

# Introduction to Produce Safety Rules



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Master Garden Class of 2023



**NETFLIX**

**OFFICIAL  
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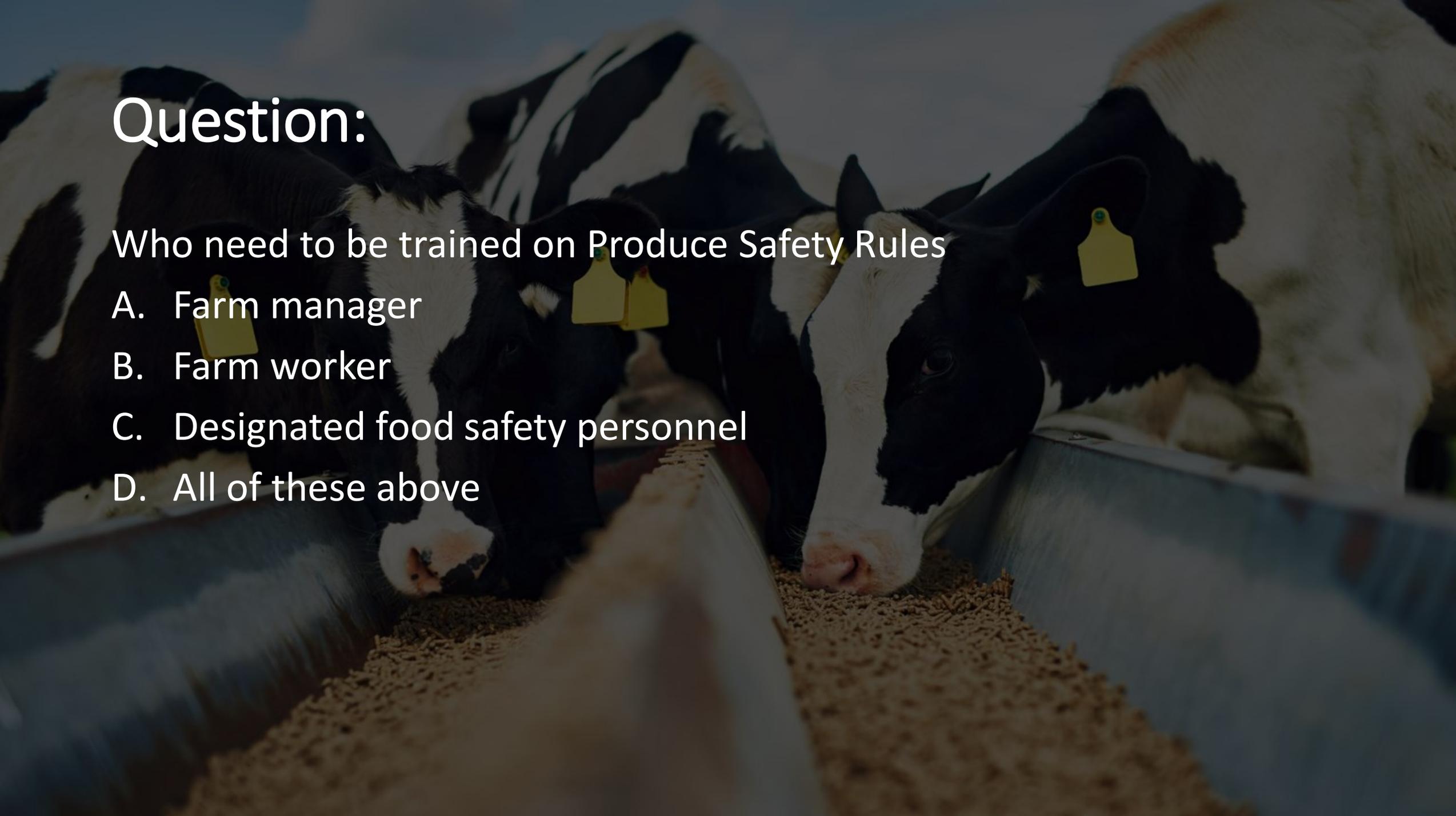
# Learning Objectives

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

# Relevance to the Farm

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





# Question:

Who need to be trained on Produce Safety Rules

- A. Farm manager
- B. Farm worker
- C. Designated food safety personnel
- D. All of these above

# The Food Safety Modernization Act (FSMA)

## FSMA includes:

1. Produce Safety Rule
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

Focused on prevention of food safety issues and encompasses the entire food system





# FSMA Produce Safety

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:

1. Commodities grown (e.g., rarely consumed raw)
2. Processing activities that include a 'kill step'
3. Average annual produce sales
4. Average annual food sales and sales to 'qualified end users'
5. Ultimately, all growers should understand and take action to reduce food safety risks on the farm

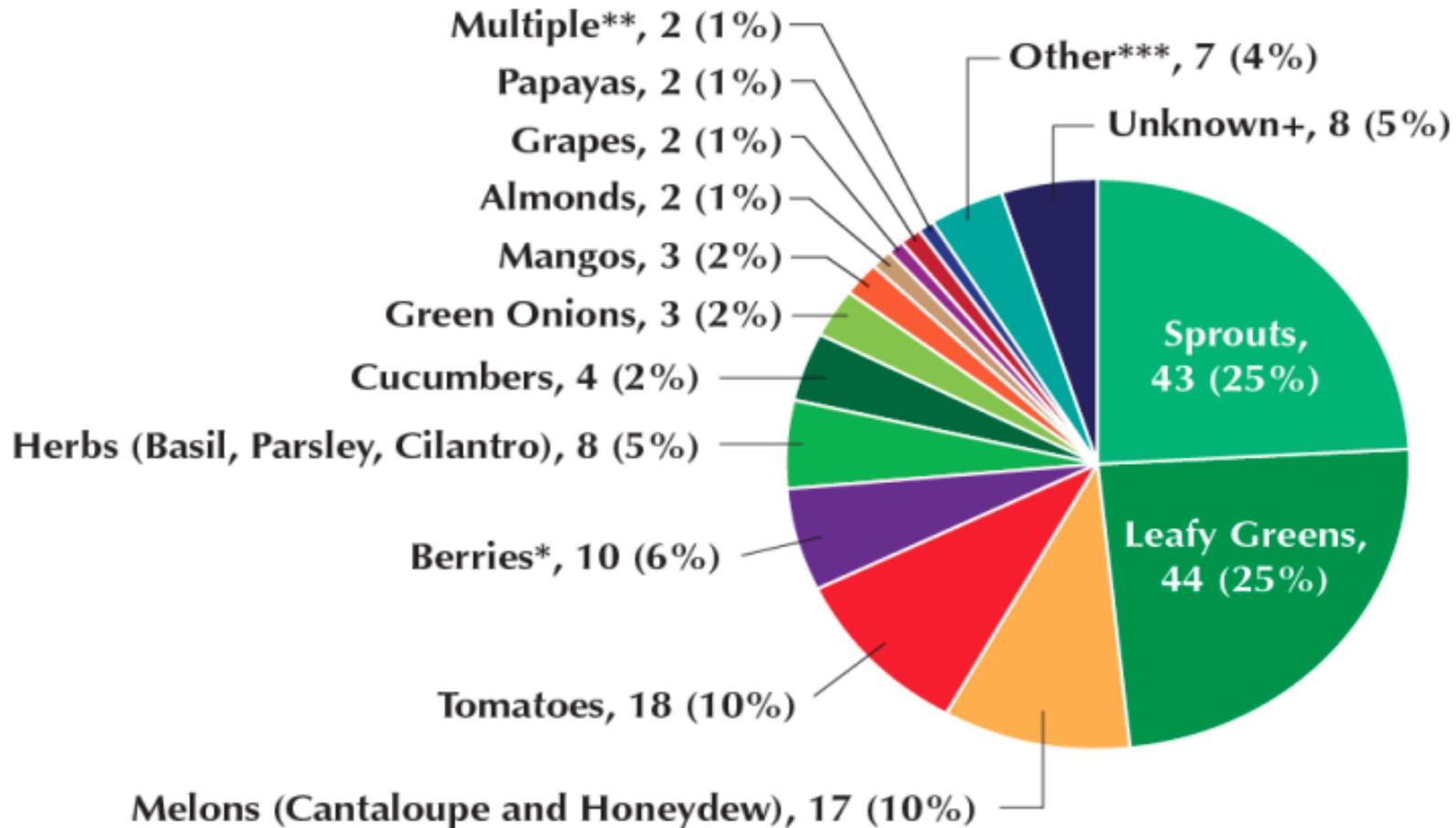
# FSMA Produce Safety Rule Compliance

Business Size	Compliance Dates for Most Requirements	Water Related Compliance Dates
All other businesses (>\$500K)	1/26/18	1/26/22
Small businesses (>\$250K-500K)	1/28/19	1/26/23
Very small businesses (>\$25K-250K)	1/27/20	1/26/24

- In the Final Rule issued March 2019, compliance dates for all agricultural water requirements (other than sprouts) allow for an additional 4 years
- For example, 'all other businesses' could wait until sampling 2022 to begin sampling

# Outbreaks associated with Produce

FDA Outbreaks Linked to Produce Contamination Likely Prior to Retail: 1996–2014





# Microorganisms of Concern in Fresh Produce

- Bacteria:
  - ❖ Salmonella, toxigenic E. coli, Shigella, Listeria monocytogenes
- Viruses:
  - ❖ Norovirus, Hepatitis A
- Parasites:
  - ❖ Giardia lamblia, Cryptosporidium parvum, Cyclospora cayetanensis, Toxoplasma gondii

# Bacteria in the Farm Environment

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- Bacteria are microorganisms that can multiply both inside and outside of a host.
- Bacteria include pathogens such as *E. coli* 0157: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.

# Bacteria

- If conditions are ideal, bacteria can multiply once every 20 minutes
- It is unlikely you'll ever start with just ONE bacterium
- Some pathogens can make people sick with a dose of 10 cells or less
- Optimal Condition:
  - ❖ Food source
  - ❖ Moisture
  - ❖ Right temperature



# Conditions for Bacterial Growth FATTOM



FOOD



ACIDITY (PH)



TIME



TEMPERATURE



OXYGEN

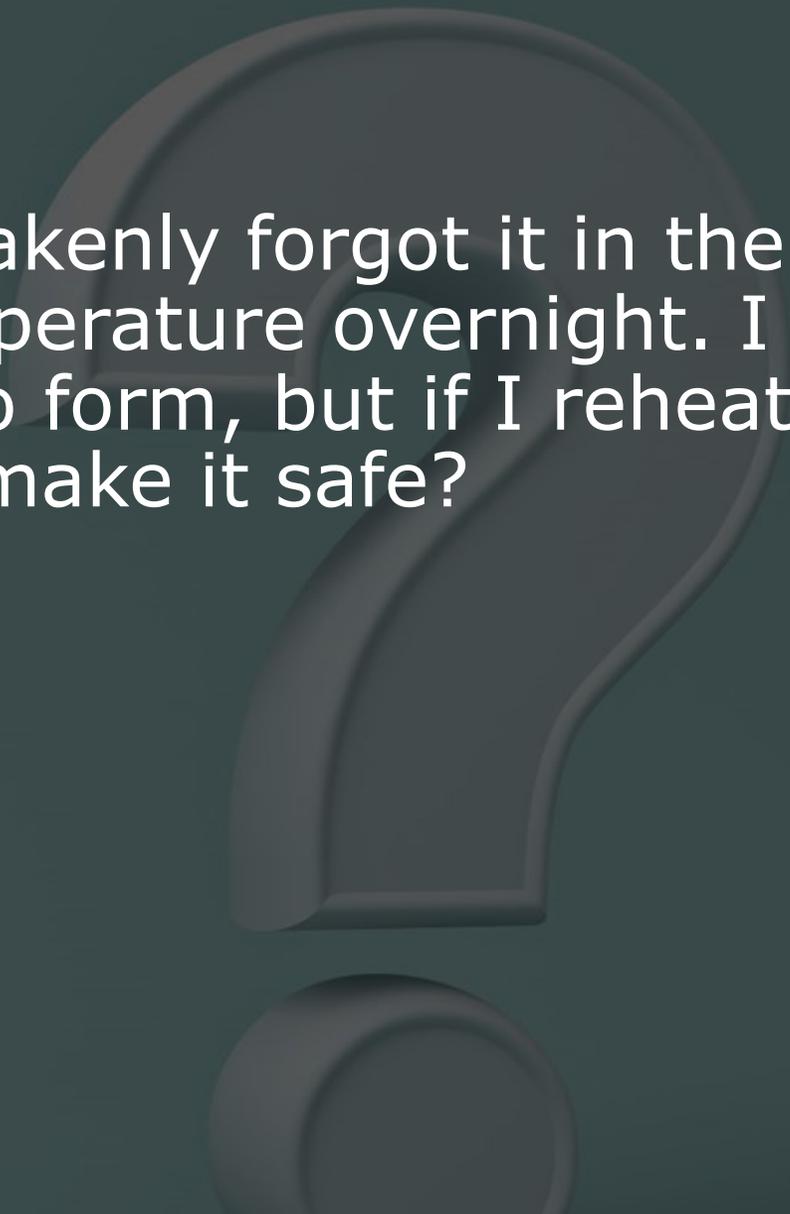


MOISTURE



## Question:

I made some lasagna and mistakenly forgot it in the oven, where it sat at room temperature overnight. I know that can cause bacteria to form, but if I reheat the lasagna thoroughly won't that make it safe?



# 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



# 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



# Health Impacts by Pathogen Type

## FDA Outbreaks Linked to Produce by Pathogen Types: 1996-2014

Pathogen Type	Outbreaks (% of total)	Illnesses (% of total)	Hospitalizations (% of total)	Deaths
Bacterial	148 (85.55)	11,377 (66.28)	1,844 (89.21)	65
Parasitic	21 (12.14)	4,786 (27.88)	67 (3.24)	0
Viral	3 (1.73)	993 (5.79)	156 (7.55)	3
Total	173*	17,164	2,067	68

\*The total also includes chemical hazards not identified in this table a (e.g., a Curcubitacin toxin outbreak associated with squash).

# Produce Safety Challenges

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

# Contamination Sources to Produce

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- Humans
- Soil
- Animals
- Equipment Tools
- Water



# How Contamination Is Spread

## *Humans*

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

### 1. Improper health and hygiene practices

- ❖ Lack of adequate training and handwashing practices.
- ❖ Lack of or inadequate toilet facilities

### 2. Illness or injury

- ❖ Working while sick
- ❖ Injuries that result in blood contacting fresh produce



# How Contamination Is Spread

## ***Soil Amendments***

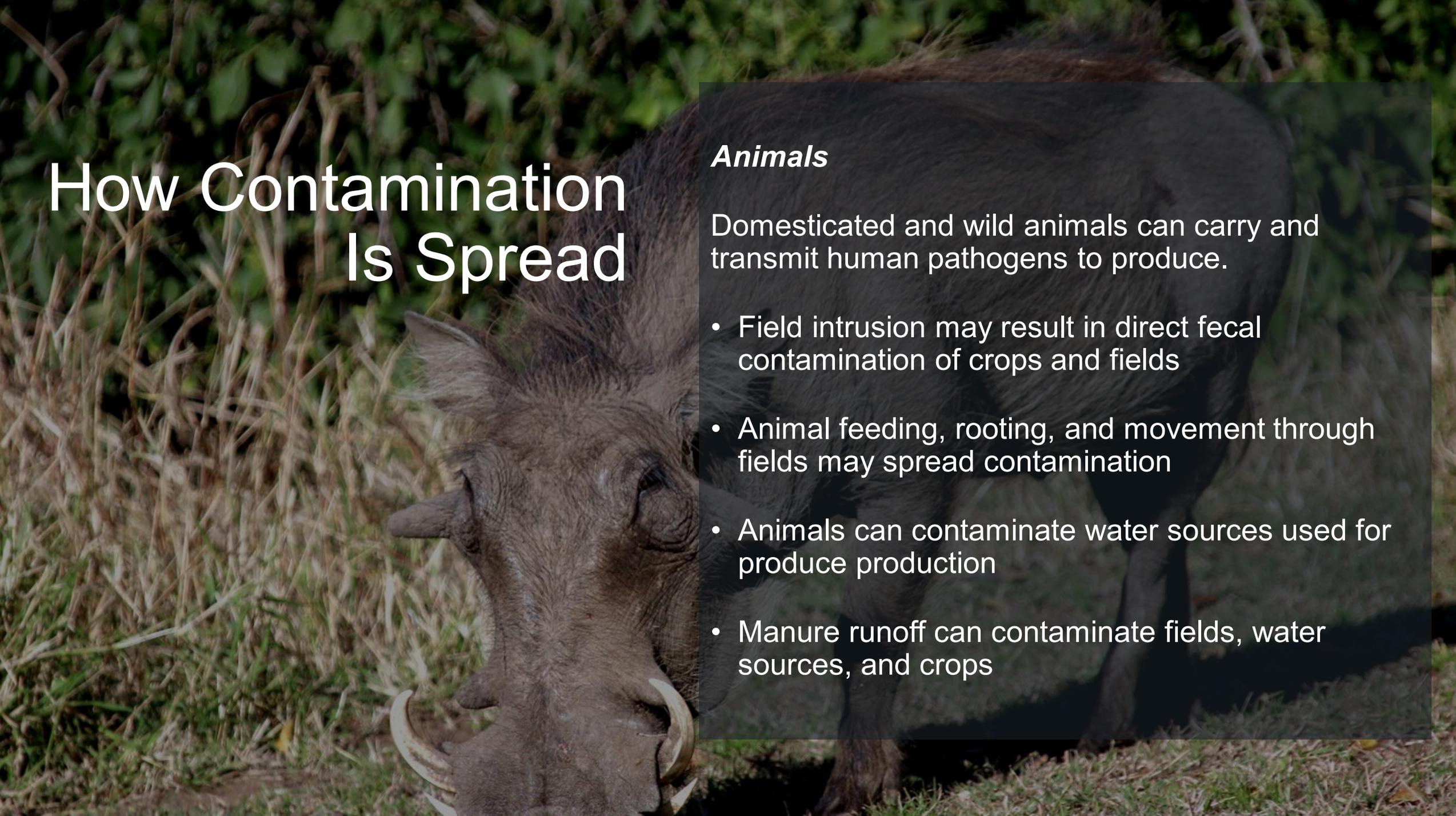
Raw manure and other soil amendments can be a source of contamination if not properly handled and applied.

- Application too close to harvest
- Improper/incomplete treatment
- Improper storage
- Runoff
- Wind spread
- Cross-contamination due to improper sanitation procedures

# Food safety risks on the field caused by wild animal



# How Contamination Is Spread

A water buffalo is shown grazing in a field of tall grass. The buffalo is dark brown with a lighter face and has small horns. The background is a dense field of green and brown grass.

## *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

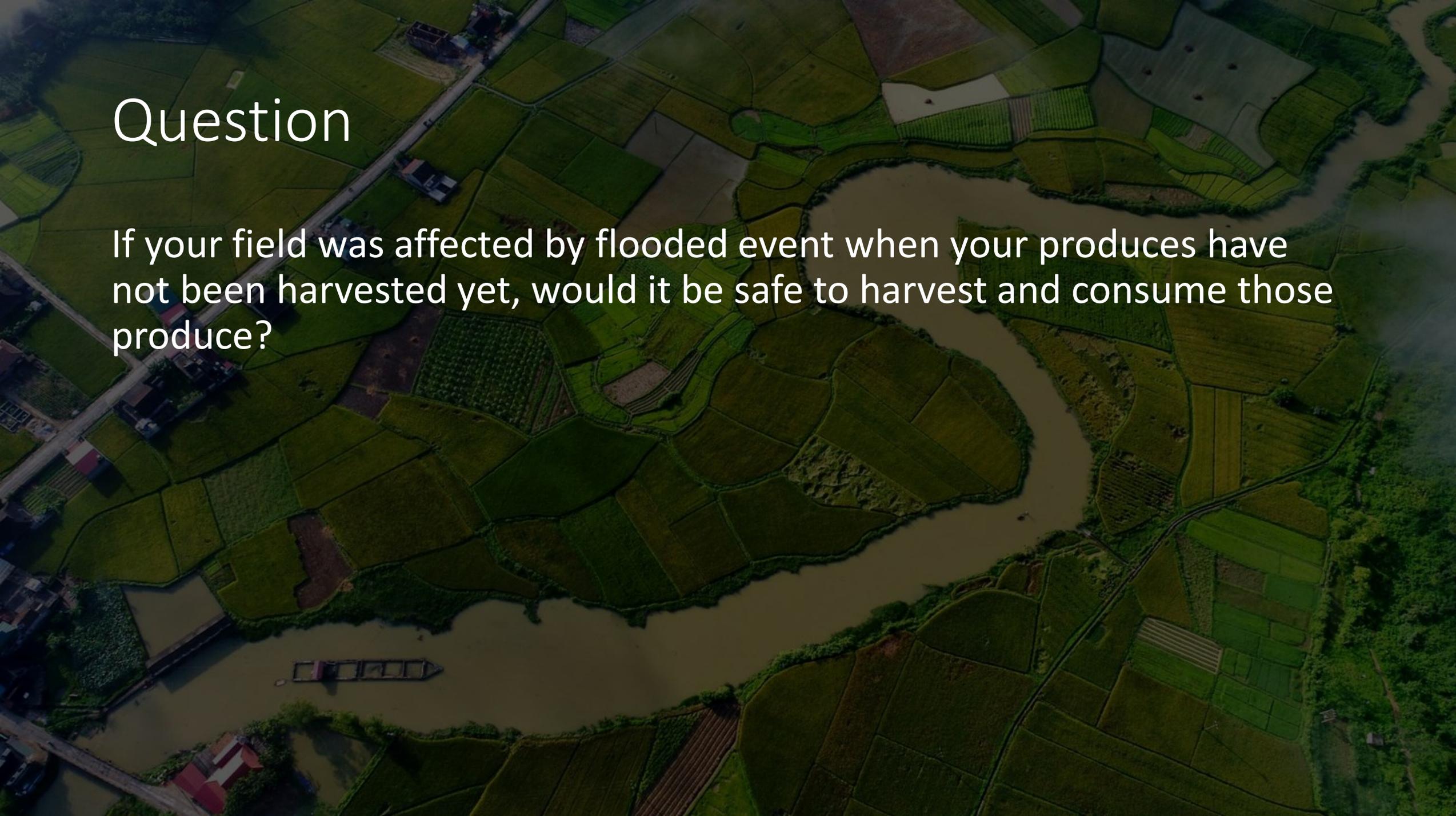
# How Contamination Is Spread

## *Water*

Water can carry and spread human pathogens, contaminating entire fields or large amounts of produce.

- Production water: Irrigation, crop sprays, frost protection
- Post-harvest water: Fluming, cooling, washing, waxing, cleaning
- Unexpected events: Flooding, runoff



An aerial photograph of a rural landscape. A wide, muddy river flows through the center, with a long, narrow boat on its surface. The surrounding land is divided into numerous rectangular agricultural plots, some of which are partially submerged in water, indicating a flooded event. The fields are various shades of green, suggesting different crops or stages of growth. A road and some buildings are visible on the left side of the image.

# Question

If your field was affected by flooded event when your produces have not been harvested yet, would it be safe to harvest and consume those produce?

# 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



# *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!



# Produce Safety Begins With Your Commitment

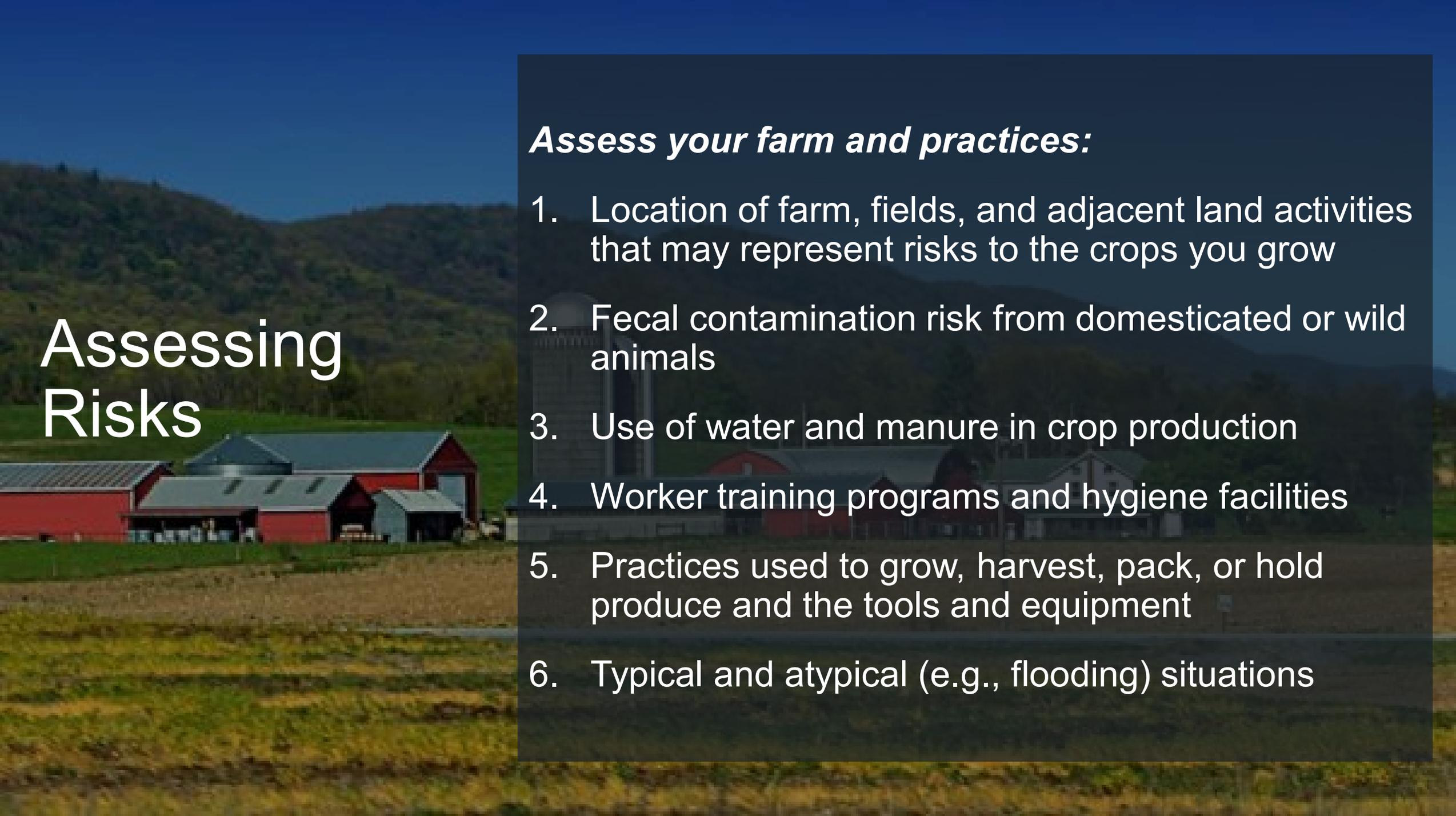
1. Identifying produce safety risks on your farm
2. Supporting the implementation of food safety policies and practices to reduce risks
3. Providing equipment and facilities necessary to implement practices that reduce risks
4. Supporting effective food safety training so everyone can actively be involved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

A person in a white lab coat and mask is writing in a notebook. In the background, other people in lab coats and masks are working in a laboratory or food processing facility. There are green crates and a large green container visible.

# Steps Towards Produce Safety

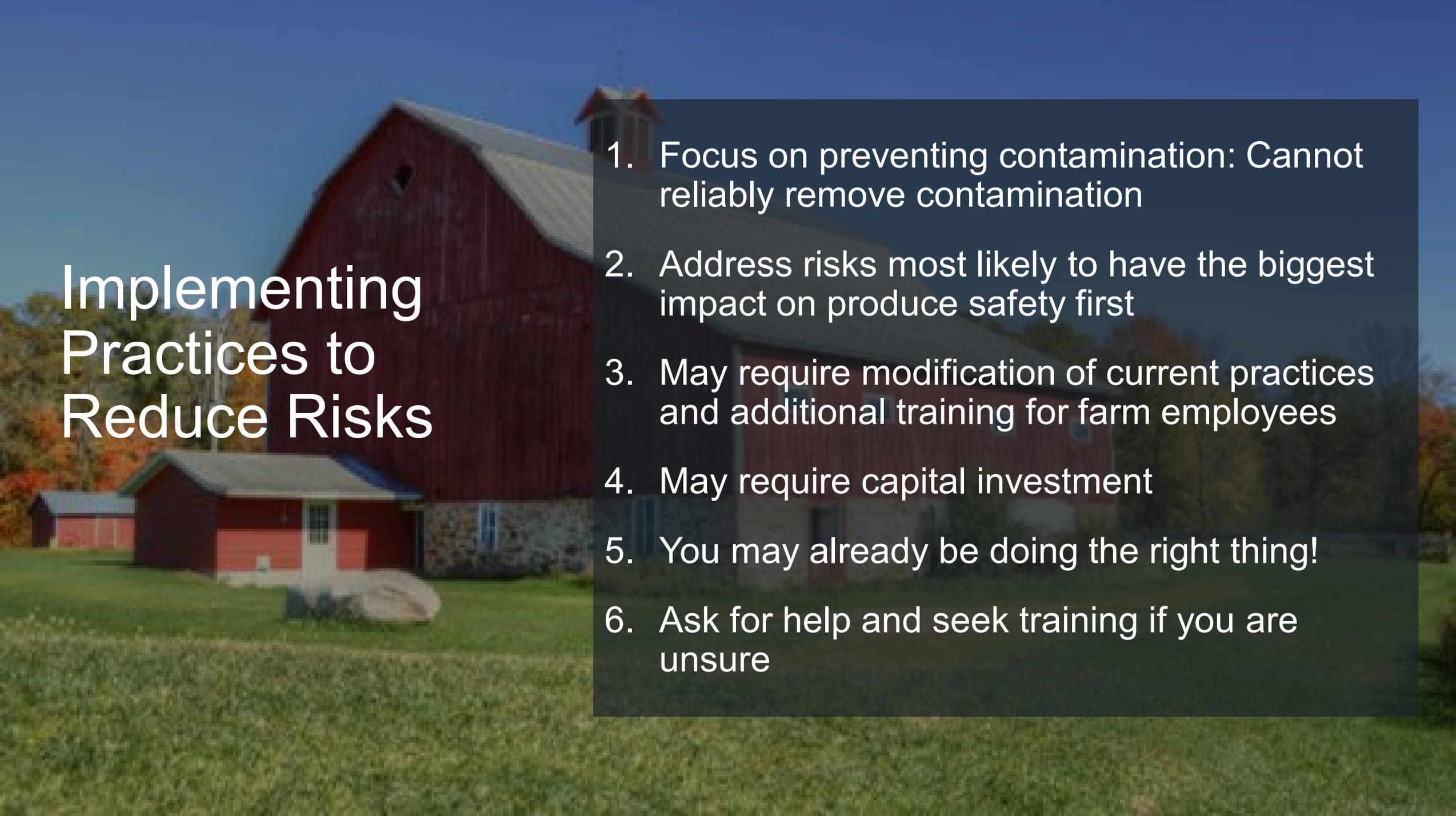
1. Assess Produce Safety Risks
2. Implement Practices
3. Monitor Practices
4. Use Corrective Actions
5. Keep Records

# Assessing Risks



## ***Assess your farm and practices:***

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



# Implementing Practices to Reduce Risks

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



# Good Agricultural Practices (GAPs)

Key areas will be reviewed as well as practices that can be implemented to reduce risks including:

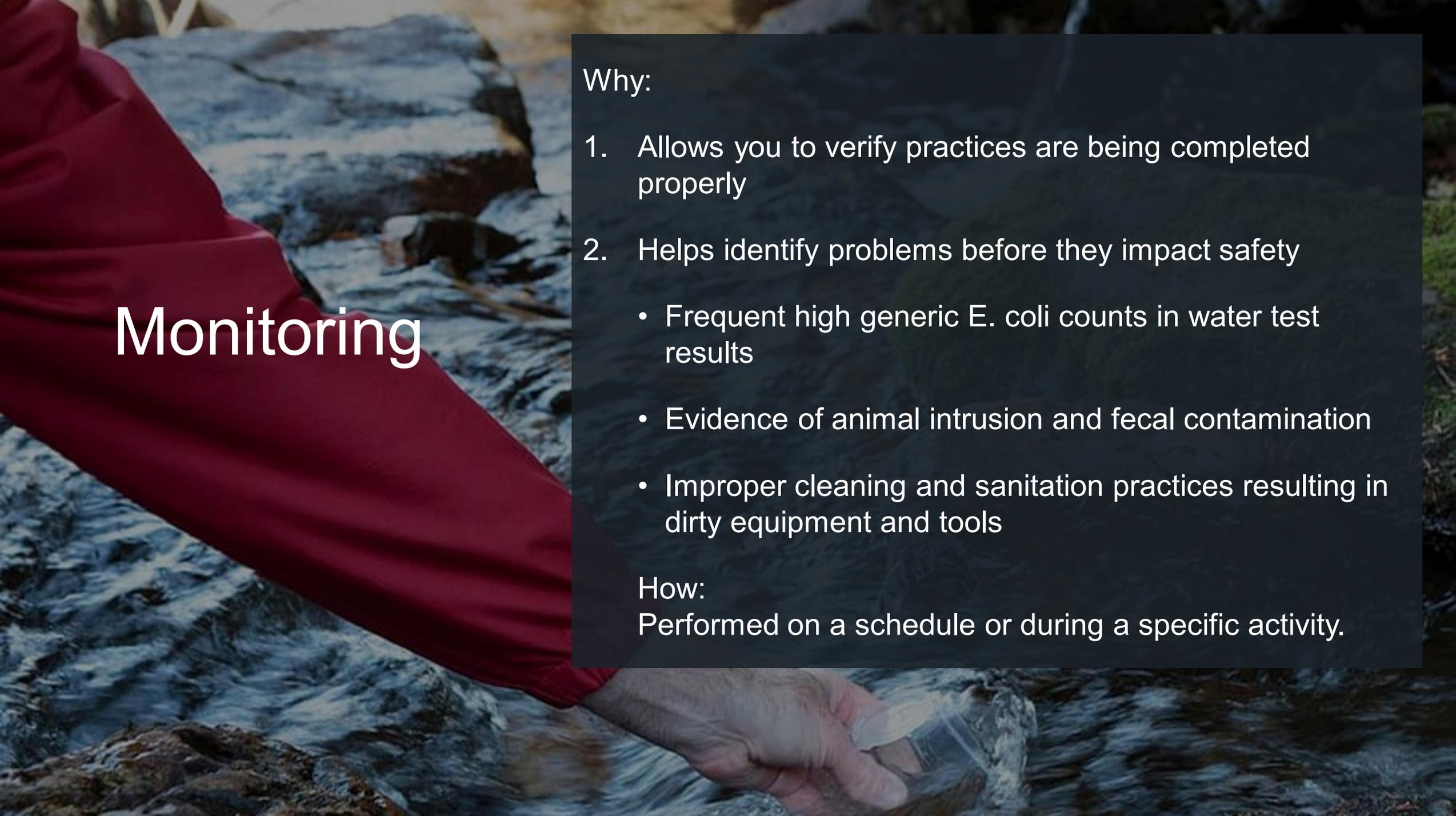
1. Worker training programs
2. Water monitoring, testing, and treatment
3. Manure and compost management
4. Wildlife and animal monitoring
5. Sanitation programs

# 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

A person wearing a red jacket is shown from the side, reaching into a stream to collect a water sample in a clear plastic bottle. The water is flowing over rocks, creating white foam. The background is slightly blurred, showing more of the stream and surrounding vegetation.

# Monitoring

## Why:

1. Allows you to verify practices are being completed properly
2. 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

## How:

Performed on a schedule or during a specific activity.

# Corrective Actions

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

# Record-keeping Benefits

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

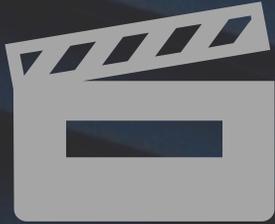
# Record-keeping

- Record-keeping includes documenting practices, monitoring, and corrective actions
- There are many templates available
- Record-keeping should be convenient, or else it will not get done
- Required records must be dated and signed or initialed by the person who performed the activity
- Some records must be periodically reviewed, signed, and dated by a supervisor or responsible party
- Keep all records for at least 2 years

# Record-keeping Basics

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

# Record-keeping Tips



## 1. 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?



## 2. Build recordkeeping into normal routines:

Place recordkeeping logs in accessible areas with necessary supplies (e.g., pens, paper)

# 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-party audits and some buyers
- Is not required by the FSMA Produce Safety Rule, but is a good idea!

# Summary

1. Produce safety impacts your farm
2. Microorganisms are the primary produce safety concern
3. Your commitment is critical to success
4. Produce safety includes: 1. Assessing risks, implementing practices, monitoring practices, using corrective actions, and keeping records. 2. Providing the necessary resources to get it done
5. A written Farm Food Safety Plan guides your produce safety efforts



# Module 2 – Soil Amendment

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# Defination

- 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
- 
- A young green plant with several leaves and a visible root system is growing in dark soil. The background is a light, clear sky. The plant is positioned in the upper right quadrant of the image.

# Soil Amendments & Food Safety Risks

1. Biological soil amendments, especially those that include untreated (raw) manure, pose significant microbial risks

2. 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

# 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

# Chemical Soil Amendments

## *Minimal risk of human pathogens*

- 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



# 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

# 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

# Minimum Application Intervals

## Untreated soil amendments:

- FDA is currently pursuing further research to support application interval of raw manure, thus, to be safe a 90 – 120 days interval are recommended
- Must not be directly applied to the harvestable portion of the crop

## Treated soil amendments:

- Zero-day application interval



# 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
- Feather meal
- Blood meal
- Fish emulsion

# 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

# Animal Manure Food Safety Cont.



# 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

# Reducing Soil Amendment Risks

- Selection
- Application Methods
- Treatment
- Handling and Storage
- Application Timing
- Record-keeping



# Treated Soil Amendments

1. Treatment requires a controlled process such as composting that decomposes organic matter and reduces pathogens
2. Temperature is the primary method of pathogen reduction for “thermophilic composting”; however, chemical and biological factors also contribute
3. Only a treatment process that has been scientifically validated ensures pathogen reduction
4. Process monitoring and record-keeping are critical to ensuring the soil amendment is adequately treated



Food safety risk with DIY composting operation – Bokashi (horticulture)

# Composting Options

***Must use a scientifically valid process:***

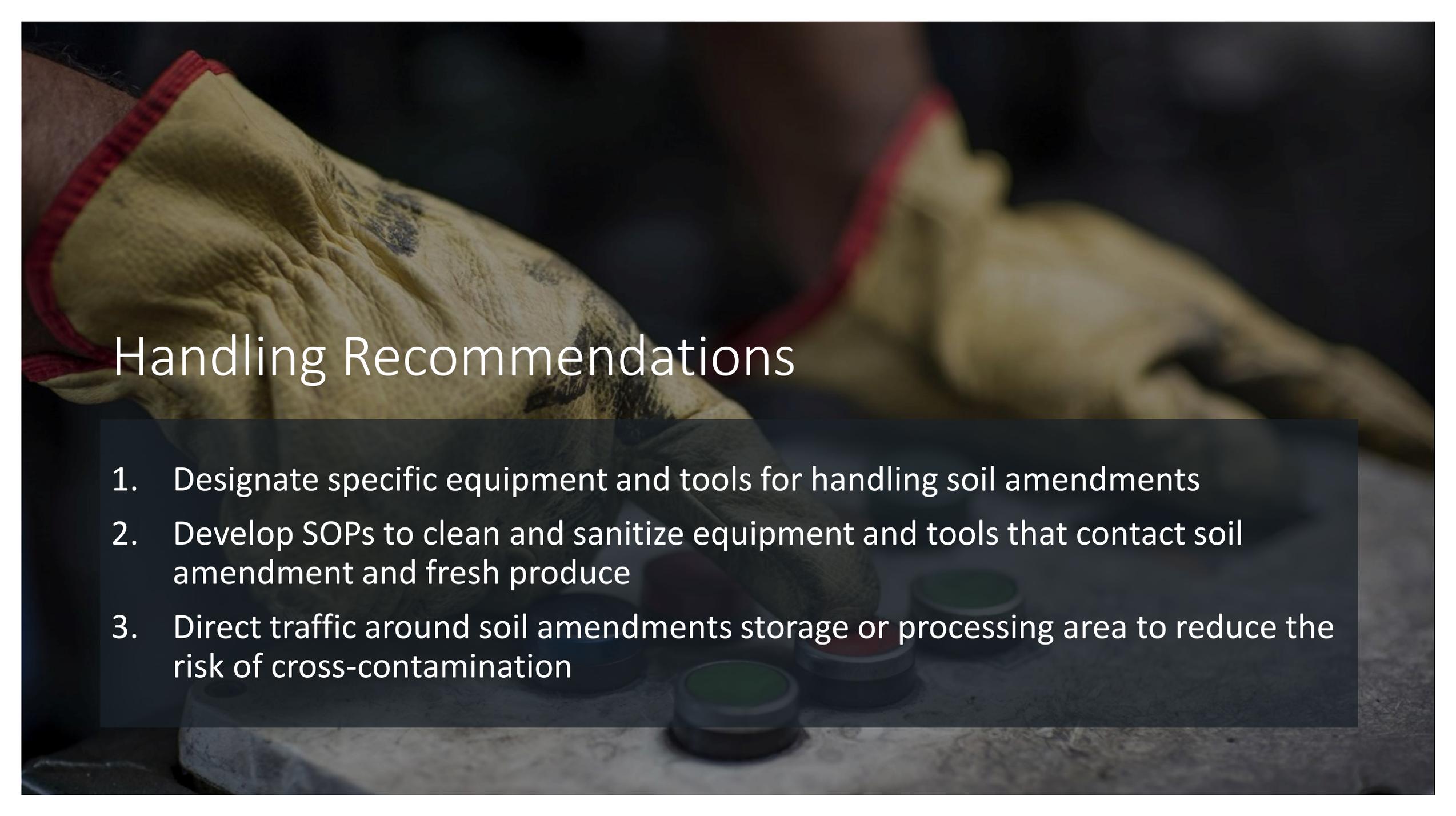
1. **Aerated static composting:** aerobic, minimum 131°F (55°C) for 3 days, followed by curing with proper management to ensure elevated temperatures throughout all materials

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

# Reducing Risks During Application

- Apply to crop not intended for fresh consumption (cover crops, grains or hay)
- Apply during non-produce field rotation
- Maximize the time between application and harvest
- Do not contact the harvestable 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

A close-up photograph of a person's hands wearing yellow nitrile gloves with red wristbands. The person is handling several small, dark-colored containers, likely containing soil amendments, on a light-colored surface. The background is dark and out of focus.

# Handling Recommendations

1. Designate specific equipment and tools for handling soil amendments
2. Develop SOPs to clean and sanitize equipment and tools that contact soil amendment and fresh produce
3. Direct traffic around soil amendments storage or processing area to reduce the risk of cross-contamination

# Storage Area Recommendation

- Minimize runoff, leaching and wind drift
  - Cover plies
  - 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 finish compost in separate area
- Minimize animal access to compost pile

# Worker training

1

Understand SOPs for properly completing tasks which requires managing raw manure or compost



2

Make sure clothes, boots and gloves are clean before handling produce



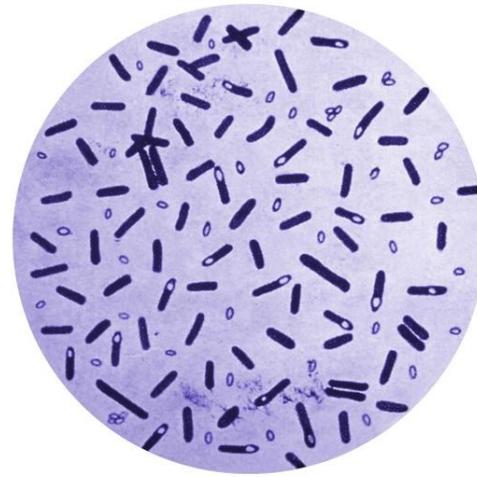
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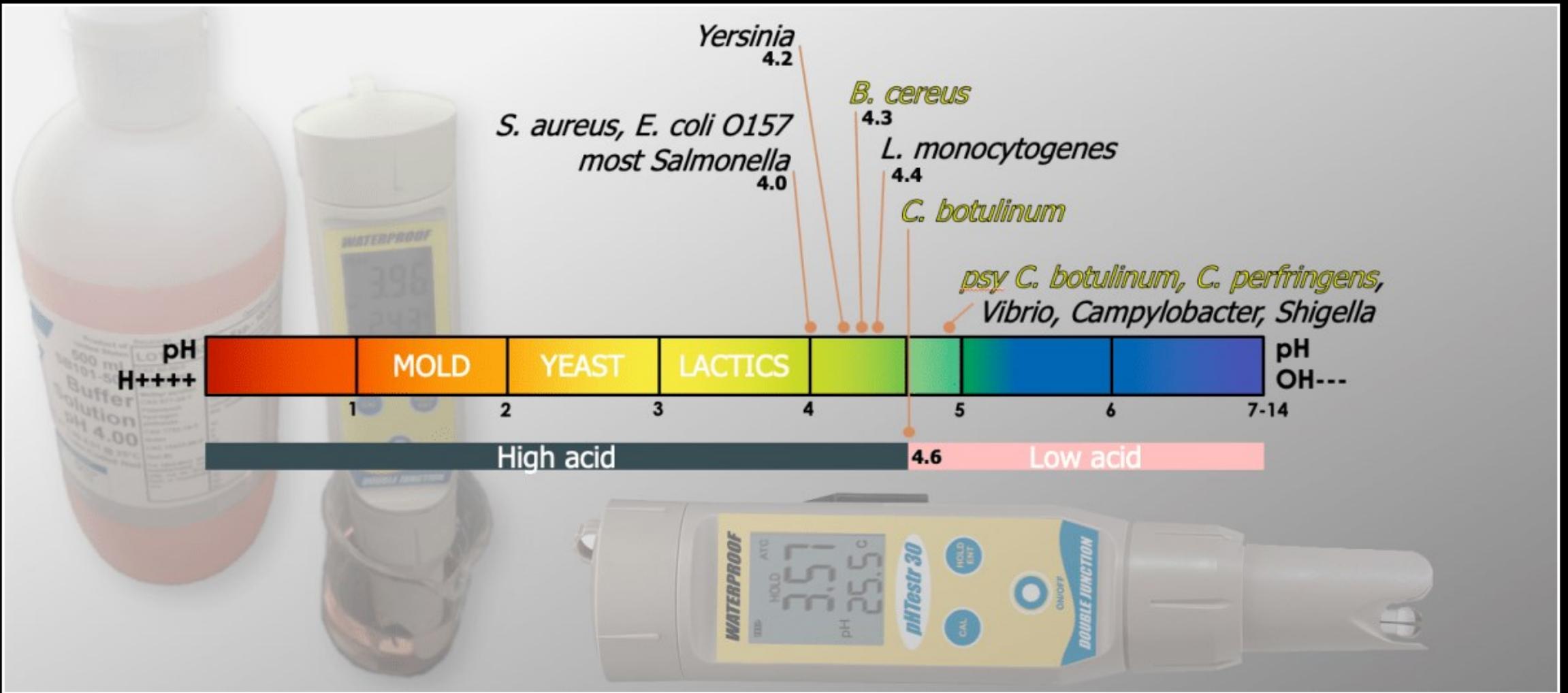
Wash hand after handling

A row of five glass jars with silver metal lids sits on a dark wooden surface. The jars contain various preserved food items: the first is mostly empty, the second has dark seeds, the third has dark seeds, the fourth is filled with dark seeds and some lighter-colored pieces, and the fifth contains a light-colored, granular substance. The background is softly blurred, showing a kitchen setting with a white cloth and wooden utensils.

# Food Preservation activities

*Clostridium  
botulinum*





Principle of preservation based on food acidity

# Canning 101

## CANNING 101:



### WATER BATH

For processing **high-acid foods**. The pH is the measurement of how acidic a food is: Foods with a 4.6 pH or less are considered high-acid.



High acid  
4.6 pH or less

### PRESSURE CANNER

Pressure canning is the only safe method for processing **low-acid foods** such as vegetables, meat, poultry, and fish. Foods with a 4.6 pH or more are considered low-acid.



Low acid  
4.6 pH or more

**★ THIS IS IMPORTANT! ★**

**Failure to adequately preserve foods in the home can result in foodborne illness.**

To learn more, check out the National Center for Home Food Preservation: [nchfp.uga.edu](http://nchfp.uga.edu)

FOR MORE INFORMATION:  
<https://ext.vt.edu/food-health/home-food-preservation.html>  
National Center for Home Food Preservation: [nchfp.uga.edu](http://nchfp.uga.edu)

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# General principles

**Caution: The level of acidity in a pickled product is as important to its safety as it is to taste and texture.**

1. Do not alter vinegar, food, or water proportions in a recipe or use a vinegar with unknown acidity.
2. Use only recipes with tested proportions of ingredients.
3. There must be a minimum, uniform level of acid throughout the mixed product to prevent the growth of botulinum bacteria.

## ***Pickles with reduced salt content:***

- Recipes for pickles with reduced sodium content are provided in [Guide 6](#) of the USDA Complete Guide to Home Canning.
- Do not attempt to make fermented pickles by cutting back on the salt required.

# Vietnamese salted lemonade

## Chanh Muối (Vietnamese Preserved Lemons)

- Makes 1 quart

### Ingredient

- 1/4 cup kosher salt, plus more to sprinkle
- 1 1/2 cups water
- 3 to 5 organic lemons (more or less, depending on how many will fit in your jar)

### Instructions

1. In a small saucepan over medium-high heat, dissolve the salt in water and then remove the brine from heat
2. Wash and scrub your lemons thoroughly to remove any wax from store-bought lemons, or any dirt from homegrown lemons
3. Slice off the top and bottom of the lemon so that a little flesh is showing
4. Liberally salt the inside of your almost-quartered wedges and set aside while you slice and salt the other lemons
5. Pack the lemons into your jar and cover them completely with brine.

