
- Module 7: How to Develop a Farm Food Safety Plan

In addition to learning about produce safety practices, key parts of the FSMA Produce Safety Rule requirements are outlined within each module. There will be time for questions and discussion, so participants should come prepared to share their experiences and ask questions.

### Benefits of Attending the Course

The course will provide a foundation of Good Agricultural Practices (GAPs) and co-management information, FSMA Produce Safety Rule requirements, and details on how to develop a Farm Food Safety Plan. Individuals who participate in this course are expected to gain a basic understanding of:

- Microorganisms relevant to produce safety and where they may be found on the farm
- How to identify microbial risks, practices that reduce risks, and how to begin implementing produce safety practices on the farm
- Parts of a Farm Food Safety Plan and how to begin writing one
- Requirements in the FSMA Produce Safety Rule

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After attending the entire course, participants will be eligible to receive a certificate from the Association of Food and Drug Officials (AFDO) that verifies they have completed the training course. To receive an AFDO certificate, a participant must be present for the entire training and submit the appropriate paperwork to their trainer at the end of the course.

### **Costs to Attend**

Total costs to attend the PSA Grower Training Course will vary. Costs include PSA Grower Training Manuals and a certificate of course attendance from AFDO (\$35). All other training costs, such as the cost of the venue and meals, will vary depending on location, food costs, travel costs, and availability of funding to reduce training costs.

### **Additional Information**

For more information about scheduled PSA Grower Training Courses, please visit the PSA website at <http://producesafetyalliance.cornell.edu>.

**For any other questions or to reach the Produce Safety Alliance, please contact:**

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## Acknowledgements

We would like to acknowledge and thank the many individuals and organizations who have contributed to the development and completion of this national produce safety curriculum. We would like to recognize and thank the 178 Produce Safety Alliance (PSA) Working Committee Members and the 89 fruit and vegetable growers who participated in the focus groups. Though their names are not listed here, we appreciate their efforts to identify produce safety challenges on farms, their guidance in developing learning objectives, and their honest opinions about how best to deliver the curriculum. Our Working Committees (WC) would not have been successful without their co-chairs who form the PSA Steering Committee. Not only did they guide their individual WCs, but they have remained engaged in reviewing the curriculum throughout its development.

We would also like to thank the PSA Executive Committee Members and our colleagues in the produce industry, at Land-Grant Universities, the United States Food and Drug Administration (FDA), and the United States Department of Agriculture (USDA) who have provided continual support to ensure the curriculum reflects the most current science, regulatory requirements, guidance, and Good Agricultural Practices. We are grateful for the many volunteer reviewers from across the United States that have provided comments, suggestions, and critiques through the many curriculum draft efforts.

## Reviewers

### PSA Executive and Steering Committee Members

Joann Baumgartner, Executive Director, Wild Farm Alliance

Mary Bianchi, Horticulture Farm Advisor, University of California Cooperative Extension

Michelle Danyluk, Assoc. Professor of Food Microbiology & Safety, University of Florida

Dave Gombas, Senior Vice President, Food Safety & Technology, United Fresh

Jim Gorny, Vice President, Food Safety & Technology, Produce Marketing Association

Michele Jay-Russell, Project Director, UC Davis Western Center for Food Safety

Wes Kline, Associate Professor & Agricultural Agent, Rutgers Cooperative Extension

Sophia Kruszewski, Policy Specialist, National Sustainable Agriculture Coalition

Karen Lowell, Agronomist, USDA-NRCS

Michelle Smith, Senior Policy Analyst, Produce Safety Staff, FDA

Trevor Suslow, Extension Research Specialist, University of California, Davis

James Theuri, Extension Educator, University of Illinois Extension

Phil Tocco, Extension Educator, Michigan State University Extension

Randy Worobo, Professor, Department of Food Science, Cornell University

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### FDA Division of Produce Safety

Samir Assar, Yaping Ao, Annemarie Buchholz, Cecilia Crowley, Chelsea Davidson, David Ingram, Joy Johanson, Karen Killinger, Rachael Kozolup, Michael Mahovic, Amber Nair, Kruti Ravaliya, Scarlett Salem, Fazila Shakir, Michelle Smith, Erick Snellman, Insook Son, Mary Tijerina

Finally, we would like to acknowledge those who were involved in making the modules aesthetically appealing and more effective by providing photographs that highlighted key learning objectives to enhance the learning experience.

### Photo Contributors

Aubrey Ettinger, Diane Ducharme, Ben Chapman, & Audrey Kreske: **North Carolina State University**; Mark Kogut, Gretchen Wall, Elizabeth Bihn, Randy Worobo, Kristin Woods, Donna Pahl, Don Stoeckel, & Stephanie Mehlenbacher: **Cornell University**; Elisa Shackelton & Marisa Bunning: **Colorado State University**; Trevor Suslow: **University of California, Davis**; Lynn Brandenberger: **Oklahoma State University**; Annette Wszelaki: **University of Tennessee**; Michele Schermann: **University of Minnesota**; Keith Schneider & Michelle Danyluk: **University of Florida**; Meredith Melendez and Wes Kline: **Rutgers University**; Bob Nolan & Samuel Nolan: **Deer Run Farms**; Laura Strawn: **Virginia Tech**

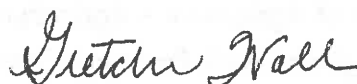
Though we have tried to remember everyone, we apologize if anyone is missing from our acknowledgements. We know the PSA's success is due to collaboration and the countless contributions of many. We are grateful for everyone's effort, sharing of their professional expertise, and continued engagement with the PSA.

Sincerely,



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## **Produce Safety Alliance Executive Committee Members**

### **Cornell University**

- Elizabeth Bihn, PSA Director, Department of Food Science, Cornell University
- Gretchen Wall, PSA Coordinator, Department of Food Science, Cornell University
- Robert Gravani, Professor, Department of Food Science, Cornell University

### **Association of Food and Drug Officials (AFDO)**

- Byron Beerbower, Compliance Manager, Michigan Dept. of Agriculture & Rural Development
- Stephen Stich, Director, Div. of Food Safety & Inspection, New York State Dept. of Ag. & Markets

### **National Association of State Departments of Agriculture (NASDA)**

- Bob Ehart, Public Policy Director, NASDA
- Joe Reardon, Assistant Commissioner, North Carolina Department of Agriculture and Consumer Services

### **U.S. Food and Drug Administration**

- Samir Assar, Director of the Division of Produce Safety, Center for Food Safety and Applied Nutrition, Food and Drug Administration

### **U.S. Department of Agriculture – Agricultural Marketing Service**

- Jennifer Dougherty, Audit Programs Coordinator USDA-AMS, Fruit & Vegetable Programs
- Charles Parrot, Deputy Administrator, Fruit & Vegetable Program, USDA
- Leanne Skelton, Senior Policy Analyst, USDA-AMS Fruit & Vegetable Programs, FDA Center for Food Safety & Applied Nutrition

### **U.S. Department of Agriculture – Natural Resources Conservation Service**

- Diane Gelburd, Special Assistant to the Chief for Strategic Natural Resources Initiatives
- Karen Lowell, Agronomist, USDA-NRCS

We would also like to recognize the contributions of Dr. Erick Snellman, policy analyst with the FDA Produce Safety Staff, and a valuable member of our Executive committee, who passed away in August 2014.

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## **Produce Safety Alliance Steering Committee Members**

### **WC 1: Core Curriculum/General Topics (57 members)**

- **Benjamin Chapman** – Associate Professor, North Carolina State University
- **James Theuri** – Extension Educator, University of Illinois Extension

### **WC 2: Core Curriculum/Hazards & Preventive Controls – Common Issues (59 members)**

- **Diane Ducharme** – GAPs Program Coordinator and Extension Associate, North Carolina State University
- **Brian Reeves** – Owner, Reeves Farms

### **WC 3: Core Curriculum/Hazards & Preventive Controls – Farm Review (44 members)**

- **Robert Hadad** – Vegetable Extension Specialist, Cornell Cooperative Extension
- **Henry Giclas** – Senior Vice President of Strategic Planning, Science, and Technology, Western Growers

### **WC 4: Core Curriculum/Hazards & Preventive Controls – Production (72 members)**

- **Fred Finney** – Owner, Moreland Fruit Farm Ltd.
- **Karen Killinger** – Research Staff Fellow, Division of Produce Safety, Center for Food Safety & Applied Nutrition, Food and Drug Administration

### **WC 5: Core Curriculum/Hazards & Preventive Controls – Harvest (55 members)**

- **Reggie Brown** – Manager, Florida Tomato Committee
- **Trevor Suslow** – Extension Research Specialist, University of California, Davis

### **WC 6: Core Curriculum/Hazards & Preventive Controls – Postharvest Handling (68 members)**

- **Wesley Kline** – Agricultural Agent, Cumberland County, Rutgers University
- **Barry Eisenberg** – Technical Marketing Manager, Food Safety, Fresh Produce, BASF

### **WC 7: Train the Trainer Lesson Plan (45 members)**

- **James Rushing** – Manager of International Training Programs, Joint Institute for Safety and Applied Nutrition
- **Michael Villaneva** – Technical Director, California Leafy Green Marketing Agreement

### **WC 8: Education Outreach Program Delivery – Farmers & Trainers (68 members)**

- **Craig Kahlke** – Extension Educator, Lake Ontario Fruit Program, Cornell Cooperative Extension
- **Keith Schneider** – Professor, Department of Food Science and Human Nutrition, University of Florida

### **WC 9: Education Outreach Program Delivery – Regulators & Trainers (45 members)**

- **Bill Miller** – Grading Inspector III, New York State Dept. of Ag & Markets
- **Anita MacMullan** – Agriculture Program Specialist, North Carolina Department of Agriculture & Consumer Services

### **WC 10: Certification (41 members)**

- **Joseph Corby** – Executive Director, Association of Food and Drug Officials
- **Janet Williams** – Training Officer, FDA Division of Human Resource Development, Office of Regulatory Affairs University

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## **Produce Safety Alliance Disclaimer**

This information provided by the Produce Safety Alliance (PSA) is for training purposes only. The PSA is not your attorney and cannot provide you with legal advice. The PSA curriculum is intended as a training tool to assist produce growers, packers, and handlers in complying with the U.S. Food and Drug Administration (FDA) Food Safety Modernization Act (FSMA) Standards for the Growing, Harvesting, Packing, and Holding Produce for Human Consumption; however, following this curriculum does not ensure compliance with the law or the FDA's regulations. For advice regarding legal compliance with the FSMA Produce Safety Rule, please consult your legal counsel.

The information provided by the PSA will vary in applicability to each produce grower, packer, or handler. It is not possible for the PSA training curriculum to address every situation. Produce growers, packers, and handlers should implement the practices and programs that will function best to produce safe fruits and vegetables based on the nature of their individual operations. PSA materials do not outline the only approach to developing and implementing the regulation. Produce grower, packers, and handlers can follow any approach that satisfies the requirements of the applicable statutes and regulations related to FSMA. The information provided by the PSA does not create binding obligations for the FDA, growers, packers, handlers, or others in the industry.

PSA does not guarantee accuracy, adequacy, completeness or availability of any information provided in its curriculum and is not responsible for any errors or omissions or for any results obtained from the use of such information. PSA gives no warranties (expressed or implied), including but not limited to, any warranties of merchantability or fitness for a particular purpose or use. In no event shall the PSA be liable for any indirect, special, or consequential damages in connection with any use of this training curriculum.

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# Produce Safety ALLIANCE

## Introduction to Produce Safety

1) Introduction to  
Produce Safety



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## **Learning Objectives**

### **Module 1: Introduction to Produce Safety**

#### **Objective 1:**

Develop a better understanding of produce safety and how it may impact your fruit and vegetable farm.

#### **Objective 2:**

Identify the types of human pathogens that can contaminate fresh produce and give an example of each.

#### **Objective 3:**

Understand common ways that produce may become contaminated on the farm.

#### **Objective 4:**

Describe strategies to prevent and reduce risks of contamination by human pathogens.

#### **Objective 5:**

Understand the value of your commitment to implementing food safety practices.

#### **Critical Concepts**

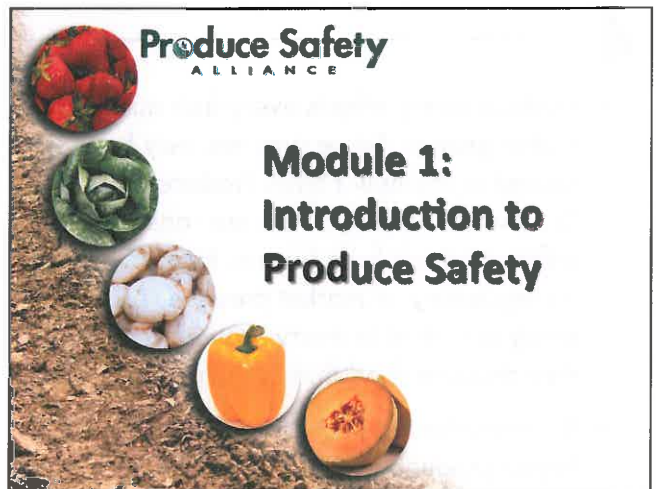
- Produce safety and its relevance to your farm
- Basic introduction to the Food Safety Modernization Act's Produce Safety Rule
- Foodborne illness outbreak impacts to the produce industry and consumers
- Different types of foodborne illness organisms
- Why prevention of contamination is critical to produce safety
- Unique challenges in produce safety
- Environmental factors that can contribute to human pathogen growth and survival
- The importance of a grower's commitment to produce safety
- How to conduct a basic risk assessment
- Basic introduction to Good Agricultural Practices (GAPs)
- What Standard Operating Procedures (SOPs) are
- Steps involved in monitoring, recordkeeping, and corrective actions
- The value of a Farm Food Safety Plan



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### 3




#### Learning Objectives

- Develop a better understanding of produce safety on your fresh fruit and vegetable farm
- Identify types of human pathogens that can contaminate fresh produce
- Understand common ways that produce might become contaminated on the farm
- Describe strategies to prevent and reduce risks of contamination by human pathogens
- Understand the value of commitment to implementing food safety practices

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- Produce safety affects every fruit and vegetable grower. Some growers may be subject to the new FSMA Produce Safety Rule, while other growers are receiving food safety pressure from buyers. Even if there is no regulatory or market pressure, produce safety is critical to every grower because they produce food that consumers will eat.
- It is important to know that growers are the key to produce safety on the farm, and making the decision to do something on the farm is up to them.
- All farms, regardless of size, location, or commodities grown, can reduce food safety risks.
- Growers know their farm best—their production practices, who works on the farm, and all of the other details that go into running a successful business.
- Those who make major decisions for the farm and know the day-to-day farm activities need to be involved in assessing food safety risks and developing the farm's food safety plan.
- Actions to reduce food safety risks not only impact the financial viability of farms, but also the health and safety of those who consume the produce grown.



#### Relevance to the Farm

- You can prevent and reduce risks on the farm
- You know your farm and practices better than anyone, but you may not know the consequences of your current practices on food safety risks
- Your actions directly impact food safety and the financial viability of your farm



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- The Food Safety Modernization Act (FSMA) was signed into law on January 4, 2011 by President Obama. It is the most sweeping reform of the United States' food safety laws in over 70 years. The overall objective of FSMA is to focus on prevention of food safety issues.
- There are seven primary rules included within FSMA:
  1. Produce Safety Rule which includes Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption
  2. Preventive Controls for Human Food
  3. Preventive Controls for Animal Food
  4. Foreign Supplier Verification Programs
  5. Accreditation of Third-Party Auditors/Certification Bodies
  6. Sanitary Transportation of Human and Animal Food
  7. Prevention of Intentional Contamination/Adulteration



### The Food Safety Modernization Act (FSMA)

- FSMA includes:
  - **Produce Safety Rule**
  - Preventive Controls for Human Food
  - Preventive Controls for Animal Food
  - Foreign Supplier Verification Programs
  - Accreditation of Third-Party Auditors/Certification Bodies
  - Sanitary Transportation of Human and Animal Food
  - Prevention of Intentional Contamination/Adulteration
- Focused on prevention of food safety issues and encompasses the entire food system





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**Additional Resource:**

- FDA Factsheet. *Background on the Food Safety Modernization Act.*  
<http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm239907.htm>

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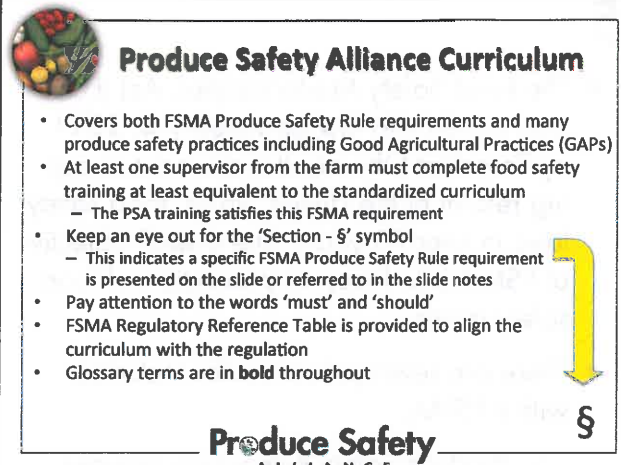
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- This curriculum covers the FSMA Produce Safety Rule requirements as well as Good Agricultural Practices (GAPs) for on-farm food safety. This training is one way to meet § 112.22(c) which requires that at least one supervisor or responsible party from a farm subject to the FSMA Produce Safety Rule must have successfully completed food safety training at least equivalent to that received under standardized curriculum recognized as adequate by the Food and Drug Administration.
- The final FSMA Produce Safety Rule was published in the Federal Register on November 27, 2015.
- The 'Section' symbol (§) is displayed on slides where there are specific FSMA Produce Safety Rule requirements either mentioned on the slide or referenced in the slide notes. These numbers refer to specific sections of the regulation.
- While the slides and/or notes may not reflect the regulatory language exactly in all cases, a FSMA Regulatory Reference Table has been provided so specific language can be reviewed and regulatory standards can be aligned with the slides in the curriculum.
- Every grower should know how to find the specific regulatory requirements to be sure they are fully complying with all the details included in the particular requirement. Many of the requirements have been abbreviated to fit on the slides.
- As an exercise, ask participants to locate § 112.2. Can they name one produce item that is NOT covered by the regulation?
  - Answer: § 112.2 lists produce that is not covered by the FSMA Produce Safety Rule. For example, asparagus which is considered to be 'rarely consumed raw' can be found on this list. There are other types of produce also not covered by the regulation, such as produce grown only for personal consumption or consumption on the farm that produced it.
- Additionally, some terms are in **bold**. These terms have been defined either by the FDA in the Produce Safety Rule, the Food, Drug and Cosmetic Act or provided by the PSA for further clarification in the glossary of this training manual.



**Produce Safety Alliance Curriculum**

- Covers both FSMA Produce Safety Rule requirements and many produce safety practices including Good Agricultural Practices (GAPs)
- At least one supervisor from the farm must complete food safety training at least equivalent to the standardized curriculum
  - The PSA training satisfies this FSMA requirement
- Keep an eye out for the 'Section - §' symbol
  - This indicates a specific FSMA Produce Safety Rule requirement is presented on the slide or referred to in the slide notes
- Pay attention to the words 'must' and 'should'
- FSMA Regulatory Reference Table is provided to align the curriculum with the regulation
- Glossary terms are in **bold** throughout

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- The FSMA Produce Safety Rule is the first mandatory federal standard for the production of fruits and vegetables in the United States. Prior to FSMA, growers, packers, and the produce industry were encouraged to follow voluntary guidance such as FDA's 1998 "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables".
- Resource documents are available to help growers and packers determine whether they will be covered or exempt from these regulations. These documents are available on the PSA website at <http://producesafetyalliance.cornell.edu/> and the FDA's website at <http://www.fda.gov/downloads/Food/GuidanceRegulation/FSMA/UCM472499.pdf>
- Produce not covered by the FSMA Produce Safety Rule (§ 112.2(a)) includes:
  1. Produce commodities that FDA has identified as rarely consumed raw: asparagus; black beans, great Northern beans, kidney beans, lima beans, navy beans, and pinto beans; garden beets (roots and tops) and sugar beets; cashews; sour cherries; chickpeas; cocoa beans; coffee beans; collards; sweet corn; cranberries; dates; dill (seeds and weed); eggplants; figs; ginger; hazelnuts; horseradish; lentils; okra; peanuts; pecans; peppermint; potatoes; pumpkins; winter squash; sweet potatoes; and water chestnuts
  2. Produce that is used for personal or on-farm consumption
  3. Produce that is not a raw agricultural commodity (A raw agricultural commodity is any food in its raw or natural state)
- The definition of produce (§ 112.3) does not include food grains, including barley, dent- or flint-corn, sorghum, oats, rice, rye, wheat, amaranth, quinoa, buckwheat, and oilseeds (e.g., cotton seed, flaxseed, rapeseed, soybean and sunflower seed).
- The rule provides eligibility for an exemption for produce that receives commercial processing that adequately reduces the presence of microorganisms of public health significance, under certain conditions and with certain documentation requirements (§112.2(b)).
  - Documentation requirements include disclosure statements accompanying produce for further processing and annual written assurances from customers (§§ 112.2(b)(2) and (b)(3)).



### FSMA Produce Safety Rule

- First ever mandatory federal standard for growing, harvesting, packing, and holding of fresh produce
- Some growers may be eligible for an exemption or excluded based on:
  - Commodities grown (e.g., rarely consumed raw)
  - Processing activities that include a 'kill step'
  - Average annual produce sales
  - Average annual food sales and sales to 'qualified end users'
- Ultimately, all growers should understand and take action to reduce food safety risks on the farm

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- Farms that have an average annual value of produce sold during the previous three-year period of \$25,000 (adjusted for inflation) or less would not be covered by the regulation (§ 112.4).
- Farms may be eligible for a qualified exemption and associated modified requirements (§ 112.5, § 112.6). To be eligible for a qualified exemption, the farm must meet two requirements:
  1. The farm must have food sales averaging less than \$500,000 per year adjusted for inflation during the previous three years; AND
  2. The farm's direct sales to qualified end-users must exceed sales to all buyers combined during the previous three years. **A qualified end-user** is either (a) the consumer of the food or (b) a restaurant or retail food establishment that is located in the same state or the same Indian reservation as the farm or not more than 275 miles away.
- A farm with the qualified exemption must still meet certain modified requirements, including prominently and conspicuously displaying the name and the complete business address of the farm where the produce was grown either on the label of the produce or at the point of purchase. These farms are also required to establish and keep certain documentation.
- While some growers may be exempt or not covered by the Produce Safety Rule, all growers should be prepared to implement food safety practices because they grow food people eat. Growers may also sell to buyers that require the implementation of food safety practices, including those required in the regulation.

#### Additional Resource:

- Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables:  
<http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM169112.pdf>

## 8

- Growers and packers will have several years to comply with the Produce Safety Rule, unless excluded or exempt.
- The final rule was published on November 27, 2015. The regulation became effective 60 days after the publishing date (January 26, 2016).

 <b>Produce Safety Rule Compliance</b>	
Business Size	Years to Comply After Effective Date (1-26-16)*
All other businesses (>\$500K)	2
Small businesses (>\$250K-500K)	3
Very small businesses (>\$25K-250K)	4
<small>*Compliance dates for certain aspects of the agricultural water requirements allow an additional two years beyond each of these compliance dates.</small>	
	

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- Compliance dates, for all covered produce except sprouts, by business size:
  - All other businesses, defined as greater than \$500,000 in average annual (previous three year period) produce sales, will need to comply with the regulation within two years of the effective date.
  - Small businesses, defined as greater than \$250,000 but less than \$500,000 in average annual (previous three year period) produce sales, will need to comply with the regulation within three years.
  - Very small businesses, defined as greater than \$25,000 but less than \$250,000 in average annual (previous three year period) produce sales, will need to comply with the regulation within four years.
  - The compliance dates for certain aspects of the agricultural water requirements allow an additional two years beyond each of these compliance dates.
- Compliance dates for farms eligible for qualified exemptions are:
  - Labeling requirements (if applicable): January 1, 2020
  - Retention of records supporting eligibility for a qualified exemption: Effective date of final rule (January 26, 2016)
  - For all other modified requirements for farms growing covered produce other than sprouts:  
Very small businesses—4 years, Small businesses—3 years
- Although this provides sufficient time for growers and packers to understand and comply with the regulations, growers should familiarize themselves with the requirements as soon as possible to determine if they are subject to the rule. As mentioned previously, buyer requirements for food safety practices will likely continue to increase, so all growers need to be aware of the regulation and how it might impact their farm.
- The following slides in this module will describe why produce safety is important and provide a basic overview of strategies that can be taken to reduce risk. Each area will be covered in greater detail in subsequent modules.

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Notes:

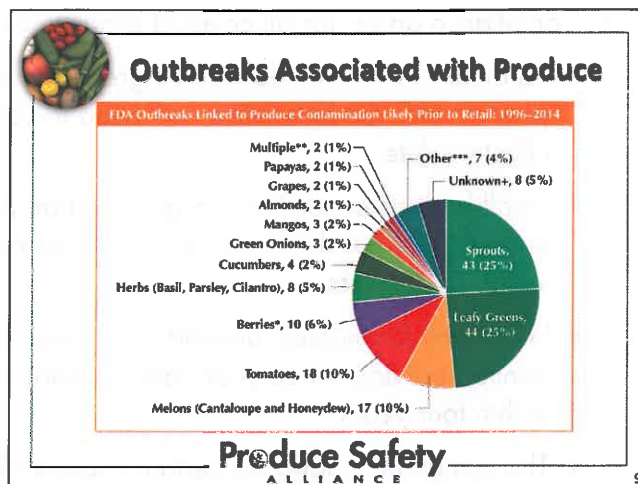
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## 9

- This graph highlights the diversity of **produce** items that have been implicated in **food-borne illness outbreaks** where the source of the outbreak likely occurred prior to retail or consumer preparation.
- Ultimately, contamination can happen to any produce commodity; therefore, preventing contamination is critical for all fruit and vegetable growers.
- For this reason, the FSMA Produce Safety Rule does not target specific commodities, but instead, focuses on the practices which reduce risks. Read more about the FDA's approach to produce regulation in the "Additional Resource" section below.

**Pie chart notes:**

- \* One outbreak of *Cyclospora* associated with raspberries in 1997 accounts for 1,012 illnesses, with no information on hospitalizations and deaths.
- \*\* Two outbreaks in 2004 were associated with mesclun lettuce and/or basil.
- \*\*\* "Other" includes one outbreak associated with each of the following commodities: celery, hazelnuts, hot peppers, pine nuts, pistachios, snow peas, and squash. The single *Salmonella* Saintpaul outbreak associated with hot peppers accounts for 1,535 illnesses, 308 hospitalizations, and 2 deaths.
- + Five outbreaks during this time period were associated with unknown produce; while no specific produce item was identified as the vehicle for these outbreaks, various produce items were found to be epidemiologically associated with illness.

**Other Notes:**

- These data do not contain information on outbreaks/illnesses where the point of contamination is the retail food setting or home.
- These data do not include illnesses transmitted from person-to-person.
- Illness data represent only the number of illnesses reported to CDC, FDA, and state/local health departments in association with an outbreak. These data do not include illnesses that may have occurred but were not reported, sporadic cases of illness, and illnesses not associated with a food vehicle.

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- Information on outbreaks/illness reported prior to 2004 has been compiled from paper records; information on outbreaks/illnesses since 2004 has been obtained from the CFSAN Outbreak Surveillance Database.
- The outbreaks tracked by FDA are a subset of all the outbreaks tracked by CDC. CDC also tracks outbreaks/illnesses where the point of contamination is the retail food setting or the home. Due to lags in reporting of illnesses, some differences in numerical tallies may exist between FDA and CDC data.

### Slide Reference:

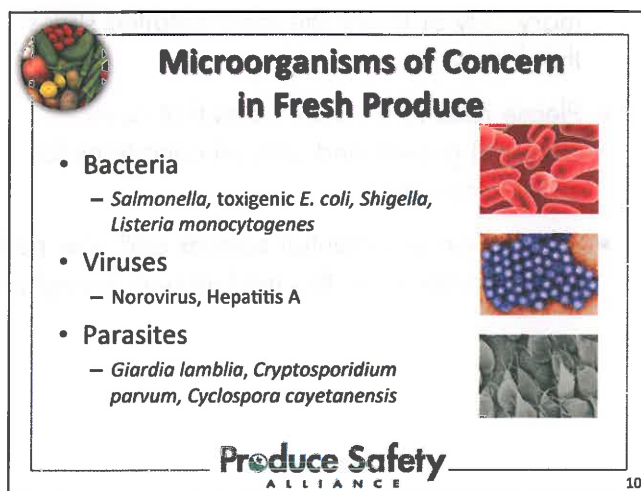
- D'Lima, C., & Vierk, K. (2011). Memorandum to the Record. In: Produce Related Outbreaks and Illnesses. Food and Drug Administration.
- Merriweather, S., Cloyd, T.C. & Gubernot, D. (2015). Memorandum to the File — Produce Related Outbreaks and Illnesses 2011–2014. In: Produce Related Outbreaks and Illnesses. Food and Drug Administration.

### Additional Resource:

- FDA Factsheet. *Why doesn't this rule only target fruits and vegetables that are known to have caused outbreaks of foodborne illness?*.  
<http://www.fda.gov/downloads/Food/GuidanceRegulation/FSMA/UCM360758.pdf>

## 10

- To begin to understand food safety risks, growers should start with understanding what types of microorganisms can contaminate fresh produce.
- The biggest food safety **hazards** in fresh produce are pathogens. A human pathogen is a microorganism capable of causing disease or illness in humans. There are three primary groups of pathogenic microorganisms that are of concern in fresh produce: bacteria, viruses, and parasites.
- This slide provides a few examples of each type of microorganism plus a few names of pathogens you may recognize; however, there are many more pathogens that may cause **foodborne illness outbreaks**. We will cover each type in detail within the next few slides.



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## 10—Introduction to Produce Safety


- Chemical and physical food safety hazards are much less common and typically are responsible for fewer serious health outcomes. Physical food safety risks may present choking hazards or cause someone to chip a tooth (such as from a pebble from the field in the product).
- Chemical food safety risks (such as improper application of pesticides) are certainly a concern, but are much less common than microbial food safety risks. Many chemical hazards are also controlled by established programs outside of the FSMA Produce Safety Rule, for example through EPA pesticide registration and application requirements.

### Additional Resource:


- FDA Bad Bug Book: <http://www.fda.gov/downloads/Food/FoodSafety/Foodbornellness/FoodbornellnessFoodbornePathogensNaturalToxins/BadBugBook/UCM297627.pdf>

## 11

- This slide summarizes important facts about how bacteria multiply and persist in farm environments. More detailed information is provided in the next two slides, but they are optional slides. Depending on the audience, the trainer may choose to present this summary only or to use the more detailed slides that follow.
- Please refer to the slide notes that cover bacterial growth and optimal conditions for more information.
- Information on potential sources and how pathogens are spread in the farm environment will be covered later on in this module and throughout the course.



### Bacteria in the Farm Environment



- Bacteria are microorganisms that can multiply both inside and outside of a host
- Bacteria include pathogens such as *E. coli* O157:H7, *Salmonella*, and *Listeria monocytogenes*
- Bacteria can multiply rapidly given the right conditions: water, food, and the proper temperature
- Good Agricultural Practices can reduce risks by minimizing situations that support bacterial survival and growth

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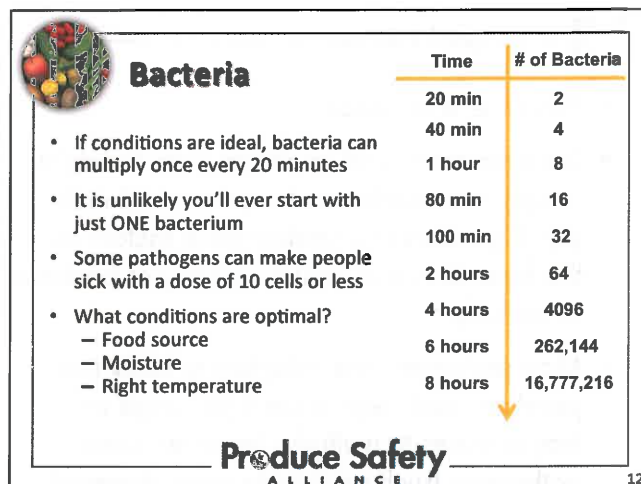
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## 12 Additional Information

- This slide is optional.
- Bacteria are single-celled microorganisms that can multiply in environments outside of a host organism as well as inside a host. Most can multiply very quickly, reaching high numbers in a short period of time if they are in the right environment.
- Examples include: *E. coli* O157:H7, *Salmonella*, *Campylobacter*, *Listeria monocytogenes*, *Shigella*, and more.
- It is unlikely that just ONE bacterial cell will be present. Where there is one, there usually are many – sometimes up into the millions!
- Some pathogens, such as *E. coli* O157:H7 can cause illness with just 10 cells ingested. Other pathogens require a much higher dose (i.e., ingesting many more cells) to cause illness.



### Example outbreaks caused by pathogenic bacteria:

- 2006 *E. coli* O157:H7 outbreak in spinach:  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm55d926a1.htm>
- 2011 *Listeria monocytogenes* outbreak in cantaloupes:  
<http://www.cdc.gov/listeria/outbreaks/cantaloupes-jensen-farms/index.html>
- 2014 *Salmonella* outbreak in bean sprouts:  
<http://www.cdc.gov/salmonella/enteritidis-11-14/index.html>

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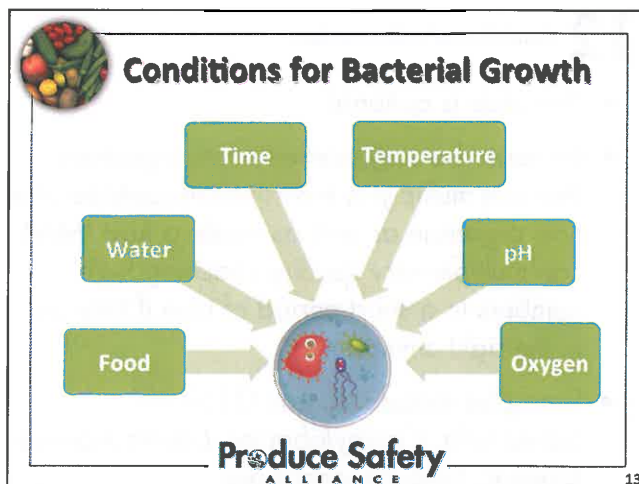
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## 13 Additional Information

- This slide is optional.
- Bacteria need food, moisture, and the right range of temperatures to survive and multiply. If growers can control these factors on the farm, they can limit the ability of bacteria to multiply.
- Most pathogens are adapted to body temperature, and require the right range of temperatures to multiply; however, some pathogens (such as *Listeria monocytogenes*) can not only survive, but also multiply at refrigeration temperatures.
- Think about where bacteria might find food (e.g., sugars from broken fruit in a wash tank), water (e.g., washing water), and other ideal growing environments (e.g., hard to clean spaces where water and food collect).
- The acronym FATTOM has been traditionally used to describe ideal conditions for bacterial growth.



**Food:** Sufficient nutrients are needed to promote growth of bacteria; this can be controlled by proper sanitation.

**Acidity:** Most pathogens thrive at pH 6.6–7.5, but can grow at slightly acidic conditions (pH 4.5–7.5).

**Time:** To reduce risks, use cooling and/or move produce quickly out of the field to a covered location. Clean frequently to prevent build-up of bacteria and **biofilms**.

**Temperature:** Most pathogens grow best between 41°F (5°C) and 135°F (57°C). Keeping produce cool and maintaining the cold chain will deter or slow pathogen multiplication rates. Some pathogens, such as *Listeria monocytogenes*, can multiply in cooler temperatures, so maintaining sanitation practices and keeping produce at the proper temperature will reduce risks.

**Oxygen:** Many pathogens are aerobic, meaning they need oxygen to grow. One exception is *Clostridium botulinum* (botulism) which does not grow in the presence of oxygen and can be associated with canned foods that do not receive adequate thermal processing. Botulism results from ingesting the botulinum toxin produced by the growth of *C. botulinum* in the

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absence of oxygen in canned food products, rather than from traditional infection. Botulism can occur in canned foods but is not likely in raw agricultural commodities since they are exposed to oxygen. Produce in modified atmosphere packaging can deplete oxygen levels that may lead to accelerated decay and growth of spoilage organisms. Food safety challenges with *Clostridium botulinum* and mushrooms in modified atmosphere packages (sealed packages lacking venting) have occurred (See reference below).

**Moisture:** Water is essential for pathogen growth. Controlling standing water and making sure the packing environment, food contact surfaces, and produce going into cold storage are kept as dry as possible, will help reduce risks.

#### Additional Resource:


- Iowa State University Extension and Outreach: Lesson 4 Food Safety —FATTOM: <http://www.extension.iastate.edu/foodsafety/Lesson/L4/L4p1.html>

#### Reference:


- Sugiyama, H., & Yang, K.H. (1975). Growth potential of *Clostridium botulinum* in fresh mushrooms packaged in semipermeable plastic film. *Appl Microbiol*, 30(6), 964–969.

## 14


- Viruses are small particles of nucleic acid that require a host in order to reproduce themselves.
- Viruses are typically spread by people such as food handlers who have not washed their hands before touching produce or food. Examples of viruses associated with fresh produce outbreaks and illnesses include Norovirus and Hepatitis A.
- Only a few virus particles are needed to make someone ill and they are very easy to spread through the environment and from person to person. You may be familiar with Norovirus because of its association with cruise ship outbreaks and its ability to spread rapidly in tight quarters.
- Prevention is key to reducing the spread of viruses. Basic handwashing, proper restroom use, and illness reporting can help prevent the spread of viruses.




### Viruses



- **Viruses** are small particles that multiply only in a host, not in the environment or on produce
- Contamination most often linked to an ill worker handling fresh produce (fecal-oral route) or contaminated water
- It only takes a few virus particles to make someone ill
- Can be very stable in the environment
- Prevention is the key to reducing viral contamination
- Limited options for effective sanitizers





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- Research on the reduction of Norovirus on food contact surfaces is currently limited, making selection of a sanitizer effective on viruses very difficult. Growers should focus on preventing contamination from occurring in the first place.

#### Example outbreak:


- 2003 Hepatitis A outbreak in green onions:  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5247a5.htm>

#### Additional Resources:

- Norovirus Collaborative for Outreach, Research, and Education (NoroCORE):  
<http://norocore.ncsu.edu/>
- EPA Registered Hospital Disinfectants Effective Against Norovirus:  
[https://www.epa.gov/sites/production/files/2016-06/documents/list\\_g\\_norovirus.pdf](https://www.epa.gov/sites/production/files/2016-06/documents/list_g_norovirus.pdf)
  - Special note: The sanitizers/disinfectants listed in the above resource are not suitable for food contact surfaces, but could be used in other areas, such as restrooms.
- Indirect food additives: adjuvants, production aids, and sanitizers. Subpart B-Substances Utilized To Control the Growth of Microorganisms, 21 C.F.R. Section 178.1010 (2015).  
<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=178.1010>

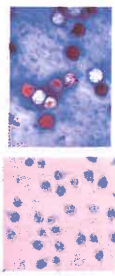
## 15

- Parasites need a host to multiply, but they can also be very stable in the environment. They can remain viable in the environment for long periods of time and are often transmitted through water contaminated with fecal material.
- Examples of parasites include: *Giardia*, *Toxoplasma gondii* (often carried by cats), *Cyclospora*, and *Cryptosporidium*.
- Some parasites can survive in the body for long periods of time without producing any symptoms. This makes it difficult to know when, where, and how the individual became infected. Symptoms may also come and go, making parasitic infections difficult to diagnose.



### Parasites

- **Parasites** are protozoa or intestinal worms that can only multiply in a host animal or human
- Commonly transmitted by water
- Can be very stable in the environment; often not killed by chemical sanitizers
- Can survive in the body for long periods of time before ever causing signs of illness



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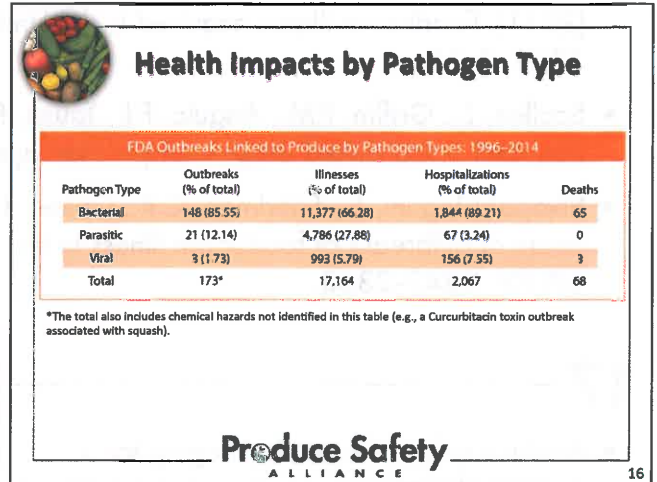


**Example outbreak:**

- 2004 *Cyclospora* in snow peas traced back to Guatemala:  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5337a6.htm>

**16**

- This slide is intended to highlight two key points: 1) number of outbreaks caused by each type of pathogen and 2) the significant impact they have on the health of the individuals who become ill.
- From 1996 to 2014, approximately 172 produce-related reported outbreaks occurred, resulting in 17,156 outbreak-related illnesses, 2,067 hospitalizations and 68 deaths. The total number of outbreaks also includes a single outbreak attributed to Curcubitacin toxin, a chemical hazard that was linked to the consumption of squash in 2004.
- As the previous slides have illustrated, there have been a variety of **pathogens** which have been associated with produce outbreaks including:
  - Bacterial pathogens—*Escherichia coli* (*E. coli*) O157:H7, non-O157 Shiga toxin-producing *E. coli* (STECs) (e.g., O145, O111, O104:H4); *Salmonella* spp.; *Listeria monocytogenes* (*L. monocytogenes*); *Shigella sonnei*.
  - Viruses—Hepatitis A, Norovirus.
  - Parasites—*Cryptosporidium parvum*; *Cyclospora cayetanensis* and *Giardia lamblia*
- Though many may experience only minor symptoms, such as diarrhea, nausea, or vomiting, others have more serious symptoms that result in hospitalization, long term health impacts, and even death.

**Slide Reference and data adapted from:**

- D'Lima, C., & Vierk, K. (2011). Memorandum to the Record. In: Produce Related Outbreaks and Illnesses. Food and Drug Administration.
- Merriweather, S., Cloyd, T.C. & Gubernot, D. (2015). Memorandum to the File—Produce Related Outbreaks and Illnesses 2011–2014. In: Produce Related Outbreaks and Illnesses. Food and Drug Administration.

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### Additional Resources:

- Beuchat, L.R. (1996). Pathogenic microorganisms associated with fresh produce. *J Food Prot*, 59(2), 204–216.
- Scallan, E., Hoekstra, R.M., Angulo, F.J., Tauxe, R.V., Widdowson, M.A., Roy, S.L., et al. (2011). Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*, 17(1), 7–15.
- Scallan, E., Griffin, P.M., Angulo, F.J., Tauxe, R.V., & Hoekstra, R.M. (2011). Foodborne illness acquired in the United States—unspecified agents. *Emerg Infect Dis*, 17(1), 16.
- Sivapalasingam, S., Friedman, C.R., Cohen, L., & Tauxe, R.V. (2004). Fresh produce: a growing cause of outbreaks of foodborne illness in the United States, 1973 through 1997. *J Food Prot*, 67(10), 2342–2353.



## 17

- Produce safety can be challenging for a number of reasons.
  1. Many fruits and vegetables are consumed raw, so there is no cooking or “kill step” to destroy pathogens that may be on the produce.
  2. Contamination events are often sporadic, affecting small portions of the crop, so knowing contamination has occurred is difficult.
  3. Microorganisms, as their name suggests, are not easily seen, so contamination is difficult to detect visually.
  4. Contamination is usually present at very low levels and difficult to detect through product testing.
  5. Rough surfaces (e.g., cantaloupes), large folded surface areas (e.g., leafy greens), and stem scars (e.g., tomatoes) provide great places for pathogens to hide, thereby making pathogens difficult to remove by any amount of washing at the farm level or in the consumer’s home.
- For these reasons, the focus of produce safety is on preventing contamination from occurring in the first place. Contamination is difficult to remove once present.



### Produce Safety Challenges

- Fresh produce is often consumed raw (i.e., not cooked)
- Microbial contamination on produce is extremely difficult to remove once present
  - Natural openings, stem scars, bruises, cuts
  - Rough surfaces, folds, netting
- Contamination is often sporadic
- Bacteria can multiply on produce surfaces and in fruit wounds, provided the right conditions are present


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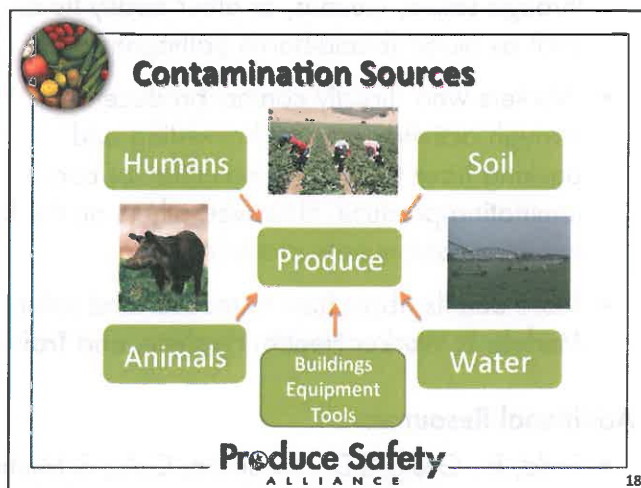
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**Additional Resources:**

- Beuchat, L.R. (2002). Difficulties in eliminating human pathogenic microorganisms on raw fruits and vegetables. In *XXVI International Horticultural Congress: Horticulture, Art and Science for Life-The Colloquia Presentations*, 642, 151–160.
- Fatemi, P., LaBorde, L.F., Patton, J., Sapers, G.M., Annous, B., & Knabel, S.J., (2006). Influence of punctures, cuts and apple surface morphologies on penetration and growth of *Escherichia coli* O157:H7. *J Food Prot*, 69(2), 267–275.

**18**

- On the farm, contamination can come from a number of sources.
- Do growers have these things on their farms (e.g., water, workers, soil, tools, or animals)? Of course they do—which is why every grower needs to understand food safety risks and how to reduce them on the farm.
- This course will cover each of these areas and the risks they may pose to the contamination of produce. The next five slides will introduce the risks associated with each of these areas.

**Additional Resources:**

- Beuchat, L.R. (2002). Ecological factors influencing survival and growth of human pathogens on raw fruits and vegetables. *Microb Infect*, 4(4), 413–423.
- Park, S., Szonyi, B., Gautam, R., et al. (2012). Risk factors for microbial contamination in fruits and vegetables at the pre-harvest level: a systematic review. *J Food Prot*, 75(11), 2055–2081.
- Strawn, L.K., Fortes, E.D., Bihn, E.A., et al. (2013). Landscape and meteorological factors affecting prevalence of three food-borne pathogens in fruit and vegetable farms. *Appl Environ Micro*, 79(2), 588–600.

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## 19


- Humans can carry pathogens and spread them to produce, food contact surfaces, or other people while they work on the farm.
- Pathogens are most commonly spread, directly or indirectly, by fecal material (fecal-oral route) but they can also be spread through saliva, mucous, or other bodily fluids such as blood (blood-borne pathogens).
- Workers who directly contact produce through activities such as harvesting and packing have the highest potential for contaminating produce. However, others on the farm, such as visitors, office staff, and volunteers, can also contaminate produce.
- More details about how to reduce food safety risks associated with workers are presented in **Module 2: Worker Health, Hygiene, and Training**.

### Additional Resource:

- Todd, E., Greig, J.D., Bartleson, C.A., & Michaels, B.S. (2009). Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 6. Transmission and survival of pathogens in the food processing and preparation environment. *J Food Prot*, 72(1), 202–219.

## 20

- Both domesticated animals (e.g., cattle, chickens, pigs, family pets) and wild animals (e.g., deer, geese, wild pigs) can carry pathogens in their feces and spread contamination by tracking feces through the field as they move.
- Produce can be contaminated directly or indirectly by feces, through contamination of water, or **cross-contamination** from wildlife movement.




### How Contamination Is Spread

- **Humans**


Workers can spread pathogens to produce because they directly handle fruits and vegetables.

  - Improper health and hygiene practices
    - Lack of adequate training and handwashing practices
    - Lack of or inadequate toilet facilities
  - Illness or injury
    - Working while sick
    - Injuries that result in blood contacting fresh produce



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### How Contamination Is Spread

- **Animals**

Domesticated and wild animals can carry and transmit human pathogens to produce.

  - Field intrusion may result in direct fecal contamination of crops and fields
  - Animal feeding, rooting, and movement through fields may spread contamination
  - Animals can contaminate water sources used for produce production
  - Manure runoff can contaminate fields, water sources, and crops




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- The risks associated with animals are discussed in more detail in **Module 4: Wildlife, Domesticated Animals, and Land Use.**

### Additional Resources:

- Jay, M.T., Cooley, M., Carychao, D., et al. (2007). *Escherichia coli* O157:H7 in Feral Swine near Spinach Fields and Cattle, Central California Coast. *Emerg Infect Dis*, 13(12), 1908–1911.
- Islam, M., Doyle, M.P., Phatak, S.C., Millner, P., & Jiang, X. (2004). Persistence of enterohemorrhagic *Escherichia coli* O157:H7 in soil and on leaf lettuce and parsley grown in fields treated with contaminated manure composts or irrigation water. *J Food Prot*, 67(7), 1365–1370.

## 21

- Water is used in many ways on the farm—everything from irrigating to washing produce.
- Water is also a great vehicle for carrying and spreading human pathogens if the water becomes contaminated.
- Water can become contaminated at the source as well as at any point in its distribution and use.
- **Module 5: Agricultural Water**, will discuss both production and postharvest water risks and how they can be minimized.



### How Contamination Is Spread

- **Water**  
Water can carry and spread human pathogens, contaminating entire fields or large amounts of produce.
  - Production water
    - Irrigation, crop sprays, frost protection
  - Postharvest water
    - Fluming, cooling, washing, waxing, cleaning
  - Unexpected events
    - Flooding, runoff




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### Additional Resources:

- Bihn, E.A., Smart, C.D., Hoepting, C.A., & Worobo, R.W. (2013). Use of Surface Water in the Production of Fresh Fruits and Vegetables: A Survey of Fresh Produce Growers and Their Water Management Practices. *Food Prot Trends*, 33(5), 307–314.
- Mootian, G., Wu, W.H., Matthews, K.R. (2009). Transfer of *Escherichia coli* O157:H7 from soil, water, and manure contaminated with low numbers of the pathogen to lettuce plants. *J Food Prot*, 72(11), 2308–2312.

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## 22


- Raw **manure** represents a significant microbial risk to fresh produce since animal manures can contain human pathogens.
- Manure can be a valuable resource to farms and nutrient cycling. There are ways, such as through **composting** or by extending the time between application of manure and harvest, to reduce food safety risks when using raw manure as a soil amendment.
- More details about soil amendments will be covered in **Module 3: Soil Amendments**.

### Additional resources:

- Jiang, X., Morgan, J., & Doyle, M.P. (2002). Fate of *Escherichia coli* O157:H7 in Manure-Amended Soil. *Appl Envir Micro*, 68(5), 2605–2609.
- Erickson, M.C., et al. (2014). Examination of factors for use as potential predictors of human enteric pathogen survival in soil. *J Appl Micro*, 116(2), 335–349.


## 23

- One way that contamination can be spread that is often overlooked is through cross-contamination from food contact surfaces, such as sorting tables, tools, and equipment.
- The best way to reduce risks is to keep all food contact surfaces clean and sanitized, when possible.
- Dedicating tools to a task will also reduce risks, such as having separate sets of tools for different jobs, such as for cleaning food contact surfaces and for cleaning bathrooms.
- Debris, trash, or standing water can pose risks to food contact surfaces.



### How Contamination Is Spread

- **Soil Amendments**  
Raw manure and other soil amendments can be a source of contamination if not properly handled and applied.
  - Application too close to harvest
  - Improper/incomplete treatment
  - Improper storage
  - Runoff
  - Wind spread
  - Cross-contamination due to improper sanitation procedures



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### How Contamination Is Spread

- **Surfaces, equipment, tools, and buildings**  
Any unclean surface that contacts produce can harbor pathogens and serve as a source of contamination.
  - For example, not having an established schedule for cleaning or sanitizing food contact surfaces, including tools
- Facility management can also impact risks
  - Areas outside buildings that are not kept mowed or clean can serve as pest harborage areas
  - Standing water or debris present in the packinghouse can become a source of cross-contamination



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- Keeping areas outside buildings cleaned-up (e.g., free of debris or unused equipment) and mowed will reduce pest harborage areas as well as their presence inside buildings.
- More details about reducing risks posed by buildings, equipment, and tools will be covered in **Module 6: Postharvest Handling and Sanitation**.

## 24

- **Cleaning** and **sanitizing** will be covered in greater detail in **Module 6: Postharvest Handling and Sanitation**; however, these definitions are critical to review since these terms will be mentioned throughout the following modules.
- A dirty surface CANNOT be sanitized! Not all surfaces can be sanitized, but all surfaces can be cleaned! This may include sweeping, wiping off tables, or brushing/rinsing off dirt from harvest totes. Cleaning must be done before sanitizing.
- Surfaces may also be cleaned with a **detergent** and a **sanitizer**, or another treatment can then be applied to reduce or eliminate pathogens and spoilage **microorganisms**.
- In the FSMA Produce Safety Rule, **sanitize** means to adequately treat cleaned surfaces by a process that is effective in destroying vegetative cells of microorganisms of public health significance, and in substantially reducing numbers of other undesirable microorganisms, but without adversely affecting the product or its safety for the consumer.



### Cleaning vs. Sanitizing

*What is the difference and why does it matter?*

- **Cleaning:** Physical removal of dirt (soil) from surfaces which can include the use of clean water and detergent
- **Sanitizing:** Treatment of a cleaned surface to reduce or eliminate microorganisms

**Important point: You cannot sanitize a dirty surface.  
Cleaning always comes first!**

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### Additional resources:

- Schmidt, R. (2009). Basic Elements of Equipment Cleaning and Sanitizing in Food Processing and Handling Operations. University of Florida/IFAS Extension. <http://edis.ifas.ufl.edu/fs077>

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## 25

- The importance of a grower's commitment to produce safety cannot be overstated!
- The safety of produce depends on the grower and every person who works on the farm.
- This slide highlights why their commitment is important to produce safety.



### Produce Safety Begins With Your Commitment

- Identifying produce safety risks on your farm
- Supporting the implementation of food safety policies and practices to reduce risks
- Providing equipment and facilities necessary to implement practices that reduce risks
- Supporting effective food safety training so everyone can actively be involved in reducing risks
- Setting a good and consistent example on your farm

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## 26

- Growers need to know what risks exist on their farms before they begin. Many farms have limited resources, so identify the biggest risks and work to minimize those risks first.
- Implement practices to reduce the risks identified. Practices might include training workers or **composting** manure before it is applied to fields.
- Monitor implementation to make sure practices are getting done and being completed correctly.
- Implement **corrective actions** to fix a problem identified through monitoring and prevent it from occurring again.
- Recordkeeping is very useful in making sure tasks are being completed and to visualize trends over time. It is also required for some provisions of the FSMA Produce Safety Rule and for many third party audits.



### Steps Towards Produce Safety

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



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### Additional Resource:

- Bihn, E.A., Schermann, M.A., Wszelaki, A.L., Wall, G.L., & Amundson, S.K. (2014). Farm Food Safety Decision Trees. <http://gaps.cornell.edu/educational-materials/decision-trees>


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## 27

- Assessing produce safety risks requires a systematic review of the farm location, practices, conditions, and typical situations to determine where contamination could most easily occur.
- Many situations and risks will be discussed during this training, but each farm has its own unique risks. Growers should focus on learning how they can assess these risks so they can evaluate their own farm.



### Assessing Risks




- **Assess your farm and practices**
  - Location of farm, fields, and adjacent land activities that may represent risks to the crops you grow
  - Fecal contamination risk from domesticated or wild animals
  - Use of water and manure in crop production
  - Worker training programs and hygiene facilities
  - Practices used to grow, harvest, pack, or hold produce and the tools and equipment
  - Typical and atypical (e.g., flooding) situations

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## 28

- Most farms are already implementing practices to reduce produce safety risks—so many growers are likely already doing some of these things.
- Growers should prioritize those risks that they think will have the biggest impact on produce safety and address those risks first; farm resources are limited, so they should choose their investments wisely.
- Some things may only require a slight modification of practices, while others may require a capital investment.
- If growers are unsure about what practices may work best for their farm to reduce food safety risks, they should consider contacting their state or local GAPs or Extension educator or other educational resources listed in the PSA Training Manual. See **Module 7: How to Write a Farm Food Safety Plan** and the training manual for more information.



### Implementing Practices to Reduce Risks



- Focus on preventing contamination
  - Cannot reliably remove contamination
- Address risks most likely to have the biggest impact on produce safety first
- May require modification of current practices and additional training for farm employees
- May require capital investment
- You may already be doing the right thing!
- Ask for help and seek training if you are unsure

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**Additional Resource:**

- University contacts are listed on the PSA website at <http://producesafetyalliance.cornell.edu/contact-us/university-contacts> or on the National GAPs website at <http://www.gaps.cornell.edu>


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## 29

- **Good Agricultural Practices (GAPs)** encompass all of the areas that have been discussed—from planting through postharvest handling. They represent best practices related to food safety on the farm and in packinghouses. These areas and more will be discussed throughout this curriculum.
- This curriculum includes regulatory requirements, but also places emphasis on providing a foundation of GAPs and other produce safety practices so growers can assess risks and implement practices to reduce risks.
- The farm environment cannot be considered zero risk; therefore, the focus is to minimize risks to fresh produce during production and packing.



### Good Agricultural Practices (GAPs)

- This curriculum will focus on GAPs and provide information on how growers can comply with the FSMA Produce Safety Rule
- Key areas will be reviewed as well as practices that can be implemented to reduce risks including:
  - Worker training programs
  - Water monitoring, testing, and treatment
  - Manure and compost management
  - Wildlife and animal monitoring
  - Sanitation programs






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## 30

- **Standard operating procedures (SOPs)** can help growers implement GAPs and ensure that practices are done properly.
- Think of an SOP as a recipe card. It provides step-by-step instructions on how to complete a task that needs to be done for produce safety. It also includes where the supplies are located to complete the task and how often the task should be done.
- Practice writing SOPs can be a great learning exercise and helps refine the instructions to get the job done properly. Have the grower write an SOP and then give it to someone who has never done the task before. Did that person complete the task correctly? Were they confused at any point about the instructions or location of supplies? If so, growers should revise the SOP to be more clear.



### Standard Operating Procedures (SOPs)

- **A written document defining how to complete a specific food safety practice.**
- **SOPs include:**
  1. Step-by-step instructions to ensure that even a person who has never done a practice before can complete the practice correctly by following the instructions
  2. Location and name of any supplies needed to complete the practice
  3. When and how often the practice should be completed
  4. What records are needed/necessary

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- As growers view the modules today, ask them to consider where SOPs might be useful to help implement food safety practices on their farm. Encourage them to make notes in the modules so they know where to begin when they return home.

### Additional Resource:


- Bihn, E.A., Schermann, M.A., Wszelaki, A.L., Wall, G.L., & Amundson, S.K. (2014). Farm Food Safety Decision Trees. How to Write An SOP.  
<http://gaps.cornell.edu/sites/gaps.cornell.edu/files/shared/documents/How-to-Write-SOP.pdf>

## 31

- **Monitoring** is very important to ensure food safety practices are done properly and at times when they have the most impact.
- Monitoring appears in each module to highlight its importance and the benefit of identifying problems before they impact the safety of produce.
- What activities should be monitored on the farm? What monitoring is required? Make a list and discuss with the group. As a note, required monitoring practices will be covered throughout the course, so revisiting this exercise at the end of the course will be most beneficial.



### Monitoring



- Performed on a schedule or during a specific activity
- Allows you to verify practices are being completed properly
- Helps identify problems before they impact safety
  - Frequent high generic *E.coli* counts in water test results
  - Evidence of animal intrusion and fecal contamination
  - Improper cleaning and sanitation practices resulting in dirty equipment and tools

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## 32


- Corrective action plans can be established in advance for problems that are reasonably likely to happen, such as too little sanitizer added to wash water.
- Some events cannot be predicted, so corrective actions may need to be developed after the problem has been identified. Monitoring will help identify when a corrective action is needed. These corrective actions can then be added to the overall plan. Growers can also have a plan for responding when the unexpected occurs.

- Either way, corrective action plans should be directed toward fixing the problem and helping identify the underlying issue to reduce the likelihood that the problem will occur again.



### Corrective Actions

- Can be established in advance
  - Negative consequences for workers not following practices
  - Plans for a spilled portable toilet
- Fix problems that are identified during monitoring
  - Restocking toilet and handwashing facilities
  - Retraining supervisors and farm workers
- May require short and long term planning
  - Establishing sanitation programs (short term)
  - Replacing equipment (long term)




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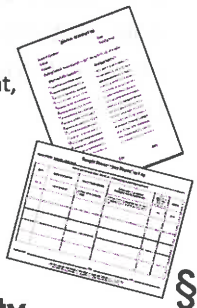
## 33

- Make recordkeeping easy and useful! There are many **templates** to use that can be tailored to each farm.
- Make sure the recordkeeping logs are located near where the tasks need to be done. If the records are in the office, which is a 5 minute walk from the packing area, the record likely will not be filled out.
- Required records must be dated and signed or initialed by the person who performed the activity (§ 112.161(a)(4)).
- Be sure to review logs on a regular basis to make sure there are no problems. Managers or a responsible party must sign and date certain required records after they are reviewed (§ 112.161(b)).
- Required records, per § 112.164, must be kept for at least two years past the date the record was created.



### Recordkeeping

- Recordkeeping includes documenting practices, monitoring, and corrective actions
- There are many templates available
- Recordkeeping should be convenient, or else it will not get done
- Records must be signed and dated after they are reviewed
- Keep all records for at least 2 years



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- Retaining records for at least this length of time is necessary to ensure that the records are available for reference during verification activities as well as during inspections or in the event something goes wrong.
- Records can be stored off-site, as long as they can be retrieved and made available and accessible to FDA within 24 hours of request by FDA for inspection and copying (§ 112.166).
- Electronic records are considered to be 'on-site' if they can be accessed from the farm via computer or other devices.

## 34

- There are many benefits to recordkeeping.
  - Be assured that the task was completed and done properly.
  - See trends or outliers that may cause problems in the future, such as toilet facilities that are frequently out of stock, indicating they need to be checked and cleaned more often.
  - Recordkeeping is required for third party audits and for some parts of the FSMA Produce Safety Rule, see Subpart O—Records for more information on requirements for making and keeping records.



### Recordkeeping Benefits



- You can verify practices were done
  - And done properly!
  - Assures you that everyone is sticking to the food safety policies
- Look for trends or outliers and eliminate potential problems
- May be required for certain activities
  - Regulatory (i.e., FSMA Produce Safety Rule requirements)
  - Third party audits

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## 35

- Duct tape, pencils, clipboards, log sheets, and plastic sleeves go a long way to facilitate recordkeeping.
- Technology can be used for recordkeeping too. Phones, apps, tablets, and computers can make the transfer and saving of documents easy for food safety.
- If using electronic recordkeeping, be sure that the records are authentic and cannot be changed after entries have been made.
- § 112.165 outlines acceptable record formats which include original records, true copies, and electronic records.



### Recordkeeping Basics

- Records can be handwritten (pen & paper) or electronic (handheld data entry or scanner)
- Invest in tools that make it work
  - Clip boards
  - Pens tied to long pieces of string attached to a clipboard with the recordkeeping logs
  - Plastic page sleeves
  - Duct tape
- Use technology to your advantage
  - Phones, apps, tablets, computer software




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## 36

- Make recordkeeping easy for workers and the tasks they are doing.
- Workers should understand which records they are responsible for filling out as well as when and how to do it.
- Recordkeeping supplies should be available where the task is being done to make completing records easy.
- **Tip:** Use clear plastic sleeves to tape records near the site of where the task is being done. Clipboards (with pens attached) can also be nailed to the wall in a convenient location for workers to fill out.



### Recordkeeping Tips

- Establish record keeping schedules that make sense for the record keeper and the action
  - When does it need to be recorded?
  - Who is in charge of documenting it?
  - How often does it need to be documented?
- Build recordkeeping into normal routines
  - Place recordkeeping logs in accessible areas with necessary supplies (e.g., pens, paper)

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## 37

- A **Farm Food Safety Plan** guides practices to ensure food safety.
- When growers return to their farms, writing a food safety plan will solidify their ideas and allow them to take action on their own farm to reduce risks.
- A Farm Food Safety Plan is not required under the FSMA Produce Safety Rule, but is generally accepted as a best practice and is needed for many third party audits.



### A Farm Food Safety Plan

- Gets you thinking about YOUR farm and practices
- Keeps you organized so you can focus your time and resources more effectively
- Gives you a plan to follow and assure everyone is involved
- Documents your progress
- Is required by third part audits and some buyers
- Is not required by the FSMA Produce Safety Rule, but is a good idea!



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## 38

- Produce safety impacts every farm. Outbreaks also impact the health of consumers and reduce confidence in produce and influence purchase/consumption decisions.
- Financial viability of farms depends on safe produce because outbreaks can impact sales and the local economy.
- Commitment to food safety is critical to the success of every farm food safety program.
- Leadership should be provided to guide the implementation and management of produce safety practices on each farm.
- Necessary resources for food safety may include training, facilities, and equipment must be provided to workers so that they can do their jobs correctly and follow regulatory requirements (Discussed in more detail in **Module 2: Worker Health, Hygiene, and Training**).
- Never underestimate the value of setting a good example for all of your employees to follow.
- Writing a Farm Food Safety Plan is a good place to start!



### Summary

- Produce safety impacts your farm
- Microorganisms are the primary produce safety concern
- Your commitment is critical to success
- Produce safety includes:
  - Assessing risks, implementing practices, monitoring practices, using corrective actions, and keeping records
  - Providing the necessary resources to get it done
- A written Farm Food Safety Plan guides your produce safety efforts



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# Produce Safety ALLIANCE

## Worker Health, Hygiene, and Training



2) Worker Health,  
Hygiene, and Training



Cornell University





## **Learning Objectives**

### **Module 2: Worker Health, Hygiene, and Training**

#### **Objective 1:**

Identify the potential routes of contamination associated with workers that could result in the contamination of fresh fruits and vegetables in produce fields and packinghouses.

#### **Objective 2:**

Identify adult learning concepts that should be considered when developing a training program.

#### **Objective 3:**

Describe topics that must be included in a worker training program and what resources need to be provided to reduce the risk of fresh produce contamination.

#### **Objective 4:**

Describe how to monitor that facilities are available and maintained, and that appropriate health and hygiene practices are being followed by everyone on the farm.

#### **Objective 5:**

Describe corrective actions that can be taken when health and hygiene policies are not followed or when facilities are not maintained.

#### **Objective 6:**

Identify the records and recordkeeping tools that could be used to monitor and manage a worker health, hygiene, and training program.

#### **Critical Concepts**

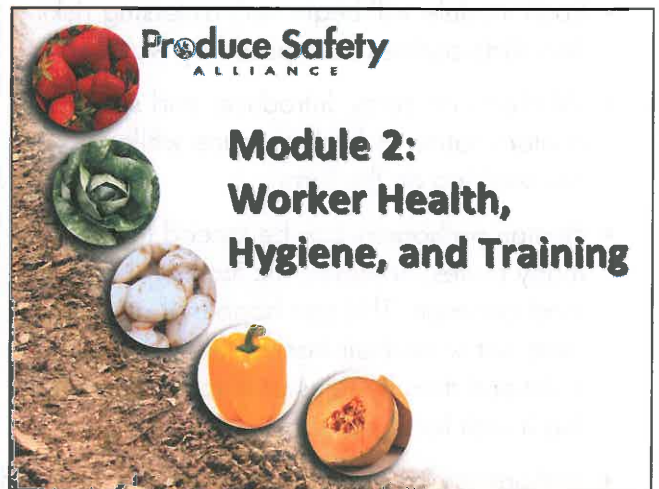
- Food safety risks and potential routes of contamination from workers
- Importance of worker training
- Principles of adult learning important to use in worker training programs
- Key parts of a worker training program
- Potential training challenges
- Understanding cultural differences and language barriers
- Development of policies to encourage and enforce proper food safety behaviors
- Development of worker illness and injury policies
- Proper facilities and resources that need to be provided and maintained to enable health and hygiene practices
- Steps involved in monitoring, recordkeeping, and corrective actions



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### 3




#### Learning Objectives

- Identify potential routes of contamination associated with workers
- Identify adult learning concepts and topics to include in a worker training program
- Describe how to monitor that facilities are maintained on the farm
- Describe corrective actions that may be used to correct identified problems
- Identify recordkeeping tools for worker health and training

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### 4

- Each module will begin with assessing risks. This slide outlines risks posed by workers.
- Workers can carry, introduce, and spread contamination to fresh produce while they are working on the farm.
- Human **pathogens** can be spread through many routes; however, the fecal-oral route is most common. This can happen if a worker does not wash their hands after using the toilet and then handles produce, contaminating it with fecal material.



#### Workers Are A Food Safety Concern Because They...

- **Can carry human pathogens**
  - *Shigella*, Hepatitis A, Norovirus, and others
- **Can spread human pathogens**
  - Harvest and pack with their hands
  - Fecal-oral route
- **Require training to reduce risks**
  - Proper handwashing
  - How to handle illnesses and injuries



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- Pathogens can also spread through saliva and mucus, and contact with other contaminated surfaces. For example, hands may become contaminated while eating, smoking, or sneezing.
- Workers must wash their hands at times where hands may have become contaminated.
- Worker training should include how to wash hands and workers should be given opportunities to practice this skill during the training.
- Workers must know what to do if they are ill or injure themselves while working. This reduces the risks of human pathogens, blood, and other bodily fluids contaminating fresh produce, fields, and packinghouses.

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- Remember, workers and the training they receive are very important since workers play a key role in farm food safety.
- **Example outbreak:** Hepatitis A in Green Onions
  - Calvin, L., Avendaño, B., Schwentesius, R. (2004). The economics of food safety: The case of green onions and Hepatitis A outbreaks. *Electronic Outlook Report from the Economic Research Service*.  
<http://www.ers.usda.gov/publications/vgs/nov04/VGS30501/VGS30501.pdf>
  - Centers for Disease Control and Prevention (CDC). (2003). *Hepatitis A Outbreak Associated with Green Onions at a Restaurant — Monaca, Pennsylvania, 2003*.  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5247a5.htm>

## 5

Here are some ways that workers can introduce contamination.

- Feces (poop) can contaminate produce directly if workers defecate (poop) in the field or if there is a leak in the sewage system.
- Workers' hands can also **cross-contaminate** produce if they do not wash their hands after using the toilet or returning from a break (e.g., after eating or smoking) and then handling produce.
- Another example of indirect contamination can occur when workers' clothing is contaminated for example, by animal feces, that can be transmitted to covered produce or food contact surfaces. When working with animals or handling manure, workers may need to use protective outer garments (e.g., aprons or coveralls) to protect their clothing from contamination.
- Injuries can result in blood or other bodily fluids contaminating produce, so it is also important to stress worker safety on the farm.
- Workers can contaminate tools/equipment if proper hygiene practices are not followed.



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## 6

- Fresh fruits and vegetables often do not receive a “kill step” such as processing or cooking before being consumed. Pathogens that contaminate produce can cause food-borne illness if they are consumed.
- Workers are a critical part of any Farm Food Safety Plan because they are responsible for using food safety practices every day while they work.
- Food safety practices are learned, so training is key to successful implementation.



### Importance of Training Workers

- Fresh fruits and vegetables often receive no additional processing (such as cooking), so contamination with a pathogen can result in illness when the produce is consumed
- Workers need to use food safety practices every day to reduce produce safety risks
- Food safety practices are learned so training is key to successful implementation



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## 7

- Training can present challenges when implementing the farm’s food safety plan.
- Time is money, so taking time to train workers means an investment in food safety. Making time for training may mean training right when workers are hired or committing time each week to remind workers about key food safety issues.
- Any training should be provided in the workers’ native languages; this includes any written materials provided during the training.
- Keep in mind that some workers may not be able to read, even if materials are printed in their native language. Using pictures or showing workers what they need to do may be more effective than using written materials. Most people are visual learners, so this is good for everyone attending the training.
- Some farms bring on additional labor at the height of harvest, when things are busiest on the farm. Even during these times, new workers must be trained, so it is best to plan for worker training before things get too busy.



### Potential Training Challenges

- Time for training
- Language
- Literacy level
- Training mid-season
- Variation in hygiene practices and expectations
- Misconceptions/misperceptions



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- As an example of the variability in hygiene practices, toilet paper may end up in the garbage can or on the floor next to the toilet. Some workers are from countries where the plumbing is not sufficient to allow toilet paper to be deposited into the toilet, so to avoid plumbing problems they DO NOT put toilet paper in the toilet. This highlights a hygiene practice that is different from U.S. expectations. Understand that workers may have different hygiene practices and address expectations directly in trainings so workers know what to do while working on the farm or packing areas.
- Many people, including workers, have preconceived notions about food safety. Understanding their current knowledge and beliefs can help address and dispel myths or reinforce core knowledge about why food safety policies and practices are important to follow.


## 8 Additional Information

- This slide is optional.
- Adults learn best when it is clear why the information and practices are needed. For this reason, it is important to explain how practices reduce risks and how these practices are relevant to each worker's job in order to complete them correctly.
- For the training to be effective it should:
  - Include reasons why food safety is relevant to workers and their jobs
  - Outline clear expectations and detail practices that reduce risks
  - Be presented through a variety of learning media and methods (through posters, verbal training, etc.)
  - Provide an opportunity for participants to practice skills they are expected to use
  - Include interactive and visual learning opportunities, such as walking through the steps of a specific task or showing a short video
- Incorporating principles of adult education will make the training more effective.



### Principles of Adult Learning

- Adults need to understand why food safety practices are important and needed
- Training should:
  - Be relevant to their jobs and daily tasks
  - Outline clear expectations
  - Detail practices that reduce risks
- Effective training materials:
  - Are presented through a variety of methods with practical examples and an opportunity to practice skills
  - Include interactive and visual learning opportunities



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## 9


- Good communication is a two-way street, meaning everyone has a responsibility to share what they know and listen when others have information to share.
- Since workers handle fresh produce and are working in the fields and packing areas daily, they are a valuable part of the food safety team since they can identify risks IF they understand what risks they might see.
- Workers should understand that communicating food safety risks is a critical part of doing their jobs and reducing or eliminating a potential problem.
- Workers should also be comfortable talking to their supervisor or manager and know that their concerns will be taken seriously. If workers report a problem and it is not addressed, they may be less likely to report problems in the future.



### Communication

- Good communication supports food safety by improving risk identification and reduction
- Trained workers know:
  - How to identify food safety risks
  - How to reduce risks they find
  - Who to tell if they see a food safety risk they cannot minimize or eliminate
  - That their food safety concerns will be taken seriously






9



## 10


- All workers that handle or contact covered produce or supervise covered activities must be trained (§ 112.22(a)). However, everyone who works on the farm should understand the company's food safety policies.
- Paid workers, volunteers, interns, pesticide applicators, and even family members can impact the safety of fresh produce. Anyone on the farm who does not wash their hands properly can contaminate produce or **food contact surfaces** through direct contact, or spread contamination indirectly to others by touching door knobs or other non-food contact surfaces.



### Everyone Needs Training

- Implementing food safety practices is a company wide task
  - Managers, farm workers, office staff, volunteers, interns, family members
- Everyone needs to know how to identify and reduce food safety risks
  - Practices they are responsible for doing
  - How to report food safety risks they see
- Owners, managers, and supervisors should set a good example and follow company policies



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- Training all members of the farm on food safety helps each employee know their responsibilities and helps identify potential risks that someone else may not see. Remember, everyone should be actively involved in identifying and reducing risks.
- Most importantly, owners, managers, and supervisors need to be committed to food safety AND set a good example for workers and visitors to ensure that their policies are followed.
- In addition to the training requirements for supervisors of those that handle covered produce during covered activities, § 112.22(c) requires that at least one supervisor from the farm complete food safety training at least equivalent to the standardized curriculum recognized by the FDA. This curriculum satisfies that requirement.

## 11

- Visitors to the farm must be made aware of food safety policies set by the farm and visitors must have access to toilet and handwashing facilities (§ 112.33).
- Policies can be reviewed with visitors through the use of posters, handouts, short policy summaries, or verbally when they enter the farm.
- Key items to review with volunteers and visitors are:
  - Understand what parts of the farm and packing areas they can enter
  - Understand they should not visit the farm if they are sick or have symptoms of illness
  - Understand why, when, where, and how to wash their hands
  - To keep their pets at home (This is not just a food safety risk, but a liability issue as well)
- Examples of visitors include pick-your-own customers, agricultural tour groups, or school groups. § 112.3(c) defines a **visitor** as any person (other than personnel) who enters the farm with permission.
- § 112.33(a) requires that growers must make visitors aware of policies and procedures to protect covered produce and food contact surfaces from contamination by people and take all steps reasonably necessary to ensure that visitors comply with such policies and procedures and (b) make toilet and handwashing facilities accessible to visitors.



### Visitors



- **Growers must:**
  - Make visitors aware of the farm's food safety policies
  - Provide access to toilet and handwashing facilities
- **Other key information for visitors should include:**
  - Areas of the farm they are allowed to visit
  - The importance of not visiting the farm when ill
  - How to wash their hands
  - Instructions to keep pets at home

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## 12

- § 112.22(a) requires that all personnel who handle covered produce during covered activities or supervise the conduct of such activities must receive training that includes all of the following:
  - 1) Principles of food hygiene and food safety;
  - 2) The importance of health and personal hygiene for all personnel and visitors, including recognizing symptoms of a health condition that is reasonably likely to result in contamination of covered produce or food contact surfaces with microorganisms of public health significance; and
  - 3) The standards established by FDA in subparts C through O of this part that are applicable to the employee's job responsibilities.



### Training Programs Must Include

- Principles of food hygiene and food safety
- Recognizing symptoms of foodborne illness and the importance of personal hygiene for all personnel and visitors
- Other training relevant to the worker's job



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## 13

A successful program will have these attributes:

- Training is required upon hiring, regardless of when they arrive on the farm, and then at least once annually after hiring. Training must be appropriate for the job. Everyone working on the farm receives some instruction on how to accomplish their new job. This introductory training should include basic food safety concepts that are likely to apply to the job. Concepts to include in a training program will be discussed in the next few slides.
- Training must be conducted in a way that is easily understood by employees. Training in the employees' native language, using visual aids, using demonstrations, and providing a variety of other educational materials are good ways to accomplish this.



### Training Programs Must

- Be appropriate for the job and conducted upon hiring
- Include refresher training throughout the season (at least annually) or when a problem arises
- Be easily understood
- Be supervised by a qualified person
- Include a process for documenting the training

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- Training must be supervised by a qualified person.
- Training must be documented and documentation must include the names of those trained, the date they were trained, and the topics covered.
- **Standard Operating Procedures** (SOPs) should be developed to provide clear step-by-step instructions for how workers should complete practices they need to do.
- § 112.21(a) requires workers to be trained as appropriate to the person's duties, upon hiring and periodically thereafter, at least once annually.
- § 112.21(c) requires that training must be conducted in a manner that is easily understood by personnel being trained.
- § 112.21(d) requires that training must be repeated as necessary and appropriate in light of observations or information indicating that personnel are not meeting standards established by FDA in subparts C through O of this part.
- § 112.23 requires that an individual be identified to supervise operations to ensure compliance with the rule requirements.
- § 112.30(b) requires that records be established and kept to document the names of those who were trained, the date they were trained, and the topics that were covered.

## 14


- The level of education, training, and experience necessary for supervisors and workers will vary depending on the job. A supervisor of a field operation needs a different set of knowledge and skills compared to an employee who is packing boxes. Since many farm workers will not have formal education, providing training is particularly important.
- While on the job training and experience at farming gives employees certain skills necessary to perform their jobs, it does not necessarily convey information about food safety.
- Some members of the crew will need specific training focused on food safety.



### Worker Qualifications

Workers and supervisors must be qualified to conduct their job duties through:

- Education
- Training
- Experience



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- § 112.21(b) All personnel (including temporary, part time, seasonal, and contracted personnel) who handle covered produce or food contact surfaces, or who are engaged in the supervision thereof, must have a combination of education, training, and experience necessary to perform the person's assigned duties in a manner that ensures compliance with this part.

## 15

- § 112.22(b) requires that persons who conduct harvest activities for covered produce must also receive training that includes all of the following (1) Recognizing covered produce that must not be harvested, including covered produce that may be contaminated with known or reasonably foreseeable hazards; (2) Inspecting harvest containers and equipment to ensure that they are functioning properly, clean, and maintained so as not to become a source of contamination of covered produce with known or reasonably foreseeable hazards; and (3) Correcting problems with harvest containers or equipment, or reporting such problems to the supervisor (or other responsible party), as appropriate to the person's job responsibilities.
- Additionally, workers must take measures to identify and not harvest any produce that is reasonably likely to be contaminated, including produce that is visually contaminated with animal feces or has dropped to the ground\* (§ 112.112 and § 112.114).
- **\*Dropped covered produce** is covered produce that drops to the ground before harvest. Dropped covered produce does not include root crops that grow underground (such as carrots), crops that grow on the ground (such as cantaloupe), or produce that is intentionally dropped to the ground as part of harvesting (such as almonds) (§ 112.114).
- Growers should be aware that there may be other, unique challenges on the farm that require specialized training in addition to the regulatory requirements.



### Training Workers to Identify and Reduce Risks at Harvest

- Evaluate contamination risks before and during harvest such as significant animal activity, presence of fecal matter, damaged crops, or extensive animal tracks
- Never harvest produce destined for the fresh market that is visibly contaminated with feces
- Never harvest dropped produce
- Only use clean harvest and packing containers

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## 16 Additional Information

- This slide is optional.
- Food safety is not just for a day, but should be implemented every day!
- Signs and reminders can help workers remember to implement food safety practices every day, especially if they are placed in high traffic areas or strategic locations where workers are present (restrooms, break areas, packing areas).
- Review sessions can be conducted on a schedule (daily/weekly) before workers begin work. This might involve a quick review of a flip-book, poster, or just a reminder of a few practices that workers should follow. Covering different topics and using diverse materials will help keep workers attention during training.



### Reinforcing Food Safety Training

- Post signs and reminders
  - Place signs where they will be most effective
  - Pictures are often better than words
  - Use appropriate language
- Conduct review and refresher training sessions throughout the season or when a problem arises
- Mix it up to keep information relevant and interesting to workers



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## 17

- As a farm owner and manager, it is important to realize the need to provide the following resources for workers. If toilets, toilet paper, water, soap, and paper towels are not provided, workers will not be able to properly use the toilet, wash their hands, and follow farm food safety policies. It is also important to provide garbage cans, first aid kits and areas where workers can take a break without introducing contamination to fresh produce.
- Keep in mind, on small farms, these facilities can be located inside the home or office as long as the same resources are provided.
- Reusable towels are not allowed because of the risk of transferring pathogens from one person to another. Single-use paper towels are one acceptable option for workers to use to dry their hands.



### Resources Provided to Support Food Safety Practices

- Toilets
- Toilet paper
- Soap
- Clean water
- Paper towels
- Container to catch wastewater
- Garbage cans
- First Aid Kit
- Break Areas



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- § 112.129(a) requires that toilets must be provided for workers and readily accessible in growing areas during harvest activities, (b) that toilet facilities must be designed, located, and maintained to: (1) Prevent contamination of covered produce, food-contact surfaces, areas used for a covered activity, water sources, and water distribution systems with human waste; (2) Be directly accessible for servicing, be serviced and cleaned at a frequency sufficient to ensure suitability of use, and be kept supplied with toilet paper; and (3) Provide for the sanitary disposal of waste and toilet paper.
- § 112.130(b) requires handwashing facilities have soap, running water, and adequate drying devices to dry hands (such as single service towels, sanitary towel service, or electric hand dryers), (c) requires that appropriate disposal of waste must be provided for dirty towels and wastewater.

## 18

- OSHA requires one toilet and one handwashing facility per every 20 workers within a ¼ mile of the working area. If the workers have access to a vehicle and can drive 5 minutes to reach a bathroom at another location, this can also work. Be sure to check state and local regulations regarding resources that must be provided for workers in addition to OSHA policies.
- § 112.129(b)(2) requires toilet facilities must be designed, located, and maintained to be directly accessible for servicing, be serviced and cleaned at a frequency sufficient to ensure suitability of use, and be kept supplied with toilet paper.
- Monitoring on a regular schedule can help ensure requirements are met and facilities are in proper working order. Recordkeeping logs can assist in maintaining an adequate frequency for these activities.
- If a company is contracted to provide these services, have them fill out the records.
- Schedules may need to be adjusted during the season for cleaning and restocking facilities as more or less workers are present.



### Toilet & Handwashing Facilities

- Provide a sufficient number of toilets and sinks to meet worker and visitors' needs
  - OSHA requires one facility per 20 workers within ¼ mile of the working area
- Facilities must be fully serviced on a regular schedule
- Toilet and handwashing facilities must be well stocked
- Facilities should be monitored every day when in use

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### Additional Resource:

- OSHA Regulation for Field Sanitation:  
[https://osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10959](https://osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10959)



## 19

- In order for workers to do their job and stay healthy, potable (drinking) water should be provided. This can help reduce the risk of dehydration and heat exhaustion.
- OSHA requires that "Potable water shall be provided and placed in locations readily accessible to all employees."
- Single use cups should be provided so that workers are not sharing cups.
- If workers are allowed to bring their own water containers, make sure they are plastic (not glass) and that they know where they can refill their containers.
- Check local and state regulations regarding worker health and safety. Some states allow "hydration" fluids such as Gatorade™ or have specific requirements for sending workers home if it is too hot outside.
- § 112.32(b)(6) requires not eating, chewing gum, or using tobacco products in an area used for a covered activity (however, drinking beverages is permitted in designated areas).



### Drinking Water & Break Areas

- Workers should be provided with drinking water to reduce the risks of heat exhaustion
- Break areas do not need to be a separate building but must be in a designated area
- Healthy workers are better able to do their jobs and implement food safety practices!

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## 20

- The FSMA Produce Safety Rule has specific requirements for training and for practices that workers must follow.
- It is important that growers understand what they are required to include in training programs and the resources they need to provide so that workers can effectively follow their training programs.
- It is equally critical that growers understand what practices workers are expected to use while they are working with covered produce.



### Training versus Practices


- The Produce Safety Rule includes requirements for
  - Training programs and resources that must be provided for workers and visitors
  - Practices workers must follow
- We just finished the training and resource slides
  - Do you remember what was required?
  - As a reminder, rule requirements are in the notes!
- Now we will cover practices workers must do to reduce microbial risks to fresh produce

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## 21

- § 112.32 lists required practices that must be followed by workers, including:
  - Maintaining adequate personal cleanliness to protect against contamination of covered produce and food contact surfaces
  - Avoiding contact with animals, other than working animals, and taking appropriate steps to minimize the likelihood of contamination of covered produce when in direct contact with working animals
- Washing hands, discussed on the slide *When Must Hands Be Washed?*
- Maintaining gloves in intact and sanitary condition
- Removing or covering hand jewelry that cannot be adequately cleaned and sanitized during periods in which covered produce is handled
- Not eating, chewing gum, or using tobacco products in an area used for a covered activity



### Workers Must

- Maintain personal cleanliness
- Avoid contact with animals (other than working animals)
- Maintain gloves in a sanitary condition, if used
- Remove or cover hand jewelry that cannot be cleaned
- Not eat, chew gum, or use tobacco in an area used for a covered activity
- Notify their supervisor if they are ill
- Wash their hands



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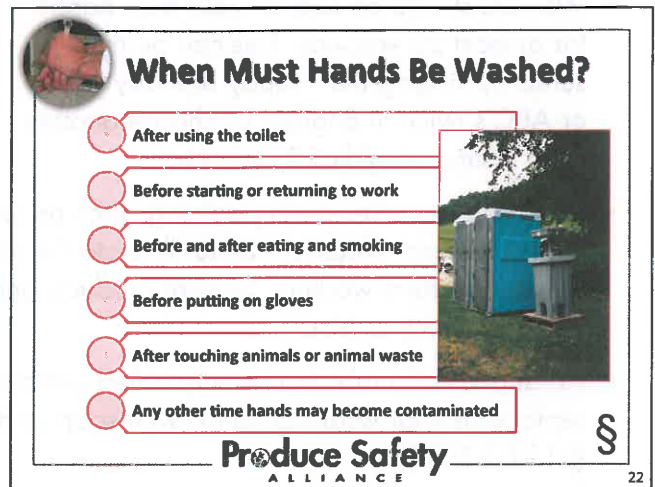
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- Other important subjects to include in a training program are:
  - What to do if they become ill or experience an injury while working, how to locate the first aid kit, how to handle cuts or injuries, and how to report an injury/illness
  - Specific food safety policies and practices that apply to their daily tasks
  - Who to tell if they see a food safety risk and that their managers will take this seriously
  - Consider positive reinforcement for reporting a food safety risk or following safe procedures. For example, farm hats for those who set good examples and follow outlined procedures.

## 22

- Washing hands after using the toilet is most important; however, it is not the only time that hands must be washed.
- § 112.32(b) requires that workers wash hands thoroughly scrubbing with soap (or other surfactant) and running water (must satisfy water quality requirements in § 112.44(a)), dry hands thoroughly using single service towels, sanitary towel service, electric hand dryers, or other adequate hand drying devices:
  - i) Before starting work
  - ii) Before putting on gloves
  - iii) After using the toilet
  - iv) Upon return to the work station after breaks or other absence
  - v) As soon as practical after touching animals or animal waste
  - vi) At any other time workers hands may have become contaminated



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## 23

- Proper handwashing steps included in worker training should also be reviewed with all visitors. It is surprising how many people DO NOT wash their hands properly. Just wetting hands without adding soap and lathering can actually make the problem worse and allow the spread of contamination.
- Workers should be told to wash their hands for at least 20 seconds. This can be measured by singing the 'Happy Birthday' song or ABC's twice in English, or choose another song lasting roughly 20 seconds.
- Hands-on exercises during training, such as using Glo Germ™ (<http://www.glogerm.com/>), are a very fun and effective way to illustrate the importance of handwashing to growers, farm managers, and farm workers. Several products and demonstrations are available to use as tools to illustrate effective practices.
- Antiseptic hand rubs (commonly called antibacterial hand sanitizers) CANNOT be used as a replacement for washing hands with soap and water. This is a requirement outlined in § 112.130(d).
- Sanitizers cannot work effectively if hands have dirt on them, which is common on farms. These products can be used in addition to handwashing, but never as a replacement for handwashing with soap and water.
- The temperature of the water is not as critical as the use of soap and vigorously rubbing hands. Warm water is more comfortable for workers, but cold water works too.
- **Note:** During the next break, participants may be challenged to wash their hands using the method described above. Did 20 seconds seem like an eternity? It is important to recognize proper handwashing is not always as simple as it might seem!



### Proper Handwashing

1. **Wet hands with water**
2. **Apply soap and lather.** Be sure to wash the front and backs of hands as well as in between the fingers. Rub hands together for AT LEAST 20 seconds
3. **Rinse hands thoroughly with clean water**
4. **Dry with a paper towel** (turn off faucet with used towel)
5. **Throw the paper towel in a trash can**

\*Antibacterial hand sanitizers CANNOT replace handwashing\*

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## 24

- This may seem obvious, but not using the toilets properly is a major food safety risk and happens more often than imagined.
- Urinating (peeing) and defecating (pooping) should be done in the toilet, NEVER in the field.
- Personnel must be provided with adequate, readily accessible toilet facilities (§ 112.129(a)) and a handwashing station must be in sufficiently close proximity to toilet facilities (§ 112.129(c)).
- Facilities should be clean, well-stocked, and close to where people are working (¼ mile or 5 minute walk) to encourage their use. No one likes to use a dirty toilet or give up precious work time to do the right thing.
- Some farms using portable toilets prefer to rent or buy portable facilities where the sink is located on the outside of the structure. This facilitates easier monitoring that farm workers are washing their hands after using the toilet.
- Certain practices may create greater risks of contamination, such as toilet paper being placed in a garbage can or on the floor next to the toilet. This may require additional training if a grower finds this type of problem on their farm.
- Toilet facilities should be monitored daily to ensure they are well-stocked, clean, and working properly.
- Workers should be instructed to tell their supervisors if there is a problem so that it can be fixed.



### Proper Use of Toilets

- All urination and defecation should be done in a toilet, NEVER in the field or nearby production areas
- Toilet paper should be deposited into the toilet, not in a garbage can or on the floor
- Always wash hands after using the toilet



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## 25

- Worker clothing and equipment is important because dirty clothes, shoes, and gloves can lead to cross-contamination of produce.
- Footwear: Have boots designated for activities that involve animals such as mucking stalls or feeding animals. Do not wear dirty boots (especially those covered in manure or other contaminants) in produce fields or packing areas.
- Gloves are not required, but if they are used, they must be changed frequently or cleaned as needed. Gloves are not a substitute for proper handwashing. § 112.32(b)(4) requires that if you choose to use gloves in handling covered produce or food contact surfaces, maintain gloves in an intact and sanitary condition and replace such gloves when no longer able to do so.
- If gloves are reusable, they should be cleaned as often as necessary so that they do not become a source of contamination.
- Aprons or other food safety equipment should be properly stored when not in use, cleaned on a regular basis, and removed prior to using toilet facilities.
- Jewelry worn by workers may present a physical food safety hazard as well as a worker safety risk. Jewelry can become stuck in processing equipment or farm tools which presents a serious safety risk to workers.
- Jewelry that cannot be adequately cleaned and sanitized before handling produce must be removed or covered to prevent contamination of produce (§ 112.32(b)(5)).



### Worker Clothing



- Clean clothes should be worn each day
- Footwear cleanliness is important
  - Designated footwear helps prevent cross-contamination
- Gloves, if worn, must be changed when they become contaminated or torn
  - If reusable gloves are used, clean often or as needed
- Aprons, gloves, and other food safety equipment should be removed before using the toilet and should be stored in a clean, designated area when not in use

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## 26

- Human pathogens can be easily transferred from sick workers, either through their hands, or from feces, vomit, or other bodily fluids.
- Workers may be embarrassed to report an illness and may not want to be sent home for the day which is why a **policy** needs to be in place.
- It is recommended that ill employees should not come to work if there is a risk of contaminating produce or food contact surfaces.
- Managers should be trained to recognize when workers are ill, such as frequent trips to the toilet, so they can intervene if necessary.
- Heat stress and other non-communicable conditions may also cause vomiting. Workers should be provided adequate water and take precautions to protect themselves from extreme temperatures.
- Growers may choose to reassign workers to jobs that do not involve handling produce or food contact surfaces to limit the chance that produce becomes contaminated, while still allowing workers to stay on the job.
- § 112.31(a) requires that growers must take measures to prevent contamination of covered produce and food contact surfaces with microorganisms of public health significance from any person with an applicable health condition (such as **communicable** illnesses that present a public health risk in the context of normal work duties, infection, open lesion, vomiting, or diarrhea).
- § 112.31(b) requires (1) Excluding any person from working in any operations that may result in contamination of covered produce or food contact surfaces with microorganisms of public health significance when the person (by medical examination, the person's acknowledgement, or observation) is shown to have, or appears to have, an applicable health condition, until the person's health condition no longer presents a risk to public health; and (2) Instructing personnel to notify their supervisor(s) (or a responsible party) if they have, or if there is a reasonable possibility that they have an applicable health condition.



### Worker Illness

- Workers who are sick or show signs of illness can contaminate fresh produce
- Ill workers must not handle fresh produce
- Symptoms of illness can include:
  - Nausea
  - Vomiting
  - Diarrhea
  - Fever
  - Jaundice



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## 27

- Make sure the injured worker receives medical attention and if necessary, call 911.
- Worker injuries represent a food safety risk because blood and other bodily fluids can contaminate produce, fields, and food contact surfaces.
- First aid kits are food safety resources that should be provided for workers.
- The first aid kit should be available in a convenient location, whether this be in a truck that goes out to the field with workers, in the packing area, or in the main office. Depending on how many workers are present on the farm, more than one kit may be necessary. All first aid kits should be inspected at least monthly (or more frequently, if needed) to make sure all supplies are stocked.
- Any minor wounds should be bandaged. If the wounds are on the hands, they should be bandaged and a glove or 'fingerbob' worn over top as a secondary barrier to protect both the worker (i.e., prevent infection) and the produce (i.e., prevent contamination).
- Workers should be instructed to tell their supervisor about all injuries.
- If blood or bodily fluids are present on fresh produce or food contact areas, be sure to properly clean and sanitize the area and dispose of any contaminated product.



### Worker Injury

- **Worker injuries may pose food safety risks**
  - A first aid kit should be available, stocked, and monitored
  - Clean and bandage all wounds
    - If the wound is on the hands, a glove should be worn to create a double barrier
  - Discard any produce that may be contaminated
  - Clean and sanitize any items that came in contact with bodily fluids
  - Report all injuries to supervisor



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## 28

- **Monitoring** worker health and hygiene practices and sanitary facilities is critical to knowing if the food safety plan is working to reduce risks.
- Developing a monitoring program may include designating individuals to check specific areas of the farm, such as checking to make sure the bathrooms are clean and well stocked, or observing employee behavior.
- Recordkeeping is critical to monitoring since it allows actions to be documented to make sure they were done properly and on time.



### Monitoring

- **Develop a monitoring process to ensure:**
  - Workers are following food safety practices and farm policies every day
  - Facilities are available, clean, and well stocked every day
- **This can include:**
  - Training supervisors to observe employee behavior
  - Appointing someone to check facilities each day
  - Using monitoring logs




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## 29

- Corrective actions should be considered if monitoring identifies a problem, if food safety policies are not being followed, or if there is an evident food safety risk.
- This slide addresses some things that may happen related to worker health, hygiene, and training, but there may be other things that come to mind that should be addressed.
- If workers do not follow food safety policies, they need to be aware that it is not acceptable behavior. The Farm Food Safety Plan can designate actions that result from workers not following company policies, such as being sent home if they are observed not washing their hands. This would be considered negative reinforcement. Alternatively, workers can be rewarded for good behaviors so that they will continue to do them. This is known as positive reinforcement and can be something as simple as verbally acknowledging proper behavior or by rewarding workers with some sort of recognition, such as a candy bar or monetary bonus.



### Corrective Actions

- Workers are not following food safety policies
  - Develop rewards to encourage positive practices
  - Implement deterrents for poor practices
- Facilities are not cleaned, restocked or are broken
  - Sanitation company contact on speed dial
  - Retraining workers or improving monitoring process
- Facilities leak in the field or packinghouse
  - Emergency plan for spills



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- Having an emergency plan for spills (such as for portable toilets) is also a good example of having corrective actions in place IF an event should occur. Although it is unlikely, the time to worry about human feces flowing into fields or the packing area is not AFTER it has happened, so have a plan so workers know who to call and what to do in case of an emergency.


## 30

- When it comes to recordkeeping for worker health, hygiene and training, there are a few things that must be documented. § 112.30(a) and § 112.30(b) require that records be kept according to the requirements in Subpart O and include the date of training, topics covered, and individual(s) trained.
- Also important to consider are records that document:
  - Facility monitoring, including cleaning and stocking toilet and handwashing facilities as well as maintaining first aid kits
  - Worker illness and injury reporting
- Remember, there are lots of templates available. Do not make recordkeeping more difficult than it has to be. Keep recordkeeping logs with pens attached in an easy to reach place, near where monitoring activities occur.
- All records should have:
  - Name of log/task
  - Date and time the task was completed
  - Name of person completing the task
  - What task was done
  - Any materials relevant to the task
  - Space for a signature of the person responsible for the food safety plan
- Subpart O contains all of the general requirements related to records, including § 112.161(a) that requires, except as otherwise specified, all records required under this part must:



### Recordkeeping

- Document actions taken to support worker health, hygiene, and training on the farm such as:
  - Worker training programs
  - Monitoring and restocking of toilet and handwashing facilities
  - Illness and injury reporting
  - Restocking of first aid kits



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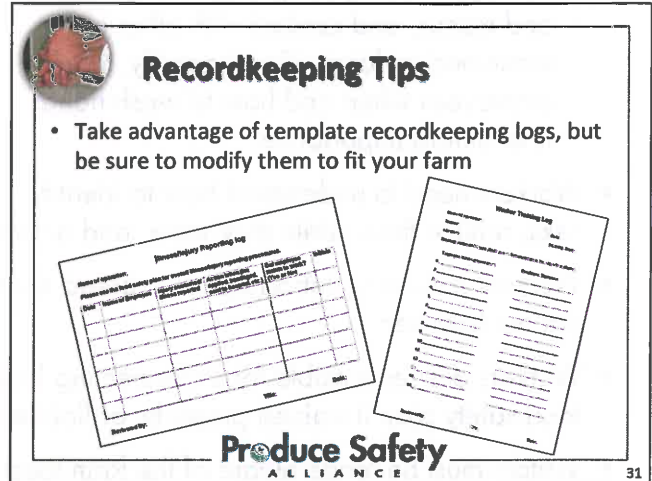
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1. Include, as applicable: (i) The name and location of your farm; (ii) Actual values and observations obtained during monitoring; (iii) An adequate description (such as the commodity name, or the specific variety or brand name of a commodity, and, when available, any lot number or other identifier) of covered produce applicable to the record; (iv) The location of a growing area (for example, a specific field) or other area (for example, a specific packing shed) applicable to the record; and (v) The date and time of the activity documented;
2. Be created at the time an activity is performed or observed.

### 31 Additional Information

- This slide is optional.
- Recordkeeping templates are available.
- Be sure to tailor them to the farm and specific tasks.



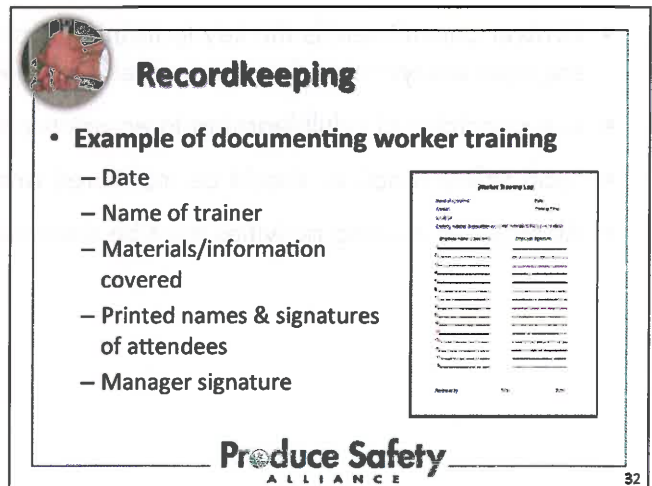
**Recordkeeping Tips**

- Take advantage of template recordkeeping logs, but be sure to modify them to fit your farm

The slide displays two sample recordkeeping forms: a 'Personnel Reporting Log' and a 'Worker Training Log'. Both forms include fields for date, time, location, and specific details of the activity. The 'Produce Safety Alliance' logo is visible at the bottom.

### 32 Additional Information

- This slide is optional.
- Records can be tailored to fit the specific task. Make sure records are legible and that they are reviewed before they are filed to make sure they are filled out correctly.
- Since this slide provides an example of a worker training document, it might be valuable to highlight that § 112.30(b) requires a grower to establish and keep records of training that document required training of personnel, including the date of training, topics covered, and the persons(s) trained.



**Recordkeeping**

- Example of documenting worker training**
  - Date
  - Name of trainer
  - Materials/information covered
  - Printed names & signatures of attendees
  - Manager signature

The slide shows a 'Worker Training Log' form with fields for date, time, location, and a list of attendees with checkboxes for training topics. The 'Produce Safety Alliance' logo is at the bottom.

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## 33

- Worker health and hygiene is critical because:
  - Pathogens can be spread by a worker or visitor that does not wash their hands after using the toilet.
  - Pathogens can also spread through saliva and mucus, and contact with other contaminated surfaces. Consequently, training employees when and how to wash hands is of utmost importance.
- Workers need to understand how to identify risks, reduce them while they work, and actively participate in the farm food safety team.
- Workers can carry, introduce and spread contamination to fresh produce if food safety policies are not followed.
- Workers are responsible for implementing food safety practices. Workers can be assets to the food safety plan if trained properly, or liabilities if not trained.
- Visitors must be made aware of the farm food safety policies and know where to find the toilets and sinks.
- Grower commitment is the key to training success! Supporting effective food safety training engages everyone on the farm in the food safety program.
- Use principles of adult learning to ensure training is effective.
- Food safety practices should be monitored and when necessary, corrective actions applied.
- All required training activities must be documented.



### Summary

- Worker health and hygiene is critical to food safety because workers can introduce food safety risks
- Everyone should be trained but anyone who handles covered produce must be trained
- Visitors must be made aware of policies too
- Training should emphasize health and hygiene practices that reduce risks
- A written training program should be developed, implemented, and documented

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# Produce Safety ALLIANCE

## Soil Amendments



3) Soil Amendments



Cornell University



## **Learning Objectives**

### **Module 3: Soil Amendments**

#### **Objective 1:**

Identify risks and potential routes of contamination that could be associated with different types of soil amendments.

#### **Objective 2:**

Explain soil amendment handling practices that can help reduce food safety risks to produce.

#### **Objective 3:**

Identify key strategies such as time/temperature management of compost and soil amendment application to harvest intervals that will reduce the risk of human pathogens contaminating produce.

#### **Objective 4:**

Describe what corrective actions may be utilized if a soil amendment has been found to present an immediate contamination risk to the crop due to improper handling, application, composting, or storage.

#### **Objective 5:**

Identify records that should be kept to monitor and manage the source, quality, handling practices, and proper use of soil amendments to reduce the risk of contaminating fresh produce.

#### **Critical Concepts**

- Understand and assess produce safety risks posed by soil amendments
- Highlight the risks associated with different types of soil amendments including non-manure based and chemical amendments, biosolids, and pre-consumer vegetative wastes
- The value of manure in soil fertility and farm systems
- GAPs to reduce risks associated with soil amendments
- The value of composting and other treatment practices in reducing risks
- Key considerations for application of soil amendments and harvest intervals
- Prevention of leaching, runoff, and wind drift through proper storage
- Methods to reduce cross-contamination in storage areas and on equipment and tools
- Worker training considerations when handling soil amendments
- The importance of monitoring, recordkeeping, and corrective actions

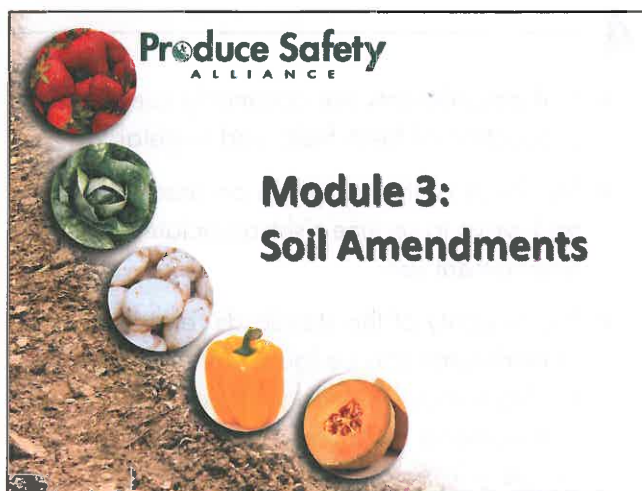




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### 3




#### Learning Objectives

- Identify potential routes of contamination associated with soil amendments
- Explain soil amendment handling practices that may reduce risks
- Identify key strategies such as composting or application intervals to reduce risks
- Describe corrective actions that may be utilized if a soil amendment presents a risk
- Identify recordkeeping tools for monitoring and managing soil amendment handling, application, and proper use

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### 4

- Soil amendments are commonly used in the production of fresh fruits and vegetables.
- The focus of this section is on assessing risk and ways to reduce risks associated with soil amendment use.
- The majority of the standards related to soil amendments can be found within Subpart F—Standards Directed to Biological Soil Amendments of Animal Origin and Human Waste § 112.51(a)–§ 112.60(b).



#### What Is A Soil Amendment?

- Soil amendments are any chemical, biological, or physical materials intentionally added to the soil to improve and support plant growth and development
- May reduce soil erosion and sediment runoff
- Many different types of soil amendments are available
- Soil amendments can present produce safety risks
- Assessing risks and implementing GAPs can reduce risks



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In this module, the term 'soil amendments' is used for brevity, however, there are multiple definitions outlined in the FSMA Produce Safety Rule that are included below in the notes. They will be discussed later in this module.

- **Soil amendment** means any chemical, biological, or physical material (such as elemental fertilizers, stabilized compost, manure, non-fecal animal byproducts, peat moss, perlite, pre-consumer vegetative waste, sewage sludge biosolids, table waste, agricultural tea and yard trimmings) intentionally added to the soil to improve the chemical or physical condition of soil in relation to plant growth or to improve the capacity of the soil to hold water. The term soil amendment also includes growth media that serve as the entire substrate during the growth of covered produce (such as mushrooms and some sprouts) (§ 112.3(c)).

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- **Biological soil amendment** means any soil amendment containing biological materials such as stabilized compost, **manure**, **non-fecal animal byproducts**, peat moss, **pre-consumer vegetative waste**, **sewage sludge biosolids**, **table waste**, **agricultural tea**, or **yard trimmings**, alone or in combination (§ 112.3(c)).
- **Biological soil amendment of animal origin** means a biological soil amendment which consists, in whole or in part, of materials of animal origin, such as manure or non-fecal animal byproducts including animal mortalities, or table waste, alone or in combination. The term 'biological soil amendment of animal origin' does not include any form of human waste (§ 112.3(c)).

## 5


- It is important to consider the types of soil amendments being used on the **farm** (if any) and understand the risks they may pose to **produce**.
- In general, the biggest risk is from soil amendments that contain **manure** or other biological components of animal origin that have not been treated to reduce microbial risks.
- Biological soil amendments may contain biological components of animal origin that are not manure-based (e.g., blood meal, bone meal). Risks associated with these types of amendments will be discussed later in the module.
- § 112.51(a) defines a treated soil amendment as having been processed to completion to reduce **microorganisms** of concern in accordance with §§ 112.54(a) and (b) (which references § 112.55 microbial criteria), or in the case of **agricultural tea**, the biological materials used to make the tea have been processed and the water has no detectable generic *E. coli*/100 mL water.
- § 112.51(b) defines a biological soil amendment of animal origin as untreated if it:
  - 1) Has not been processed to completion in accordance with § 112.54, or in the case of agricultural tea, the biological materials used to make the tea have not been so processed or the water used to make the tea is untreated surface water, or the water used to make the tea has detectable generic *E. coli* in 100 mL of water



### Soil Amendments & Food Safety Risks



- Biological soil amendments, especially those that include untreated (raw) manure, pose significant microbial risks
- Synthetic (chemical) soil amendments can also impact food safety, if not prepared and applied properly
- Risks should be assessed when selecting and applying all soil amendments on produce fields



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## 4—Soil Amendments

- 2) Has become contaminated after treatment
  - 3) Has been recombined with an untreated biological soil amendment of animal origin
  - 4) Is or contains a component of untreated waste that you know or have reason to believe is contaminated with a hazard or has been associated with foodborne illness
  - 5) Is an agricultural tea that contains an **agricultural tea additive**
- Agricultural tea additive means a nutrient source (such as molasses, yeast extract, or algal powder) added to agricultural tea to increase microbial biomass (§ 112.3(c)).
  - Chemical and synthetic soil amendments can also impact food safety, if not prepared and applied properly. The Environmental Protection Agency and Federal Insecticide, Fungicide, and Rodenticide Act regulates the use of chemical and synthetic soil amendments. The preparation of chemical and synthetic soil amendments is also an important factor in mitigating risk.

## 6


- Types of soil amendments include raw manure, composted manure, chemical, green waste, and biosolids.
- Soil amendment management can reduce food safety risks. This includes assessing risks from the soil amendment being used, selecting low risk crops for application (e.g., agronomic), and reviewing the application method (incorporated, injected, or surface applied) and timing (days to harvest; season of application) to reduce risks.
- For example, if soil amendments are applied to agronomic crops, there is lower risk of direct produce contamination.
- Excessive use of soil amendments can be a problem (i.e., when used as a 'disposal' mechanism or when applied beyond crop nutrient demand) and this may affect the safety of **agricultural water** sources or lead to runoff into produce fields.
- The rule has requirements for application method and application to harvest interval that will be discussed later in the module.
- Each of the bullets highlighted in this slide will be discussed in greater detail throughout this module.



### Assessing Your Risks

- **What type of soil amendments do you use?**
  - Raw manure, composted manure, chemical, etc.
- **What crops receive soil amendments?**
  - Fresh produce or agronomic crops
- **When do you apply them?**
  - Days to harvest, time of year
- **How do you apply them?**
  - Incorporated, injected, surface applied
- **How much and how often do you apply them?**
  - Excessive application can lead to environmental impacts

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## 7

- Chemical and synthetic fertilizers usually do not present microbial risks because they either 1) do not support the growth of human **pathogens** or 2) are processed in such a way that eliminates pathogens.
- However, chemical amendments should not be considered 100% safe. Though rare, chemical amendments have been linked to outbreaks in the past (see Additional Resource).
- Chemical and synthetic fertilizers can pose **chemical** risks to humans, including food safety risks to the crop (if applied improperly) as well as health hazards to those who apply and handle the chemicals.



### Chemical Soil Amendments

- **Minimal risk of human pathogens**
  - Cannot be considered 100% safe
  - Synthetic fertilizers, minerals
- **Can pose chemical risk to humans**
  - Be sure workers are trained to apply properly and use personal protective equipment
  - Follow all application instructions
  - Proper labeling and storage



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#### Additional Resource:

- Doran, G., Sheridan, F., Delappe, N., O'Hare, C., Anderson, W., Corbett-Feeney, G., & Cormican, M. (2005). *Salmonella enterica* serovar Kedougou contamination of commercially grown mushrooms. *Diagn Microbiol Infect Dis*, 51(1), 73–76.

## 8

- § 112.53 states that you may NOT use untreated human waste, except **biosolids** used in accordance with the requirements of 40 CFR part 503, subpart D, or equivalent regulatory requirements for growing covered produce.
  - For most purposes 40 CFR part 503, subpart D, limits application for land growing covered produce to Class A biosolids.
- Untreated human waste may contain high levels of human pathogens.



### Human Waste & Biosolids

- Human waste is prohibited for use on produce crops, unless it meets the EPA regulation for biosolids (40 CFR part 503)
- Untreated human waste may contain pathogens, heavy metals, or other contaminants
- May not be accepted by produce buyers
- Management of biosolids not discussed because use is infrequent in fresh produce production

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## 6—Soil Amendments


- Biosolids may also contain high levels of heavy metals or other contaminants such as pharmaceuticals.
  - Some States regulate the metals content of soil amendments, including Class A biosolids.
- Management of biosolids is not discussed in detail in this module because its use is infrequent in fruit and vegetable production.
- If using biosolids, review the regulatory sections that apply to ensure biosolids are used properly.

### Additional Resource:

- Standards for the Use or Disposal of Sewage Sludge, Subpart D—Pathogens and Vector Attraction Reduction, 40 CFR 503 (2015).  
<http://www.ecfr.gov/cgi-bin/text-idx?SID=cb309f2da2aba12c1d4e50233633c3e1&node=sp40.30.503.d&rgn=div6>


## 9

- In § 112.3(c), **pre-consumer vegetative waste** means solid waste that is purely vegetative in origin, not considered yard trash, and derived from commercial, institutional, or agricultural operations without coming in contact with animal products, byproducts or manure or with an end user (consumer). Pre-consumer vegetative waste includes material generated by farms, packinghouses, canning operations, wholesale distribution centers and grocery stores; products that have been removed from their packaging (such as out-of-date juice, vegetables, condiments, and bread); and associated packaging that is vegetative in origin (such as paper or corn-starch based products). Pre-consumer vegetative waste does not include table waste, packaging that has come in contact with materials (such as meat) that are not vegetative in origin, or any waste generated by restaurants.
- Pre-consumer vegetative waste could contain chemical hazards such as pesticides and physical hazards such as glass.
- Table wastes (leftovers) or wastes that could be contaminated by domesticated animals (e.g., cats or dogs) feces are considered untreated biological soil amendments of animal origin.



### Pre-Consumer Vegetative Waste

- Should not be considered zero risk and may contain:
  - Chemical hazards
  - Physical hazards
  - Biological hazards
- Examples include:
  - Produce food preparation waste
  - Out of date vegetables
  - Food products removed from their packaging



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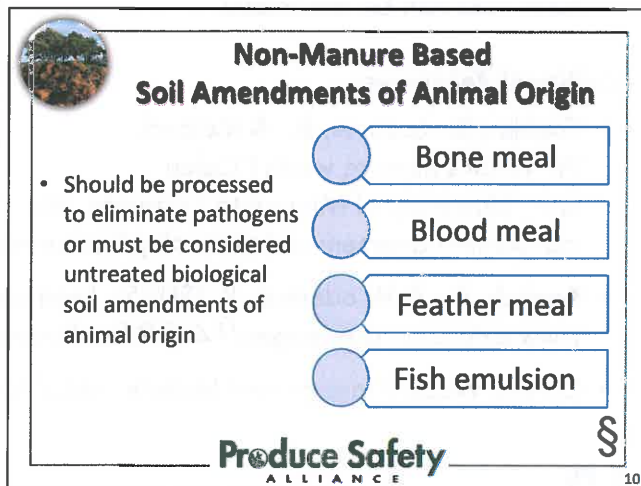
- Table wastes can also be contaminated with saliva or by contact with hands.

#### Additional Resource:

- Wilson, C.R., & Feucht, J.R. (2011). Composting Yard Waste. Colorado State University Extension. <http://extension.colostate.edu/docs/pubs/garden/07212.pdf>
- Sludge News. Branded Products Containing Sewage Sludge. <http://www.sludgenews.org/about/sludgenews.aspx?id=5>

## 10

- In the FSMA Produce Safety Rule, §§ 112.54(a) and (b) provides treatment processes which are acceptable for biological soil amendments of animal origin used in the growing of covered produce. These options will be covered in greater detail later in the module.
- All biological soil amendments of animal origin, including mortality composting, must meet the microbial standards in §§ 112.55(a) and (b) or must be considered untreated.
- The rest of this module will focus on reducing risks associated with biological soil amendments containing animal manure.



**Non-Manure Based  
Soil Amendments of Animal Origin**

- Should be processed to eliminate pathogens or must be considered untreated biological soil amendments of animal origin

- Bone meal
- Blood meal
- Feather meal
- Fish emulsion

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#### Additional Resources:

- Dunkley, C., Cunningham, D., Ritz, C., Dunkley, K., & Hinton, A. (2011). Using mortality compost in vegetable production: A comparison between summer and winter composting and its use in cabbage production. *Agric Food Anal Bacteriol*, 1, 6–14.
- Carter, J., Clark, B., Evanylo, G., Ketchum, A., Peer, B., Saunders, D., Simmerman, G., Smith, C., & Wahlberg, M. (2013). On Farm Mortality Disposal Options for Livestock Producers. Virginia Polytechnic Institute and State University - Virginia Cooperative Extension. <https://vtechworks.lib.vt.edu/bitstream/handle/10919/50693/2909-1412.pdf>

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## 11

- Manure is a valuable resource on farms. Adding manure as a soil amendment can increase soil tilth, fertility, and water holding capacity.
- There are food safety risks associated with using manure, but if managed properly, these risks can be minimized.



### Additional Resources:

- Koehler, B., Lazarus, B., & Meland, W. What's manure worth? Calculator. University of Minnesota Extension. <http://www.extension.umn.edu/agriculture/manure-management-and-air-quality/manure-application/calculator/>
- Koelsch, R., & Wiederholt, R. (2015). Environmental Benefits of Manure Application. <http://www.extension.org/pages/14879/environmental-benefits-of-manure-application#.VUJmGiFVhBc>
- Cornell Waste Management Institute. <http://cwmi.css.cornell.edu/>



### The Value of Manure

- Increases soil tilth, fertility, and water holding capacity
- Sound nutrient management and waste utilization for those with animal production or partnering with other farms who have animals
- Widely available and cost effective





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## 12

- The reason manures present food safety risks is because they can carry and spread human pathogens. Manures especially present a food safety risk to the crop if they are not applied or treated properly. Additional information is provided below, but the key is to know that raw manures represent a microbial risk.
- Different animals tend to be reservoirs for different pathogens, though all animals have the potential to shed pathogens. For example, birds (chickens) often shed *Salmonella* and *Campylobacter* and ruminants (cows, sheep) often shed toxigenic *E. coli* (EHEC/STECs).



### Pathogens in Animal Manure

- All manures can carry human pathogens
- Some animals tend to be reservoirs for certain pathogens
- Many things can affect animals shedding pathogens in their manure
  - Age
  - Rearing practices
  - Diet
  - Season
  - Environmental conditions



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- There are many factors that contribute to whether an animal will shed human pathogens in their feces including season, diet, rearing practices and age. For example, younger cattle tend to shed more toxin-producing pathogens in their manure than older animals.

### Additional Resources:

- Buchko, S.J., Holley, R.A., Olson, W.O., Gannon, V.P.J., & Veira, D.M. (2000). The effect of different grain diets on fecal shedding of *Escherichia coli* O157:H7 by steers. *J Food Prot*, 63(11), 1467–1474.
- LeJeune, J., & Kauffman, M.D. (2005). Effect of sand and sawdust bedding materials on the fecal prevalence of *Escherichia coli* O157: H7 in dairy cows. *App Environ Micro*, 71(1), 326–330.
- Doyle, M.P., & Erickson, M.C. (2006). Reducing the Carriage of Foodborne Pathogens in Live-stock and Poultry. *Poultry Science*, 85(6), 960–973.
- Langholz, J.A., & Jay-Russell, M.T. (2013). Potential role of wildlife in pathogenic contamination of fresh produce. *Hum Wildl Interact*, 7(1), 140–157.


## 13

- As a reminder, § 112.51(b) defines untreated soil amendments.
- Raw manure, aged manure (meaning no specific process, such as composting, has been followed), untreated slurry, agricultural teas from raw manure, and other raw or incompletely treated products (such as untreated bone meal and blood meal) are examples of higher risk soil amendments.
- If a treated soil amendment is mixed with raw manure or incompletely treated manure by accident (or intentionally), or if you have reason to suspect a finished compost has become contaminated, it must be handled as a raw, untreated soil amendment (§ 112.52).
- There are treatment options, such as composting or heat treatments, that will reduce food safety risks. The FSMA Produce Safety Rule standards for composting processes will be outlined in the next slides.



### Untreated Soil Amendments

- Untreated biological soil amendments of animal origin are considered high risk since they have not been treated to reduce or eliminate pathogens
- All of the following soil amendments would be considered untreated:
  - Raw manure
  - ‘Aged’ or ‘stacked’ manure
  - Untreated manure slurries
  - Untreated manure teas
  - Agricultural teas with supplemental microbial nutrients
  - Any soil amendment mixed with raw manure



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### Additional Resources:

- Jiang, X., Morgan, J., & Doyle, M.P. (2002). Fate of *Escherichia coli* O157:H7 in Manure-Amended Soil. *App Environ Micro*, 68(5), 2605–2609.
- Ingram, D., & Millner, P. (2007). Factors affecting compost tea as a potential source of *Escherichia coli* and *Salmonella* on fresh produce. *J Food Prot*, 70(4), 828–834.
- Kim, J., Shepherd, J., Marion, W., & Jiang, X. (2009). Evaluating the Effect of Environmental Factors on Pathogen Regrowth in Compost Extract. *Micro Ecology*, 58(3), 498–508.

## 14

- Implementing **Good Agricultural Practices (GAPs)** on the farm can help reduce risks associated with the use of soil amendments.
- GAPs for soil amendments could include:
  - Selecting soil amendments which have been treated (instead of using raw)
  - Extending the application to harvest interval
  - Assuring application methods do not put adjacent crops at risk (such as from wind drift on a dry day or runoff)
  - Proper storage to reduce runoff risks into produce fields (§ 112.52)
  - Handling practices to reduce cross-contamination from soil amendments to equipment and tools (§ 112.52)
  - Recordkeeping to monitor soil amendment application
  - Recordkeeping to monitor soil amendment treatment (§ 112.60)



### Reducing Soil Amendment Risks

<ul style="list-style-type: none"> <li>• Selection</li> <li>• Treatment</li> <li>• Application Timing</li> </ul>	<ul style="list-style-type: none"> <li>• Application Methods</li> <li>• Handling and Storage</li> <li>• Recordkeeping</li> </ul>
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# 15

- Composting is defined in § 112.3(c) as a process to produce stabilized compost in which organic material is decomposed by the actions of microorganisms under thermophilic conditions for a designated period of time (e.g., 3 days) at a designated temperature (e.g., 131°F (55°C)), followed by a **curing** stage under cooler conditions.
- The length of time will depend on management parameters including aeration, turning, cover, feedstock make-up, moisture levels, and many other potential variables at a designated temperature. For example, not less than 131°F (55°C) for 3 days, followed by a curing stage.
- § 112.54 provides more information on the scientific validation of composting. The next slide contains more information about this, but is an optional slide for growers using these types of amendments.
- Curing, as defined by § 112.3(c) means the final stage of composting, which is conducted after much of the readily metabolized biological material has been decomposed, at cooler temperatures than those in the thermophilic phase of composting, to further reduce pathogens, promote further decomposition of cellulose and lignin, and stabilize composition. Curing may or may not involve insulation depending on environmental conditions.
- There are many more methods of composting. Examples of thermophilic composting are provided in the FSMA Produce Safety Rule that are designed to meet § 112.55(b). Non-thermophilic methods may be acceptable (e.g., vermicomposting, anaerobic digestion, etc.). Processes must be validated to meet the treatment required (§ 112.55 (a) or (b)) for intended application (§ 112.56). Process monitoring to meet the microbial standard and record keeping are critical to ensuring the compost is adequately treated.



## Composting as a Treatment

- Composting is a controlled biological process that decomposes organic matter and reduces pathogens
- Temperature is the primary method of pathogen reduction for thermophilic composting; however, chemical and biological factors also contribute
- Only a composting process that has been scientifically validated ensures pathogen reduction
- Process monitoring and recordkeeping are critical to ensuring the compost is adequately treated

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### Additional Resources:

- Renter, D.G., & Sargeant, J.M. (2002). Enterohemorrhagic *Escherichia coli* O157:H7 epidemiology and ecology in bovine production environments. *Animal Health Research Reviews*, 3(02), 83–94.

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## 12—Soil Amendments

- Weil, J.D., Beelman, R.B., & LaBorde, L.F. (2004). Destruction of Select Human Pathogenic Bacteria in Mushroom Compost During Phase II Pasteurization. Proceedings of the 2004 ISMS/NAMC conference in Miami, Florida, 365–371.
- Jiang, X., & Shepherd, M. (2009). The Role of Manure and Compost in Produce Safety. *Microbial Safety of Fresh Produce*, 143.
- Brinton, W.F., Storms, P., & Blewett, T.C. (2009). Occurrence and Levels of Fecal Indicators and Pathogenic Bacteria in Market-Ready Recycled Organic Matter Composts. *J Food Prot*, 72(2), 332–339.
- Eamens, G.J., Dorahy, C.J., Muirhead, L., Enman, B., Pengelly, P., Barchia, I.M., Gonsalves, J.R., & Cooper, K. (2011). Bacterial survival studies to assess the efficacy of static pile composting and above ground burial for disposal of bovine carcasses. *J Appl Micro*, 110(6), 1402–1413.

## 16 Additional Information


- This slide is optional.
- Treating soil amendments which contain ingredients of animal origin, such as manure and other animal byproducts, is the best method for reducing the risk of contamination.
- §§ 112.54(b)(1) and (2) of the FSMA Produce Safety Rule provides two processes, **static** and **turned composting**, as examples of validated options for treating manure and other soil amendments.
- In § 112.54, other methods are allowed if they are scientifically valid, controlled processes supported by adequate scientific information and that has been validated to achieve the microbial standards outlined in § 112.55.
- The microbial standards outlined in § 112.55 are not meant to be lot-by-lot testing requirements. Process monitoring must be documented to support the expectation of adequate pathogen reduction (§ 112.60(b)(2)).



### Composting Options

**Must use a scientifically valid process:**

1. Aerated static composting: aerobic, minimum 131°F (55°C) for 3 days, followed by curing with proper management to ensure elevated temperatures throughout all materials
2. Turned composting: aerobic, minimum of 131°F (55°C) for 15 days, minimum 5 turnings, followed by curing
3. Other scientifically valid, controlled composting processes



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- For more information, review the response to comment 145 of the FSMA Produce Safety Rule Preamble: “FDA does not intend § 112.55 to require that farms test their treated biological soil amendments for compliance with the microbial standards. Rather, FDA intends these provisions to provide the standards against which treatment processes described in § 112.54 must be validated. Farms would be able to use treatment processes that are validated to meet the relevant microbial standard in § 112.55 without the need to test the end products of their treatments to confirm that the microbial standard was achieved”.
- There is not sufficient time in this module to cover composting in detail. Those interested in composting as a method of pathogen reduction should be encouraged to contact a professional who has experience in composting processes.

### Additional Resources:

- Cornell Waste Management Institute. <http://cwmi.css.cornell.edu/>
- Rynk, R., van de Kemp, M, Wilson, G.B., Singley, M.E., Richard, T.L., Kolega, J.J., Gouin, F.R., Lalibery, L., Kay, D., Murphy, D.W., Hoitink, H.A., Brinton, W. (1992). On Farm Composting Handbook—NRAES. R. Rynk Ed. Ithaca, NY: PALS Publishing  
[http://palspublishing.cals.cornell.edu/nra\\_order.taf?\\_function=detail&pr\\_booknum=nraes-54](http://palspublishing.cals.cornell.edu/nra_order.taf?_function=detail&pr_booknum=nraes-54)
- Frankenfield, A. Compost: How to make it and how much to use. Pennsylvania State University Extension. <http://extension.psu.edu/business/start-farming/soils-and-soil-management/compost-how-to-make-it-and-how-much-to-use>
- Topoloff, A. (2015). A Resource Guide for Beginning Farmers. Iowa State University Extension & Outreach. Module 2: Composting.  
[http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1006&context=extension\\_pubs](http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1006&context=extension_pubs)
- Natural Resources Conservation Service. Field Office Technical Guides.  
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/>
- United States Environmental Protection Agency. (2002). Biosolids Technology Factsheet.  
[https://www.epa.gov/sites/production/files/2015-06/documents/use\\_of\\_composting\\_for\\_biosolids\\_management.pdf](https://www.epa.gov/sites/production/files/2015-06/documents/use_of_composting_for_biosolids_management.pdf)
- FSMA, Produce Safety Rule, 21 CFR 112 (2015), page 74415.

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## 17


- One simple risk reduction strategy is to apply manure during non-produce (e.g., cover crops, grains, or hay) field rotations.
- Pathogens can survive in manure, compost, and soil for long periods of time. Therefore, maximizing time between application of the manure and harvest of produce can help minimize risks.
- Keep untreated soil amendments from touching the edible portions of the crop—this is easy to achieve in tree fruit, but more difficult for crops grown on or close to the soil. This is also a requirement of the FSMA Produce Safety Rule which will be discussed in the next few slides.
- **Side-dressing** should only be utilized if properly composted or treated soil amendments are used and it does not contact the edible portion of the crop.
- Application methods can impact safety. If field spread, be aware of adjacent fields or waterways that could be contaminated and take steps to reduce risks.
- Steps should include:
  - Not spreading in high winds and leaving a buffer area to prevent manure from entering adjacent fields.
  - Not applying when ground is saturated or frozen to reduce the risk of runoff.



### Reducing Risks During Application

**Steps you should take to reduce risks:**

- Preferentially apply soil amendments containing manure to crops not intended for fresh consumption
- Maximize the time between application and harvest
- Do not contact the edible portion of the crop during application.
- Do not side-dress with raw manure
- Minimize risks to adjacent produce crops if you are field spreading manure



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#### Additional Resources:

- Harris, L.J., Berry, E.D., Blessington, T., Erickson, M., Jay-Russel, I.M., Jiang, X., Killinger, K., Michel, F.C., Millner, P., Schneider, K., Sharma, M., Suslow, T.V., Wang, L., & Worobo, R.W. (2013). A framework for developing research protocols for evaluation of microbial hazards and controls during production that pertain to the application of untreated soil amendments of animal origin on land used to grow produce that may be consumed raw. *J Food Prot*, 76(6), 1062–1084.

**Note:** This resource provides a research framework for preventive control practices using a 'good, better, best' approach and validates the equivalency of alternative methods that growers may utilize.

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## 18

- The FSMA Produce Safety Rule does not currently establish intervals for the application of treated and untreated soil amendments. It is anticipated that FDA will revise this standard in the future upon completion of risk assessments and a more in-depth research agenda. The **application interval** for untreated soil amendments that may contact covered produce after application is listed as “reserved” in § 112.56(a)(1)(i)). This does not mean that there is zero risk associated with applying these amendments or that FDA is suggesting a zero day application interval.



### Minimum Application Intervals

- There are currently no application intervals for raw manure outlined in the FSMA Produce Safety Rule
- **Untreated Soil Amendments**
  - FDA is currently pursuing further research to support application intervals for raw manure
  - Raw manure must not be directly applied to the harvestable portion of the crop
- **Treated Soil Amendments**
  - Zero day application interval for compost treated by a scientifically validated process

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- Untreated biological soil amendments of animal origin must not be applied in a manner that directly contacts the harvestable portion of the crop and must be applied in a manner that minimizes the potential for contact with covered produce after application (§ 112.56(a)(1)(i)).
- Additionally, if an untreated biological soil amendment of animal origin is applied in a manner that does not contact covered produce during or after application, then the minimum application interval is zero days (§ 112.56(a)(1)(ii)).
- § 112.56 requires that biological soil amendments of animal origin treated to the microbial standards in § 112.55(b) be applied in a manner that minimizes the potential for contact with covered produce during and after application, while biological soil amendments of animal origin treated to the microbial standards in § 112.55(a) may be applied in any manner.
- The National Organic Program guidelines outlined in 7 CFR 205.203 (c)(1) can help minimize the likelihood of contamination since the probability of pathogen survival decreases as the interval between application of raw manure and harvest increases. Growers may continue to follow these standards, but they are not currently required for the FSMA Produce Safety Rule.
- The NOP Regulation states that raw animal manure must be composted unless it is: (a) Incorporated into the soil not less than 120 days prior to the harvest of a product whose edible portion has direct contact with the soil surface or soil particles; or (b) Incorporated into the soil not less than 90 days prior to the harvest of a product whose edible portion does not have direct contact with the soil surface or soil particles.

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### Additional Resource:

- National Organic Program, Subpart C— Organic Production and Handling Requirements, 7 CFR 205 (2015), § 205.203(c)(1)(ii and iii). [http://www.ecfr.gov/cgi bin/text idx?SID=7996f371f20c23c9c924928f6d53a02c&mc=true&node=se7.3.205\\_1203&rqn=div8](http://www.ecfr.gov/cgi bin/text idx?SID=7996f371f20c23c9c924928f6d53a02c&mc=true&node=se7.3.205_1203&rqn=div8)

## 19

- These examples represent ways growers might achieve the FSMA Produce Safety Rule requirements outlined below.
- To minimize the potential for cross-contamination, specific equipment and tools can be designated for use in handling soil amendments. If tools and equipment that contact soil amendments will also be used in produce fields, a **Standard Operating Procedure (SOP)** should be developed to clean them before entering the field (e.g., rakes for turning compost piles are also used in produce fields).
- One way to reduce the risk of cross-contamination is to direct farm traffic away from soil amendment handling and loading areas to reduce the chances of tracking contamination from the manure/compost pile to other areas of the farm or packinghouse.
- If equipment is used for handling soil amendments, it should not serve as a source of cross-contamination to the produce.
- § 112.123(b)(1) states that equipment and tools must be installed and maintained as to facilitate cleaning of the equipment and of all adjacent spaces.
- § 112.123(d)(2) states that all non-food-contact surfaces of equipment and tools used during harvesting, packing, and holding must be maintained and cleaned as frequently as reasonably necessary to protect against contamination of covered produce.
- § 112.123(e) requires that if equipment such as pallets, forklifts, tractors, and vehicles are used, such that they are intended to or likely to contact produce, they must be used in a manner to minimize the potential for contamination.



### Handling Recommendations

- Designate specific equipment and tools for handling soil amendments
- Develop SOPs to clean and sanitize equipment and tools that contact soil amendments and fresh produce
- Direct traffic (foot, equipment) around soil amendment storage or processing areas to reduce the risk of cross-contamination




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- § 112.52(a) requires that you must handle, convey and store any biological soil amendment of animal origin in a manner and location such that it does not become a potential source of contamination to covered produce, food contact surfaces, areas used for a covered activity, water sources, water distribution systems, and other soil amendments.

## 20

- § 112.52(a) requires that those subject to the rule handle, convey, and store any biological soil amendment of animal origin in a manner and location such that it does not become a potential source of contamination to covered produce, food contact surfaces, areas used for a covered activity, water sources, water distribution systems, and other soil amendments.
- § 112.52(b) requires that those subject to the rule handle, convey, and store any treated biological soil amendment of animal origin in a manner and location that minimizes the risk of it becoming contaminated by an untreated or in-process biological soil amendment of animal origin.
- § 112.52(c) requires that treated soil amendments that come into contact with untreated soil amendments must be handled as if they were untreated or raw.



### Storage Area Recommendations

- Minimize runoff, leaching, and wind drift to reduce contamination of crops, water sources, and handling areas by soil amendments
  - Cover piles
  - Build berms to prevent runoff
- Do not store in locations that are likely to experience runoff or areas that are close to water sources
- Keep raw manure and finished compost in separate areas to prevent cross-contamination
- Minimize animal access to compost piles



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This slide contains examples of things growers can do to minimize risks.

- Keep finished compost piles covered and separated from raw manure piles.
- Keep both domesticated animals and wildlife away from compost piles so as not to cross-contaminate the amendment with fecal material. For example, fencing compost piles to prevent free-range chickens from contaminating the piles with their feces.
- Store soil amendments away from produce growing and handling areas as well as high foot traffic areas to reduce risks of unintended cross-contamination of equipment, footwear, or packing facilities.

### Additional Resource:

- Strawn, L.K., Fortes, E.D., Bihn, E.A., Nightingale, K.K., Gröhn, Y.T., Worobo, R.W., Wiedmann, M., & Bergholz, P.W. (2013). Landscape and meteorological factors affecting prevalence of three food-borne pathogens in fruit and vegetable farms. *Appl Environ Micro*, 79(2), 588–600.

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## 21



- The success of a food safety program is in the hands of those who work on the farm, so be sure everyone receives training.
- Workers need to understand the risks that handling and applying soil amendments may present.
- Workers should be trained so that soil amendment management steps will be completed properly.
- Resources should be provided so workers can do their jobs properly. Some examples include, additional clothing worn during produce handling activities such as gloves, overalls, or aprons should be kept clean, or changed if they are dirty, prior to entering packing and produce handling areas. While many farm activities are inherently likely to cause clothing to become soiled, it is important to pay special attention when activities involve handling raw animal manures, which could cross-contaminate food contact surfaces or produce.



### Worker Training

**Workers who handle soil amendments, both treated and untreated, should:**

- Understand SOPs for properly completing tasks which require managing raw manure or compost
- Make sure clothes, boots, and gloves are clean before handling produce
- Wash hands after handling





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## 22


- Developing and keeping logs of soil amendment use and handling practices will help record what has been done and allow for the process to be reviewed from year to year.
- Recordkeeping should document the type and source of soil amendment used, when it was applied, how much was applied, and any analysis or testing that was done.
- The source of the soil amendment should be documented if it does not come from the farm where it is being used.
- If growers are already keeping these types of records for other purposes, such as organic certification, they can also use them here.



### Recordkeeping: Soil Amendments

**Soil amendments can introduce microbial risks, so you should document:**

- Type and source of soil amendment
- Rates and dates of application
- Handling and sanitation practices used that reduce risks



**There are a few records required for treated biological soil amendments of animal origin within the Produce Safety Rule**

- Some details are outlined on the next few slides

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- § 112.163 states that existing records (e.g., records that are kept to comply with other Federal, State, or local regulations, or for any other reason) do not need to be duplicated if they contain all of the required information and satisfy the requirements of this part.
- § 112.60 outlines the recordkeeping requirements for Subpart F related to biological soil amendments of animal origin. Recordkeeping requirements specific to on-farm composting and third-party supplied treated biological soil amendments of animal origin are in additional Recordkeeping slides.

## 23

- If a grower plans to treat or compost soil amendments on their farm, they must establish and keep records that document the process controls (for example, time, temperature, and turnings) were achieved (§ 112.60(b)(2)).
- This includes the length of time materials are composted, the temperature compost reaches (including the 'come-up' time), how often it is turned, and any additional steps in the process to show that the appropriate validated process has been correctly followed.



**Recordkeeping: On-Farm Composting**

Key factors in the composting process must be documented. These may include the following steps depending on the process used:

- Time
- Temperatures
- Turnings
- Other processing steps

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## 24

- Purchased, treated biological soil amendments must have documentation that indicates what process was used to treat the soil amendment, that the treatment process is a scientifically valid process that has been carried out with appropriate process monitoring (e.g., achievement of appropriate time and temperatures if composting according to § 112.54) and that the soil amendment has been handled and stored in a way that minimizes contamination from untreated amendments (§ 112.52(a)).



**Recordkeeping: Soil Amendments Supplied by a Third Party**

**Documentation should be kept of:**

- The name and address of the supplier
- What soil amendments were purchased
- The date and amount purchased
- Lot information, if available

**Documentation must be collected from the supplier:**

- To ensure the supplier has used scientifically validated treatment processes and monitoring during the production of the treated amendment (including compost)
- To ensure proper handling requirements have been met

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- For biological soil amendments of animal origin that are received from a third party, documentation must be provided and kept by the grower to show the process used to treat the soil amendment is a scientifically valid process that has been carried out with appropriate process monitoring and prove that it has been handled in a way that minimizes the risk of contamination (§ 112.60(b)(1)).
  - The documentation must be renewed at least annually (§ 112.60(b)(1)).
- As a best practice, the process should be periodically verified through testing.
- Some suppliers may not have documentation of the treatment process (e.g., certificate of conformance). If they do not, there is no way to know the process they have used. Those subject to the rule must handle these soil amendments the same as they would an untreated amendment, or consider finding another supplier who can supply the appropriate documentation.


## 25

- In the case of soil amendments, a corrective action plan could outline actions to be taken if raw manure or other untreated soil amendments are applied too close to harvest. This might include retreatment/composting options if soil amendments were cross-contaminated.
- A corrective action plan does not need to be complicated, it just needs to be documented so it is clear that growers have considered actions to reduce risks if they happen on their farm.



### Corrective Action Plan

- Outline steps that could be taken if soil amendments:
  - Pose a microbial risk to the crop
  - Were improperly treated
  - Accidentally contacted the edible portion of the crop
- Think of alternative market options
  - Processing markets that involve a “kill” step
- Document in your plan



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## 26

- When dealing with soil amendments on the farm, there are three primary ways to reduce risks:
  - 1) Apply raw/untreated soil amendments to fields that are not planted with produce, thereby avoiding direct contact with fresh produce
  - 2) Treat or process the raw soil amendment to reduce or eliminate pathogens (e.g., composting)
  - 3) Maximize the time between application of the soil amendment and harvest of the produce
- Be sure to monitor manure and compost storage areas so that they do not contaminate packing areas, produce fields, or water sources.
- Always train workers who handle soil amendments in proper sanitation and/or segregation of tools and equipment used to handle soil amendments and to practice appropriate hygienic practices, such as washing hands or changing clothes to reduce the chances of cross-contamination.
- Keep records of soil amendment applications, treatment processes, and sources (if purchasing) to ensure tasks are being done properly and that the soil amendment does not serve as a source of contamination to fresh produce.



### Summary

- Soil amendments can introduce produce safety risks, especially those that contain raw manure
- To reduce risks associated with soil amendments:
  1. Apply untreated manure to non-produce fields
  2. Treat raw manure using a scientifically validated, controlled process
  3. Extend the time between application of raw manure and harvest
- Make sure storage areas do not contaminate fields, water sources, or packing areas
- Train workers who handle and apply soil amendments
- Develop sanitation steps for tools and equipment
- Keep records of soil amendment applications and treatments

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# Produce Safety

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## Wildlife, Domesticated Animals, and Land Use



Cornell University

4) Wildlife, Domesticated  
Animals, and Land Use





## **Learning Objectives**

### **Module 4: Wildlife, Domesticated Animals, and Land Use**

#### **Objective 1:**

Identify the potential routes of contamination associated with wildlife, domesticated animals, and land use.

#### **Objective 2:**

Describe practices to mitigate risks associated with wildlife, domesticated animals, and land use.

#### **Objective 3:**

Describe co-management strategies that address both conservation and food safety goals.

#### **Objective 4:**

Describe the importance of conducting a pre-plant and pre-harvest assessment of fields to determine risks associated with animal intrusion or presence of fecal contamination.

#### **Objective 5:**

Describe corrective actions that could be used if significant risks from wildlife, domesticated animals, or land use are present in production fields.

#### **Objective 6:**

Identify records that should be kept to document any management, monitoring, or corrective actions that are taken to reduce produce safety risks in and around produce fields.

#### **Critical Concepts**

- Basic understanding of food safety risks from wildlife and domesticated animals
- Risks related to land use, including adjacent lands not owned by the grower
- Understanding principles of co-management of food safety and conservation practices
- Monitoring for wildlife activity and implementing methods to minimize wildlife intrusion and associated hazards in produce fields
- Considerations for domesticated animal management on the farm
- The value of pre-plant and pre-harvest risk assessments
- Identifying signs of animal intrusion
- Actions to take if fecal contamination is found in produce fields
- Principles of worker training to reduce risks from animals
- Development of SOPs to guide the implementation of actions, including monitoring and reporting risks related to animals and land use
- Recordkeeping and corrective actions for wildlife and domesticated animal management

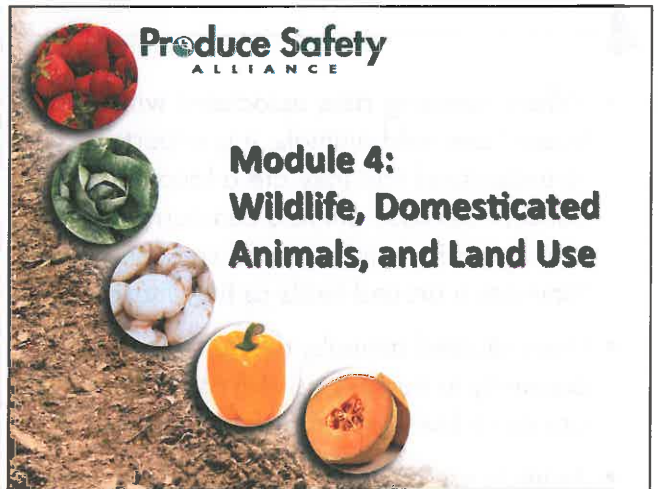




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### 3




#### Learning Objectives

- Identify potential routes of contamination from wildlife, domesticated animals, and land use
- Describe practices to mitigate risks associated with wildlife, domesticated animals, and land use
- Describe co-management strategies that address conservation and food safety goals
- Describe the importance of conducting a pre-plant and pre-harvest assessment of fields
- Describe corrective actions that could be used if significant risks are present in production fields
- Identify records that should be kept to document any management, monitoring, or corrective actions

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### 4

- When assessing risks associated with domesticated and wild animals, it is important to understand that they are a food safety concern because animals can carry human pathogens in their feces and can spread contamination around fields as they move.
- Domesticated animals, due to their close proximity to humans as well as other wildlife, are more likely to harbor human pathogens.
- Animals are naturally present in the environment and difficult to control, so complete exclusion is not possible. Knowing this, it is still important to limit their access to fields and work to ensure contaminated produce is not harvested.
- The presence of wildlife and domesticated animals is not an inherent problem, but their presence can pose risks since animals can serve as reservoirs for human pathogens.
- In Subpart I, these three provisions § 112.81, § 112.83, and § 112.84 include standards directed to minimize the potential for biological hazards from animal excreta to be deposited by domesticated animals on the farm, by domesticated animals from a nearby area or by wild animals (such as deer and wild swine) on covered produce, or in an area where growers conduct a covered activity on covered produce.



#### Animals Are A Produce Safety Concern Because They:

- Can carry human pathogens
  - e.g., *E. coli* O157:H7, *Salmonella*, *Listeria monocytogenes*
- Can spread human pathogens
  - By depositing feces in fields
  - By spreading fecal contamination as they move
- Are very difficult to control
  - Birds and small animals travel unnoticed
  - If fencing is used, even the best fence can be breached
  - Complete exclusion is not possible

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- § 112.83(a) requires that those subject to the rule take the steps as outlined in § 112.83(b) if there is a reasonable probability that grazing animals, working animals, or animal intrusion will contaminate covered produce.
- The requirements outlined in § 112.81, § 112.83, and § 112.84 apply when a covered activity takes place in an outdoor area or a partially-enclosed building and when, under the circumstances, there is a reasonable probability that animals will contaminate covered produce (§ 112.81(a)).
- The requirements in § 112.81, § 112.83, and § 112.84 do not apply when the covered activity takes place in a fully-enclosed building. These requirements also do not apply to fish used in aquaculture operations (§ 112.81(b)). Some other requirements in Subpart L related to domesticated animals and pests are covered in **Module 6: Postharvest Handling and Sanitation**.

### Additional Resources:

- Langholz, J., & Jay-Russell M. (2013). Potential role of wildlife in pathogenic contamination of fresh produce. *Hum Wildlife Interact*, 7(1), 140–157.
- Jay, M.T., Cooley, M., Carychao, D., Wiscomb, G.W., Sweitzer, R.A., Crawford-Miksza, L., Farrar, J.A., Lau, D.K., O'Connell, J., Millington, A., Asmundson, R.V., Atwill, E.R., & Mandrell, R.E. (2007). *Escherichia coli* O157:H7 in Feral Swine near Spinach Fields and Cattle, Central California Coast. *Emerg Infect Dis*, 13(12), 1908-1911.

## 5 Additional Information

- This slide is optional.
- It highlights how complex farming environments can be and some of the risks that a grower may have to consider when developing a food safety program.
- Assessing food safety risks on the farm involves not only evaluating the practices on the grower's own property, but also any risks that may be present on adjacent land that could impact the farm. This might include being aware of:
  - Wildlife movement patterns
  - Animal population density



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#### 4—Wildlife, Domesticated Animals, and Land Use


- Topography
  - Animal access to water source
  - Fecal contamination in production areas
  - Surface **runoff** to water source
- Not all risks identified will involve a corrective action. This module will help you determine which risks will have a greater impact on produce safety.

#### Additional Resources:


- Co-Management of Food Safety and Sustainability, University of California, Division of Agriculture and Natural Resources:  
[http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management\\_of\\_Food\\_Safety\\_and\\_Sustainability/](http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management_of_Food_Safety_and_Sustainability/)
- Wild Farm Alliance: Healthy Diverse Ecosystems Help Keep Pathogens in Check  
<http://www.foginfo.org/wp-content/uploads/2013/01/WFA-NRCS-Illustration-Key.pdf>  
<http://www.foginfo.org/wp-content/uploads/2013/01/WFA-NRCS-Illustration.pdf>

## 6

- Wildlife on the farm is natural and their presence is often unavoidable. Some types of wildlife can be beneficial to farm production, such as raptors or predator mammals that reduce rodent populations.
- Controlling wildlife is a complex process and may require multiple strategies.
- There are county, state, and federal laws that protect some wildlife species. Be sure your management practices are legal and effective. Contact a USDA Natural Resources Conservation Service (NRCS) specialist or Extension professional to learn about protected species and acceptable management practices.
- There is research to indicate wildlife associated with human activities (such as close proximity to cattle feedlots or garbage dumps) may present greater risk of spreading pathogenic microorganisms than other wildlife not associated with these feeding places, so consider activities that occur on or near the farm when assessing risks for this type of wildlife activity.



### Wildlife on the Farm



- Can be a natural and valuable part of the landscape and farm environment
- Depending on species, management options may be limited by county, state, or federal law
- May be resident or transient (e.g., migrating species)
- Wildlife with close association to human activities may pose greater risks
  - e.g., seagulls feeding at dumps, starlings feeding in cattle feedlots

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- § 112.83(a) requires that if there is reasonable probability that animal intrusion will contaminate produce, that those areas used for growing covered produce are monitored as needed during the growing season and immediately prior to harvest.
- § 112.84 states that nothing in the regulation authorizes the “taking” of threatened or endangered species as that term is defined by the Endangered Species Act (16 U.S.C. 1531-1544) (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct), in violation of the Endangered Species Act. The regulation does not require covered farms to take measures to exclude animals from outdoor growing areas, or to destroy animal habitat or otherwise clear farm borders around outdoor growing areas or drainages.



## 7

- Wildlife is more of a challenge to control on the farm than domesticated animals because wildlife are not under the control of the farm. Wildlife may have access to farm land that is adjacent to conservation land or other natural areas.
- Many growers already deter wildlife because they are concerned with crop damage and destruction.
- Wildlife entering fields or packing areas is a key concern, especially if significant evidence of potential contamination, such as the observation of animals, animal excreta, or crop destruction, is identified. § 112.83 (b)(2) requires that if significant evidence of potential contamination is found (such as observation of animals, animal excreta or crop destruction), you must evaluate whether the covered produce can be harvested in accordance with the requirements of § 112.112 and take measures reasonably necessary during growing to assist you later during harvest when you must identify, and not harvest, covered produce that is reasonably likely to be contaminated with a known or reasonably foreseeable hazard.
- Regardless of what risks exist, all growers should be aware of how their actions may affect wildlife and natural habitats. **Co-management** is discussed in more detail in the next few slides.



### Assessing Risks: Wildlife

- Do you find wildlife feces in your produce fields?
  - How often? Is it widely distributed? Is it in contact with produce?
- Is your farm in an area that large numbers of animals visit (e.g., flocks of migrating birds, herds of deer)?
- What management practices can limit wildlife contamination of produce fields and water sources?

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### Additional Resources:


- Nielsen, E.M., Skov, M.N., Madsen, J.J., Lodal, J., Jespersen, J.B., & Baggesen, D.L. (2004). Verocytotoxin-producing *Escherichia coli* in wild birds and rodents in close proximity to farms. *Appl Environ Micro*, 70(11), 6944–6947.
- Laidler, M.R., Tourdjman, M., Buser, G.L., Hostetler, T., Repp, K.K., Leman, R., Samadpour, M., Keene, W.E. (2013). *Escherichia coli* O157:H7 infections associated with consumption of locally grown strawberries contaminated by deer. *Clin Infect Dis*, 57(8), 1129–1134.
- Gruszynski, K., Pao, S., Kim, C., Toney, D., Wright, K., Ross, P.G., Colon, A., & Levine, S. (2014). Evaluating Wildlife as a Potential Source of *Salmonella* serotype Newport (JJPX01.0061) Contamination for Tomatoes on the Eastern Shore of Virginia. *Zoonoses and Public Health*, 61(3), 202–207.

## 8

- Produce safety is not the only concern in the farm environment. Managing natural resources and conservation programs are also important.
- **Co-management** can be defined as the practices which minimize the risk of fecal contamination and microbiological hazards associated with food production while simultaneously conserving soil, water, air, wildlife and other natural resources.
- Co-management provides a way to address complex farm management needs and there are many ways to approach them as mutually beneficial goals.
- The FSMA Produce Safety Rule encourages co-management practices, however, they are not mandated in the rule.



### Co-Management: Striking a Balance



- Farmers must address food safety requirements, but should keep the conservation of natural resources in mind
- Farmers also have stewardship, aesthetic, and business objectives of their own
- **Co-management** considers both food safety and conservation of natural resources

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### Additional Resource:

- Co-Management of Food Safety and Sustainability, University of California, Division of Agriculture and Natural Resources:  
[http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management\\_of\\_Food\\_Safety\\_and\\_Sustainability/](http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management_of_Food_Safety_and_Sustainability/)

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## 9

- Understanding food safety risks introduced by wildlife is a very complex task, even for researchers who have been thinking about it for a long time.
- Some growers have been put under pressure to eliminate wildlife from fields and non-crop areas, such as **riparian areas**, woodlands, and other **vegetated areas** around fields, in the name of food safety.
- There is some research that suggests riparian destruction may actually increase food safety risks, highlighting the fact that co-management can be critical to produce safety and environmental stewardship.
- Careful monitoring for unintended consequences of management practices on both food safety and conservation is important for sound co-management.
- Scientific evidence, not assumption, should guide risk management.



### Co-Management Considerations

- Some conservation practices support wildlife and may increase wildlife activity near produce fields
- As food safety concerns have increased, some farms have stopped or changed their conservation practices, particularly those perceived to provide habitat for wildlife (e.g., vegetation and water sources)
- Removal of conservation practices can damage natural resources (e.g., soil, water, wildlife) and may not mitigate hazards posed by domesticated and wild animals



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### Additional Resource:

- Karp, D.S., Gennet, S., Kilonzo, C., Partyka, M., Chaumont, N., Atwill, E.R., & Kremen, C. (2015). Co-managing Fresh Produce for Nature Conservation and Food Safety. *Proceedings of the National Academy of Sciences*, 112 (35), 11126–11131.

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## 10

- Practices that both reduce risks and limit environmental impacts can be a challenge to implement effectively. Contacting a local NRCS or Extension office can help with researching and implementing these practices.
- As an example, bare ground buffers allow easy monitoring of animal tracks and may discourage some animal movement BUT results in soil exposed to erosion, and may allow easier movement of pathogens in runoff, increasing the risks of contaminating water sources. Also, some animals may prefer bare ground for movement. Consider limiting bare ground buffers to key strategic areas to minimize soil erosion and pathogen movement risks.
- As another challenge, hedgerow vegetation supports threatened pollinator populations and supports beneficial insects for pest control BUT may encourage animal movement near produce fields. Consider whether these actions may increase the risk for contamination in produce fields by animals.
- **Note:** Removal of habitat may undermine conservation mandates/objectives as vegetation often serves valuable functions to protect natural resources, including soil and water. Local, state, and federal laws may govern vegetation management options and should be consulted. Co-management can benefit both food safety and conservation; however, it is important to maintain adherence to both the regulatory food safety requirements and the intent of each management concern.



### Skills to Support Co-Management

- Review the risks and benefits of practices as they relate to food safety and conservation
  - e.g., bare ground buffer and hedgerow vegetation
- Consider impact on conservation when implementing produce safety practices
  - Unintended consequences
  - Direct conflicts between produce safety and conservation



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## 11


- Monitoring wildlife activity throughout the growing season is helpful for preventing crop contamination and loss. Additionally, monitoring may allow growers to develop an understanding of when and to what degree animal intrusion occurs throughout the season, allowing them to develop more effective animal management practices.
- Consider crop characteristics when monitoring for food safety risks associated with wildlife. Tree crops and crops grown off the ground are less likely to be contaminated by small rodents and mammals since they do not grow where feces are likely to be deposited, but resident bird populations or migrating flocks, such as crows, might be more likely to directly affect a tree crop.
- Consider factors that might lead to increased animal movement toward crop and/or water sources, for example drought, post-wildfire conditions, or other events that influence animal movement patterns.
- As mentioned in previous slides, § 112.83(b) requires those subject to the rule assess relevant areas used for a covered activity for evidence of potential contamination of covered produce as needed during the growing season (based on covered produce; practices and conditions; and observations and experience) and; if significant evidence of potential contamination is found (such as observation of animals, animal excreta or crop destruction), those subject to the rule must evaluate whether the covered produce can be harvested in accordance with the requirements of § 112.112 and take measures reasonably necessary during growing to assist them later during harvest when they must identify, and not harvest, covered produce that is reasonably likely to be contaminated with a known or reasonably foreseeable hazard.
- In Subpart K, § 112.112 requires those subject to the rule must take all measures reasonably necessary to identify, and not harvest, covered produce that is reasonably likely to be contaminated with a known or reasonably foreseeable hazard, including steps to identify and not harvest covered produce that is visibly contaminated with animal excreta. At a minimum, identifying and not harvesting covered produce that is reasonably likely to be contaminated with animal excreta or that is visibly contaminated with animal excreta requires a visual assessment of the growing area and all covered produce to be harvested, regardless of the harvest method used.




### Monitoring Wildlife Activity

- **During the growing season:**
  - Monitor for feces and evidence of intrusion
  - Evaluate the risk of fecal contamination on produce (e.g., tree vs. root crop)
  - Consider past observations and wildlife attractants
- **Immediately prior to harvest**
  - Monitor for fecal contamination, signs of animal activity (e.g., trampling, rooting, feeding, tracks)
  - Assess risks and decide if the crop or a portion of the crop can be safely harvested







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# 12

- If you know you have a significant, recurring wildlife issue and are concerned about fecal contamination of the produce, water sources, or other areas of the farm, consider practical methods to discourage wildlife presence in those areas.
- The FSMA Produce Safety Rule does not require the use of deterrents as a method to manage wildlife intrusion, however, these suggestions are often effective in minimizing the presence of wildlife.



- Before taking any action, evaluate how these actions might impact wildlife habitat and movement. Natural Resource Conservation Service (NRCS) specialists or Extension professionals may be able to help recommend methods and evaluate possible impacts.
- Decoys can be an effective method for scaring away a number of different types of wildlife. Plastic coyotes (some with bushy tails that blow in the wind) can be used to deter birds, deer, and other rodents. Swans are naturally aggressive towards Canada geese, so swan decoys can be effective around waterways or flyways that are frequently visited by geese. It is especially important to move decoys every few days so that they can remain effective and wildlife do not get used to them being in one particular area.
- Fencing and netting can be very expensive; however, investing in fencing might be beneficial in the long term in reduced and recurring damage to crops. Even sections of fencing can be effective in moving wildlife around areas where produce may be growing. High value crops such as berries often benefit from lightweight netting to prevent bird damage.

## Additional Resources:

- Williams-Whitmer L.M., Brittingham M.C., & Casalena M.J. (1999). Penn State Extension: Wildlife Damage Control—Geese, Ducks, and Swans. <http://extension.psu.edu/natural-resources/wildlife/wildlife-nuisance-and-damage/birds/wildlife-damage-control-6-geese-ducks-and-swans>
- Conover, M. (2001). *Resolving human–wildlife conflicts: the science of wildlife damage management*. CRC Press, Boca Raton, FL, USA

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- Gilsdorf, J.M., Hygnstrom, S.E., & VerCauteren, K.C. (2003). Use of frightening devices in wildlife damage management. USDA National Wildlife Research Center—Staff Publications. [http://digitalcommons.unl.edu/icwdm\\_usdanwrc/227](http://digitalcommons.unl.edu/icwdm_usdanwrc/227)
- Dickman, A.J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conserv*, 13(5), 458–466.
- Anderson, A., et al. (2013). Bird damage to select fruit crops: The cost of damage and benefits of control in five states. *Crop Protect*, 52, 103–106.

## 13

- Noise deterrents, such as air cannons, can be effective on birds and ultrasonic devices can be helpful if the pests are groundhogs or small rodents.
- There are a wide range of visual deterrents that can be used such as reflective tape, inflatable air noodles (think: car dealerships), and balloons.
- Relocation of wildlife is also an option using 'Have-a-Heart' type traps for release. If this option is chosen, be sure to consult with a professional and consider the impacts to the critter's natural habitat. As a safety note, use extra precaution if you plan to handle or be near wildlife since they may transmit diseases, such as rabies, which have very serious health consequences!
- As a last resort, nuisance permits can be used to reduce wildlife populations.



### Additional Resources:

- Baldwin, R.A., Salmon, T.P., Schmidt, R.H., & Timm, R.M. (2013). Wildlife pests of California agriculture: Regional variability and subsequent impacts on management. *Crop Protect*, 46, 29–37.
- VerCauteren, K.C., Seward, N.W., Hirschert, D.L., Jones, M.L., & Beckerman, S.F. (2005). Dogs for reducing wildlife damage to organic crops: A case study. Nolte DL, Fagerstone KA (eds) Proceedings of the Eleventh Wildlife Damage Management Conference. National Wildlife Research Center, Animal and Plant Health Inspection Service, US Department of Agriculture, 286–293.

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## 14 Additional Information

- This slide is optional.
- Pathogens can be transferred from livestock to wildlife and vice versa.
- Any land or natural resources, such as water, that are shared by both wildlife and domesticated animals may present an opportunity for the transfer of pathogens.
- This type of information is important because it helps growers understand risks and where controlling wildlife access to fields and domesticated animal production areas may be even more important.



### Wildlife & Livestock Interactions

- Pathogens may be transferred between livestock and wildlife
- Pathogen loads in domesticated animals may be species specific and impacted by animal management practices on the farm
- Shared grazing lands and water sources may offer contamination pathways among species



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### Additional Resources:

- Langholz, J., & Jay-Russell, M. (2013). Potential role of wildlife in pathogenic contamination of fresh produce. *Hum Wildl Interact*, 7(1), 140–157.
- Lengacher, B., Kline, T.R., Harpster, L., Williams, M.L., & LeJeune, J.T. (2010). Low Prevalence of *Escherichia coli* O157:H7 in Horses in Ohio USA. *J Food Prot*, 73(11), 2089–2092.


## 15

- Many of the principles for food safety related to wildlife also apply to domesticated animals. With domesticated animals, there are some additional considerations on the farm because the grower has more control over these animals.
- Pathogen loads carried by domesticated animals may be influenced by a number of factors including: age of animal, type of animal, rearing practices, and other management factors (As highlighted in **Module 3: Soil Amendments**).



### Domesticated Animals on the Farm

- Domesticated animals, such as livestock and pets, may harbor human pathogens
- Domesticated animals are sometimes used in fields
  - As draft animals
  - As wildlife management (i.e., dogs)
  - To graze crop residues/culls
- Assess the risk if animals are allowed or are likely to enter your production fields



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- There may be situations where animals are allowed to enter produce fields as part of the production process. Considerations for working animals are discussed in a later slide.
- Some animals may enter fields and even packing areas unexpectedly such as wildlife, livestock that escape their pens, or pets that live outside. Excluding these animals may be more difficult, so outlining corrective actions in advance may be helpful.
- Corrective actions may include monitoring and plans for how to avoid or to address contamination events (i.e., fecal matter) that may pose a risk to the produce.

### Additional Resources:

- Jay-Russell, M.T., Hake, A.F., Bengson, Y., Thiptara, A., & Nguyen, T. (2014). Prevalence and characterization of *Escherichia coli* and *Salmonella* strains isolated from stray dog and coyote feces in a major leafy greens production region at the United States-Mexico border. *PLoS ONE* 9(11): e113433.
- Sanderson, M.W., Sargeant, J.M., Shi, X., Nagaraja, T.G., Zurek, L., & Alam, M.J. (2006). Longitudinal emergence and distribution of *Escherichia coli* O157:H7 genotypes in a beef feedlot. *Appl Environ Micro*, 72(12), 7614–7619.



## 16

- In the case of domesticated animals on the farm, there are usually more opportunities to exclude and control animals from entering produce fields and water sources than with wildlife.
- If using animals during production (such as horses), it is important to think about when and how often they are in the field. Is the crop present? Risks vary depending on the developmental stage of the covered produce (edible portion present) and when animals are present. Always consider the risk of fecal contamination to covered produce.



### Assessing Risks: Domesticated Animals

- Are domesticated animals allowed in the field while the crop is present as part of the production process?
  - Are they working animals?
- Are workers aware of cross-contamination risks from fecal contamination of hands, clothing, shoes, and equipment after handling animals or fecal material?
- Are production fields rotated into grazing land?
  - If manure is present on the ground, one recommendation is to extend the period of time between when animals were grazed and when produce can be planted

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- It is also important to think about where produce fields and packing areas are in relationship to pastures and areas where animals live.
  - Is runoff of manure or urine a concern?
  - Are animals controlled so that they do not have access to fields and packing areas? This includes pets, especially close to harvest.
  - Are the people that work with animals (and animal manure) aware of cross-contamination risks from hands and clothing such as boots?
- § 112.32(b)(2) requires that any workers in direct contact with working animals take appropriate steps to minimize the likelihood of contamination of covered produce, and § 112.32(b)(3)(v) requires thoroughly washing hands as soon as practical after touching animals or any waste of animal origin.
- **Module 3: Soil Amendments** covers considerations of using or storing manure or compost on the farm so that it does not become a source of contamination, and also covers the requirements of Subpart F.
- § 112.83 states that if there is reasonable possibility that grazing animals, working animals, or animal intrusion will contaminate covered produce, those subject to the rule must assess relevant areas for evidence of potential contamination of covered produce as needed during the growing season. If significant evidence of potential contamination is found during growing (such as observation of animals, animal excreta, or crop destruction), they must evaluate whether the covered produce can be harvested under § 112.112 and take measures reasonably necessary during growing to assist with identifying and not harvesting covered produce reasonably likely to be contaminated with a known or reasonably foreseeable hazard.
- § 112.134(a) requires that if those subject to the rule have domesticated animals, to prevent contamination of covered produce, food contact surfaces, areas used for a covered activity, agricultural water sources, or agricultural water distribution systems with animal waste, they must:
  - 1) Adequately control their excreta and litter; and
  - 2) Maintain a system for control of animal excreta and litter

**Additional Resource:**

- Wang, G., Zhao, T., & Doyle, M.P. (1996). Fate of enterohemorrhagic *Escherichia coli* O157:H7 in bovine feces. *Appl Environ Micro*, 62(7), 2567–2570.

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## 17

- Knowing the history of the production land can help identify any problems before crops are planted including biological, chemical, and physical hazards from previous uses.
- Reviewing topography of the land can identify areas prone to flooding, runoff to agricultural water sources and fields, and wind patterns that might blow contamination from compost piles or animal operations onto produce.
- If there are sewage systems or septic tanks on the farm, §§ 112.131(a) and (b) require that they be maintained in a manner that prevents contamination of produce or food contact surfaces.
- It is also important to know whether animals have grazed on the land, as the time between manure deposits from grazing to harvest of produce should be maximized.
- Adjacent land use can also pose a risk if there are livestock or production animals present. Contamination can come from wind drift or runoff from manure piles as well as animal access to water sources used for the production of produce. Other adjacent land uses associated with residential or commercial areas may present other risks.
- Wildlife can contaminate produce with their fecal material. Determining the number and type of resident and transient animals entering production fields, and monitoring the potential for introduction of known (or foreseeable) hazards can help identify the severity of the problem (as required in § 112.83(b)(1)) and whether produce can be safely harvested (§ 112.112).



### Assess Risks BEFORE Planting

- **Assess the field location**
  - Topography, wind patterns, water movement
  - Previous uses (e.g., grazing, landfills, manure applications)
  - Impact of domesticated animals
- **Assess adjacent land uses**
  - Animal production, compost, or manure storage
  - Residential, commercial, or other land uses
- **Assess wildlife risks**
  - Number, movement, likelihood of fecal contamination





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**Additional Resource:**

- Strawn L.K., Fortes E.D., Bihn E.A., Nightingale K.K., Gröhn Y.T., Worobo R.W., Wiedmann M., Bergholz P.W. (2013). Landscape and meteorological factors affecting prevalence of three food-borne pathogens in fruit and vegetable farms. *Appl Environ Micro*, 79(2), 588–600.

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# 18


- The FSMA Produce Safety Rule does not prohibit the use of working animals. The use of working animals does not mean food safety goals cannot be achieved, however the risks they may pose to produce safety should be considered and minimized.
- The best way to minimize risks is to not allow working animals in the fields close to harvest and when the edible portion of the crop is growing.
- As with all animals, they may defecate (poop) while they are in the field, so there should be a written **SOP** that deals with how a 'poop event' is handled.
  - It can be left in the field while a **no-harvest buffer zone** is established around the fecal contamination. If left in the field, be aware that splash from rain or irrigation may spread contamination.
  - If a grower chooses to bury or remove the feces, it is critical to establish sanitation procedures to make sure equipment (such as buckets, shovels, gloves, etc.) are properly cleaned and sanitized and evaluate whether these actions may impact the safety of produce.
- § 112.83, § 112.127, and § 112.134 are applicable to domesticated animals, including working animals.
- There are many ways to address the risks of using working animals in the field, but it is important that practices do not result in more risks. For this reason, it is very important that anyone who handles working animals understand food safety risks that may be present and be trained to minimize them.
  - Dedicating boots to barn activities such as cleaning animal stalls is one way to minimize the movement of fecal contamination into the produce growing or packing areas.
  - Handwashing is critical. Always wash hands after working with animals or cleaning up their poop.



## Working Animals



- The best way to minimize risk is to not allow working animals in the field when the edible portion of the crop is present
- If working animals need to be used close to harvest:
  - Establish paths to minimize contact with growing areas
  - Have an SOP that outlines practices to take if an animal defecates (poops) in the field near or on produce
- Anyone working with the animals should understand risks and be trained to minimize risks
- Develop SOPs for animal and manure handling
  - e.g., handwashing, cleaning and sanitizing tools, practices to complete after handling animals


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- As a reminder, § 112.32(b)(2) requires that any workers in direct contact with working animals take appropriate steps to minimize the likelihood of contamination of covered produce and to thoroughly wash hands, as soon as practical after touching animals or any waste of animal origin (§ 112.32(b)(3)(v)).
- More information on worker health and hygiene can be found in **Module 2: Worker Health, Hygiene, and Training**.




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- Dogs and cats are almost ubiquitous on family farms. Farmers should recognize that pets can represent a food safety risk if they have access to fields and packing areas.
- Pets can sometimes be effective working animals, such as in the case of dogs that control wildlife.
- Working dogs and cats are not prohibited in the FSMA Produce Safety Rule, however, their presence should be monitored and a corrective action plan established for their presence. See the previous slide for more information on working animals.
- Some growers like to use cats in their packinghouses as rodent control, but cats can carry *Toxoplasma gondii*, which can cause severe illness including blindness, miscarriage, and death. Because of these and other risks, cats must be excluded or separated from areas where covered produce activities performed in fully enclosed buildings (§ 112.127).
- Many farms also have U-pick operations. Instruct U-pick customers to leave their pets at home, for both food safety and liability reasons!
- Lastly, if the farm has a petting zoo or any other type of activity that involves workers or visitors touching animals, handwashing stations should be available. This is especially important if a U-pick farm is set up to allow visitors to wander from the animal barn (i.e., petting the animals) to the fields (i.e., picking fruit) where customers are likely to be eating or touching produce. There have been several foodborne illness outbreaks associated with petting zoos.



### Pets

- Should be excluded from produce fields
- Visitors to the farm should be instructed to leave their pets at home
- Farms with petting zoos should have handwashing sinks available and signage instructing visitors of the food safety policies



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### Additional Resources:

- Hale, C.R., et al. (2012). Estimates of enteric illness attributable to contact with animals and their environments in the United States. *Clin Infect Dis*, 54(suppl 5), S472–S479.
- Roug, A., Byrne, B.A., Conrad, P.A., & Miller, W.A. (2013). Zoonotic fecal pathogens and antimicrobial resistance in county fair animals. *Comparative Immune, Micro, and Infect Dis*, 36(3), 303–308.

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- A pre-harvest assessment determines if it is safe for harvest to proceed. The main objective is to determine if anything, including wildlife, domesticated animals, adjacent land use, or even isolated events such as flooding have impacted the safety of the crop.
- If wildlife or other animals have been in the field, there may be corrective actions that need to be taken to reduce the risks to fresh produce such as establishing no-harvest buffer zones or not harvesting parts of the field.
- Any actions taken should be documented. This not only documents steps taken to reduce risks but helps track trends in animal activity and ensure workers have taken all of the necessary actions to make sure the produce is safe.
- § 112.112 requires immediately prior to and during harvest activities, those subject to the rule must take all measures reasonably necessary to identify, and not harvest, covered produce that is reasonably likely to be contaminated with a known or reasonably foreseeable hazard, including steps to identify and not harvest covered produce that is visibly contaminated with animal excreta. At a minimum, identifying and not harvesting covered produce that is reasonably likely to be contaminated with animal excreta or that is visibly contaminated with animal excreta requires a visual assessment of the growing area and all covered produce to be harvested, regardless of the harvest method used.



### Pre-Harvest Assessment

**A process to assess fields before harvest to help determine if:**

- Fecal contamination is present, or signs indicate a risk (e.g., tracks, trampling, rooting, feeding)
- Fresh produce has been contaminated and cannot be harvested
- Corrective actions, such as no-harvest buffer zones, are necessary
- Harvest can safely proceed



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**Additional Resource:**

- Park, S., Szonyi, B., Gautam, R., Nightingale, K., Anciso, J., & Ivanek, R. (2012) Risk factors for microbial contamination in fruits and vegetables at the pre-harvest level: a systematic review. *J Food Prot*, 75(11), 2055–2081.


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- It is important to outline the immediate actions that should be taken in response to a contamination event.
- Not harvesting fresh produce with fecal material seems pretty straight forward, but this requires all those who harvest to know that this is a requirement (§ 112.112) and to know how to avoid contamination. If there is a significant amount of contamination, isolating the area and not harvesting any produce is the safest thing to do.
- The FSMA Produce Safety Rule does not require a no-harvest buffer zone, however, this is one effective means of minimizing the cross-contamination risk from fecal contamination in the produce field.
  - Using the presence of fecal matter found on the ground in a field as an example, a grower could decide to establish no-harvest buffer zones, not to harvest the crop, or come up with other corrective actions that minimize risk of produce becoming contaminated.
  - If establishing a no-harvest buffer zone, the radius and size will depend on a number of factors which will have to be assessed by each grower. Factors to consider are: meteorological factors (such as a predicted rain event which could cause splash onto produce or high winds and dry conditions that could cause drift), how much fecal material is present, what the consistency is (watery, solid), and the extensiveness of the problem (whole field or one event).
- The farm food safety manager will have to use best judgement on the appropriate buffer size to ensure an acceptable level of safety is maintained.



**Corrective Actions:  
What To Do If There's Contamination**

1. Do not harvest any produce that may be contaminated
2. Determine if no-harvest buffer zones around the contamination are sufficient to reduce risk to allow harvest of the uncontaminated produce
  - Suggested no-harvest buffer zones vary from a 0-25 foot radius, depending on the crop, climate, contamination event, and harvest equipment
3. Consider other corrective actions that could reduce contamination risks



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### Additional Resources:

- California Leafy Green products Handler Marketing Agreement (LGMA) — Assessing Animal Activity in the Field [http://www.wga.com/sites/wga.com/files/LGMA%20-%20Assessing%20Animal%20Activity%20in%20the%20Field%20\(SP\)%20-%20Info%20Graphic.pdf](http://www.wga.com/sites/wga.com/files/LGMA%20-%20Assessing%20Animal%20Activity%20in%20the%20Field%20(SP)%20-%20Info%20Graphic.pdf)
- Farm Food Safety Decision Trees—Wildlife and Animal Activity Decision Tree <http://gaps.cornell.edu/sites/gaps.cornell.edu/files/shared/documents/wildlife/Animal%20Management-Tree.pdf>



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- Corrective actions address identified risks and are meant to minimize risks. Establishing these actions can help identify and put into place a long term solution for preventing the risk of contamination in the future.
- Alternative markets that include a processing step, such as a heat treatment, can be considered if there are concerns about the safety of the crop or if the standards in the FSMA Produce Safety Rule cannot be met.
- Deciding what to do with contamination that is found depends on many factors. Consideration of appropriate responses before a problem is encountered can be beneficial and help to avoid inadvertently making the problem worse.
  - Removing contamination is complex because it involves people and moving the contamination around, so think critically about risks and benefits.
  - Burying contamination is also an option, but would still require sanitation of the tools and handwashing.
  - Flagging the contaminated area and not harvesting is an option, but can be an issue if using overhead irrigation since splash can continue to spread the contamination.



### Corrective Actions Continued

4. Make a decision about what to do with the contamination
  - Remove, leave, bury, or use other strategies
  - Consider risks that could result from these actions (e.g., cross-contamination of equipment with feces)
5. Document all actions
  - Monitoring, deterrence, and corrective actions



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- Workers are your front lines of defense: they are in the field harvesting product, so they can identify animal intrusion events and the presence of feces that can contaminate produce and equipment.
- Training provides the opportunity to share what is expected and answer questions so that everyone knows what their job is and can actively participate in the farm's food safety program.
- If the field has had significant animal intrusion, workers need to notify someone at the farm such as the crew leader or farm manager.
- If workers are involved in establishing no-harvest buffer zones or removing contamination, they need to know exactly what to do AND how to properly clean and sanitize tools as well as wash their hands to reduce cross-contamination risks.
- § 112.22(b)(1) requires that persons who conduct harvest activities for covered produce must also receive training to recognize covered produce that must not be harvested, including covered produce that may be contaminated with known or reasonably foreseeable hazards; (2) Inspecting harvest containers and equipment to ensure that they are functioning properly, clean, and maintained so as not to become a source of contamination of covered produce with known or reasonably foreseeable hazards; and (3) Correcting problems with harvest containers or equipment, or reporting such problems to the supervisor (or other responsible party), as appropriate to the person's job responsibilities.
- § 112.32(b)(3)(vi) requires workers to wash their hands at any other time when the hands may have become contaminated in a manner that is reasonably likely to lead to contamination of covered produce with known or reasonably foreseeable hazards.



### Worker Training: Establishing Your Front Lines of Defense

#### Workers must receive training to:

- Recognize and not harvest contaminated produce
- Inspect and correct problems with harvest containers and equipment or report issues to a supervisor, so they do not become a contamination source

#### Workers must:

- Take measures to not harvest contaminated produce
- Wash hands after handling animal feces or any time hands may be contaminated

#### Workers should:

- Report food safety concerns to a supervisor

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- Documentation is important because it allows growers to review past issues and evaluate if practices are working.
- It also establishes a system for evaluating crops and allows workers to become comfortable with how assessments are done.
- To support the farm food safety program related to domesticated and wild animals, records should be kept of monitoring and other actions taken to reduce risks, such as the use of wildlife deterrents, even though the FSMA Produce Safety Rule does not specifically require that these records be kept.
- Pre-harvest assessments, animal monitoring, records of intrusion/contamination events, and any corrective actions should also be documented.
- Documenting worker trainings related to domesticated animals and wildlife does not need to be separate from other on-farm worker training, but it is highlighted here because there are specific things that should be included about domesticated and wild animal issues, depending on the situations that occur on each farm.
- Documentation of worker trainings must be kept, including the date of training, topics covered, and the person(s) trained, according to § 112.30(b).




### Recordkeeping


**Records must be kept for:**

- Worker training

**Records should be kept for:**

- Pre-plant land assessments
- Monitoring for animal activity
- Actions taken to reduce the risks related to animal intrusion into crop (domesticated animals and wildlife)
- Pre-harvest risk assessments
- Intrusion and contamination events
- All corrective actions taken





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## 25 Additional Information

- This slide is optional and provides an example of a monitoring log.
- There are many template recordkeeping logs available, so growers do not have to start from scratch.
- It is important to make sure the recordkeeping logs are working for the farm, so farm food safety personnel should modify them to meet their needs.



### Example of Recordkeeping


**Wildlife and Domesticated Animal Monitoring Log**

Name of operation:

Please use this food safety plan for overall wildlife and domesticated animal management, monitoring, and corrective actions. Attach any relevant pictures, maps, or other notes about the monitoring or intrusive event to this recordkeeping sheet.

Date	Field or location	Wildlife activity or intrusive event noted (yes or no)	Corrective actions taken	Date corrective actions implemented	Initials

Monitored by: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_


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### Summary

- Feces and urine from domesticated and wild animals can contaminate produce fields and water sources
- Conduct pre-planting and pre-harvest assessments
- Presence of animals in the environment does not necessarily mean that produce is contaminated
- If animal intrusion occurs, fields must be monitored during the growing season for evidence of contamination
- Steps should be taken to reduce risks from animals
- Co-management should be used to balance food safety and conservation goals
- Document all actions taken to reduce risks from animals and adjacent land uses

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