Produce Safety

BEGINNING FARMERS

What Makes Produce Unsafe?

This module will introduce participants to the basic science of microorganisms that cause foodborne illness in order to understand environmental factors that can mitigate the risks they pose to fresh produce on the farm.

TEACHING OBJECTIVES: WHY DO THIS?

- Foodborne illness risk factors are present on every farm.
- While no farm can completely eliminate food safety risk, understanding the basic science of foodborne illness-causing microorganisms and the environments in which they thrive can help beginning farmers take steps to reduce the risk of transmitting foodborne illness through fresh produce.

BEST LOCATION

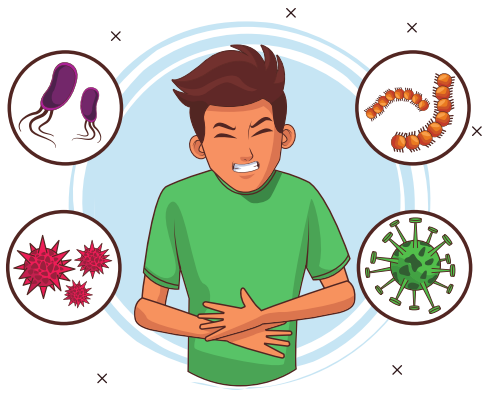
Classroom and/or on a farm

BEST TIME OF YEAR

Any time works well

LEARNING OBJECTIVES: WHAT CAN PARTICIPANTS LEARN?

- Name the categories of potentially harmful microorganisms commonly found on farms (bacteria, viruses, parasites), their characteristics, preferred environments and growth factors
- Explain how to reduce the risk of transmitting harmful microorganisms to produce through proper handwashing and sanitation practices



IMPORTANCE FOR BEGINNING FARMERS

Beginning farmers want to provide fresh, healthy and safe produce for their customers. Understanding the basic science of produce safety will help beginning farmers take action to produce safe produce and protect their business from the potential liability of people getting sick from eating unsafe produce.

UNIQUE ASPECTS OF THE CURRICULUM

This curriculum uses interactive, hands-on and visual activities to teach microbiological concepts, rather than abstract descriptions of bacteria, viruses, parasites and their characteristics.

Facilitator Planning & Preparation

Activity	Estimated Instructional Time
Primary Activity 1: Bacterial Growth Simulation	30 minutes
Primary Activity 2: Cross-contamination	30 minutes
Primary Activity 3: Handwashing	30 minutes

Technical Content

KEY WORDS

Bacteria Single-celled microorganisms that can multiply in environments outside or inside a host organism, such as a person, farm animal, or wild animal. Most can multiply very quickly, reaching high numbers in a short period of time if they are in the right environment. Examples of bacteria include E.coli, salmonella and Listeria monocytogenes.

Chemical hazards Potentially harmful substances that may be spilled or applied to produce in an improper manner, including pesticides, herbicides, fungicides, sanitizers, cleaners, fuel and lubricants.

Cleaning The physical removal of visible dirt, soil from a surface; generally involves scrubbing with a detergent and rinsing with clean water.

Cross contamination The transfer of harmful microorganisms called pathogens or germs from one person, object or place to another.

Detergent A cleaning product that helps to lift dirt, soil or other debris off a surface so that it can be brushed, wiped or rinsed off; a common example is dish soap.

Microorganisms Organisms including yeasts, molds, bacteria, viruses, protozoa and parasites that are so small they can only be viewed through a microscope.

Pathogens Commonly called “germs.” Pathogens are microorganisms that are capable of causing disease or illness; examples include bacteria, viruses and parasites.

Technical Content

KEY WORDS (continued):

Parasites A parasite may be a protozoa or intestinal worm that can multiply only in a host animal, which may be a human. Though they cannot reproduce outside of the host, they can survive outside the host for long periods of time, and a host can be affected for a long time without producing any symptoms.

Physical hazards Foreign objects (e.g., broken glass, metal shards, rocks, wood splinters, artificial fingernails, jewelry) that often end up in food due to environmental conditions and equipment that is damaged or not properly protected.

Protozoa Single-celled microscopic animals.

Sanitizer Sanitizer is any substance (e.g., bleach or peroxyacetic acid) that significantly reduces the amount of microorganisms on a surface. Importantly, sanitizers will work only on surfaces that have been cleaned first.

Sanitizing Treating a cleaned surface in order to reduce microorganisms present; sanitizing follows cleaning and is often done on food contact surfaces.

Viruses Small living particles that can multiply only in a host animal, which may be a human. Though they cannot reproduce outside of the host, they can survive outside the host for long periods of time.

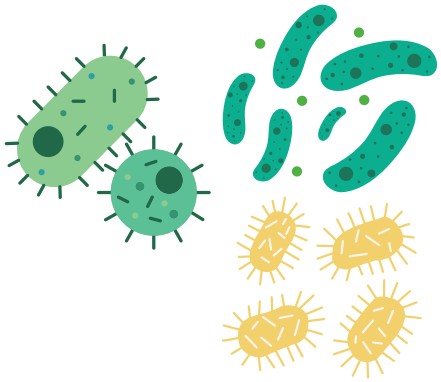
Technical Content

FACILITATOR BACKGROUND INFORMATION

- All types of produce are susceptible to contamination that can cause foodborne illness.
- Foodborne illness makes people very sick and can result in hospitalization, long-term health problems and death.Those who are more vulnerable to severe illness include young children, older adults and immunocompromised individuals.
- All farms, regardless of scale, location or type of produce grown, can reduce risks to produce safety.
- Foodborne illness is caused by contamination of fresh produce by microorganisms including bacteria, viruses and parasites. A microorganism that causes illness or disease is called a pathogen.
- Because these disease-causing organisms are microscopic, a farmer cannot easily know whether they are present. Therefore, practicing good sanitation and prevention is the best way to reduce the risk of produce becoming contaminated.
- Bacteria are single-celled organisms that can multiply extremely quickly in environments that are wet, dark and warm. Some bacteria such as Listeria even thrive in cool environments, making them even more difficult to control once present. Other examples of bacteria include E.coli, salmonella and campylobacter.

Technical Content

FACILITATOR BACKGROUND INFORMATION (continued):



- Unlike viruses and parasites, bacteria can thrive and multiply outside of an animal host.
- Bacteria can reproduce quickly and exponentially on surfaces or in water.
- While viruses and parasites cannot multiply outside of a host, they can still hitch a ride on produce and make a person sick if they eat it.
- Viruses are typically spread when produce is touched by someone who hasn't washed their hands. Only a few virus particles are needed to make someone very sick. Examples of viruses that can be transmitted on produce include norovirus and hepatitis A.
- Parasites are protozoa (single-celled animals) or intestinal worms that are often spread through contaminated water. Parasites can survive for long periods of time in the environment and are difficult to kill, even with chemical sanitizers. Examples of parasites include Giardia lamblia, Cryptosporidium parvum and Toxoplasma gondii. Toxoplasma gondii is often carried by cats.

KWL Process

Know, Want to Know, Learn

Suggested discussion questions for farmers to share from their experience:

- What have you learned from your past experience in food service roles, or just in general, about the importance of handwashing and avoiding cross-contamination?
- What kind of cleaning and sanitizing products have you tried on your farm? How did those work out? Do you have any questions about them?

Suggested discussion questions to find out what participants want to learn:

- Do you have handwashing facilities on your farm? Where are they located? Are they convenient? What do you like or not like about them?
- Do you have a policy about working when sick? What are the challenges (e.g., work not getting done, not being able to pay employees, etc.) with that?

Primary Activities

Overview of the main activities in this module

Activity 1

Bacterial Growth Simulation

Participants' current knowledge and learning opportunities around bacteria and bacterial reproduction are identified through a Know, Want to Know, Learn (KWL) process. Jelly beans in containers are used to provide a visual representation of bacteria's exponential growth pattern.

Activity 2

Cross Contamination

Using UV fluorescent powder applied to hands, produce and food contact surfaces, participants will visualize how contamination can spread on the farm.

Activity 3

Handwashing

Using UV fluorescent powder applied to hands, participants will practice various handwashing techniques and receive feedback on how well they work.

Additional Resources/Activities

Resource 1

Bacterial Growth Video

This one-minute, 38-second video complements Primary Activity 1: Bacterial Growth Simulation. It provides additional context, including the amount of bacteria that can make someone sick and the conditions in which bacteria thrive.

Resource 2

Bacteria on the Farm Infographic

This infographic complements Primary Activity 1: Bacterial Growth Simulation. It is included in the participant handouts and a .png file is also available to download from the website. It visually shows the rate in which bacteria multiply from one cell to thousands within a matter of hours.

Resource 3

Cleaning vs. Sanitizing Infographic

This infographic, included in the participant handouts and available for download from the website, could be used in a slide or as a handout. It describes the distinctly different processes of cleaning and sanitizing and provides examples of detergents and sanitizers that are appropriate and accessible (available at any supermarket or general retailer) for beginning farmers.

Review and Encouraging Further Learning

Module review and evaluation questions:

- How would you explain bacterial growth and its impact on produce safety on the farm to a new employee?
- Why should you sanitize a surface only after it's been previously cleaned?
- What are some aspects of your farm's operation that could pose a cross contamination risk?

Taking your knowledge back to the farm:

- Visit a store to explore the different types of detergents and sanitizers available for purchase. Read the labels and identify which ones would work well for your farm based on what you learned in this module.
- Walk through your farm with an eye toward conditions in which bacteria thrive: food, acidity, time, temperature, oxygen and moisture. What are some areas that will require vigilance to prevent the spread of bacteria?

1. Bacterial Growth Simulation

OVERVIEW

Participants' current knowledge around bacteria and bacterial reproduction are identified through a Know, Want to Know, Learn (KWL). Jellybeans are used to provide a visual representation of bacteria's exponential growth pattern.

MATERIALS NEEDED

- Clear plastic or glass containers of varying sizes (e.g., empty food containers with labels removed)
- Printed container labels (also provided on Page 16)
- Jellybeans

FACILITATOR BACKGROUND INFORMATION

- Bacteria are single-celled organisms that can multiply extremely quickly in environments that are wet, dark and warm. Some bacteria such as listeria thrive in cool environments, making them even more difficult to control once present. Other examples of bacteria include E.coli, salmonella and campylobacter.
- Unlike viruses and parasites, bacteria can thrive and multiply outside of a host body (animal or human).
- Bacteria can reproduce quickly and exponentially on surfaces or in water.
- Most bacteria reproduce by a process called binary fission, in which the bacteria's single cell divides into two identical cells.
- Bacteria need six things, often abbreviated as FATTOM, to thrive and reproduce:
  - Food
  - Appropriate acidity
  - Temperature (generally, bacteria grow best from 40 to 140 degrees Fahrenheit)
  - Time (bacteria double in population every 20 minutes)
  - Oxygen level
  - Moisture

1. Bacterial Growth Simulation (continued)

PROCEDURE

Prior to the first time conducting this activity, the facilitator assembles the containers by:

- Counting out the five, 20, 80, 320, and 1,280 jellybeans and placing in separate containers.
- Affixing the appropriate label to each container.

Day of activity:

- Facilitator initiates KWL conversation around the concepts of bacteria and bacterial growth.
  - What do participants already know about bacteria and how they reproduce?
  - What types of bacteria are they familiar with?
  - Under what conditions do bacteria thrive?
  - What do participants want to know about bacteria and how they multiply?
- Facilitator captures what students want to know in a shared document (flipchart, electronic document, etc.) so that these topics can be addressed during the session or as follow-up afterward.

1. Bacterial Growth Simulation (continued)

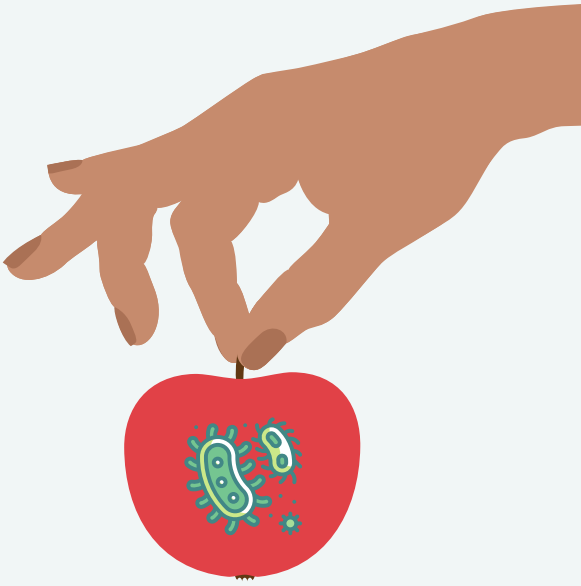
PROCEDURE (continued)

- Facilitator explains that they have created a tool to help visualize the impact of exponential bacterial growth and the impact that a small amount of bacteria can have on contaminating fresh produce.
- Facilitator introduces the jar containing five jelly beans and the scenario: “Someone didn’t wash their hands well before harvesting tomatoes and has transferred five salmonella bacteria to our tomato. When bacteria transfers from one surface to another, we call that cross contamination.”
- Next, the facilitator introduces the jar with 20 bacteria: “This tomato was one of the first to be harvested, so it sat in the crate in a nice warm area for a half hour, and then there were 20 salmonella.”
- Introduce the jar of 80 bacteria: “There were a lot of ripe tomatoes to harvest that day, so one hour later the tomato was still in a shady but warm area of the farm, now harboring 80 salmonella.”
- Introduce the jar of 320 bacteria: “After an hour and a half, our tomato is on its way to the wash pack area, now harboring 320 salmonella.”

1. Bacterial Growth Simulation (continued)

PROCEDURE (continued)

- Introduce the jar of 1,280 bacteria: “It’s been two hours since this tomato was harvested and it’s getting packed to go out to a customer. Our tomato, along with 1,280 salmonella, gets tucked in a box with a few dozen other tomatoes.
- Invite the participants to share their reactions.
- Ask the participants, “In addition to our tomato, what else potentially became contaminated in this scenario?”



1. Bacterial Growth Simulation (continued)

DIVE DEEPER

- Watch the video Bacterial Growth.
- Discuss how worker hygiene and sanitation practices can reduce the risk of bacteria being present on food or food contact surfaces.
- Share some examples, and ask participants to contribute others :
  - When you clean leftover plant debris out of bins, you remove the food source for bacteria.
  - If you spray the bins with a sanitizer after cleaning, you can further reduce the number of bacteria present.
  - When you wash your hands before working with produce, you reduce the risk of passing along any bacteria that may be hitchhiking.

VARIATIONS

- Use dry beans, corn kernels, or any other small and uniformly sized object.
- Ask participants to take guesses before disclosing the amount of jellybeans in each subsequent jar.

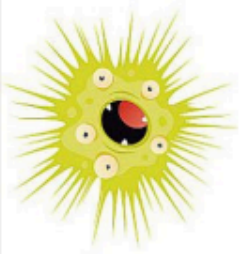
Container Labels for Bacterial Growth Simulation

0 Minutes

5 Bacteria

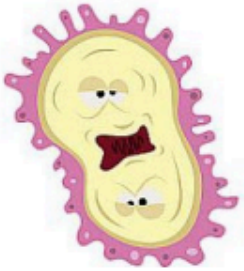
30 Minutes

20 Bacteria



1 Hour

80 Bacteria



1 ½ Hour

320 Bacteria

2 Hours

1280 Bacteria

2. Cross Contamination

OVERVIEW

Using UV fluorescent powder applied to hands, produce and food contact surfaces, participants will visualize how contamination can spread on the farm.

MATERIALS NEEDED

- UV fluorescent powder, gel or lotion, sold under brand names such as “Glo Germ” or “GlitterBug” for the purpose of food safety education
- UV light
- A viewing box* or room that can be darkened by turning off lights *Viewing box instructions can be found on page 23.
- A few pieces of produce (any type) and a few produce contact surfaces (e.g., harvest knife, harvest bin, countertop)

FACILITATOR BACKGROUND INFORMATION

- Pathogens, commonly called germs, can be spread via fresh produce and sicken those who eat it, especially if it is eaten raw, such as in salad, carrot sticks, etc.
- One way that pathogens can get on fresh produce is through contact with contaminated surfaces, such as workers hands, tools, harvest containers, etc. This is referred to as cross contamination.
- UV fluorescent powder is a commonly used tool in health care and food service industries to teach how germs can spread.

2. Cross Contamination (continued)

PROCEDURE

- Facilitator shows participants the UV fluorescent powder and explains how the harmless powder is made up of tiny particles that are roughly the same size as bacteria.
  - Explain that the powder will be used to demonstrate how germs can spread through everyday farm activities.
    - Explain that this is called “cross contamination” and define this concept: cross contamination is the transfer of harmful microorganisms called pathogens or germs from one person, object or place to another.
  - Sprinkle some powder on a surface and shine the UV light on it to demonstrate how the powder glows when illuminated with a UV light but is otherwise invisible.
  - Explain how germs are microorganisms that are too small to be seen.
  - Darken room and shine UV light on demonstration materials before any powder is applied.
- Facilitator asks for a volunteer or two to have the powder sprinkled on their hands.
  - Ask volunteers to hold out their hands and sprinkle a generous amount of powder on them.
  - Ask volunteers to interact with the produce and produce contact surfaces that have been prepared. For example, you may ask them to:
    - Put some produce in a harvest bin.
    - Hand a harvest bin to a coworker.
    - Harvest some produce.
    - Shake a coworker’s hand.
- Darken the room or retrieve the viewing box.
- Shine UV light on the produce, produce contact surfaces, and any other surfaces that you used in your simulation, such as coworkers’ hands, to see how the powder has spread.
- Ask participants to share their reactions to this activity and how it may have implications on their own farms. What preventative measures can they take to prevent cross contamination?

2. Cross Contamination (continued)

DIVE DEEPER

Come up with a list of the various food contact surfaces on a farm that could pose a cross-contamination risk.

CONNECTIONS TO OTHER MODULES

Use this activity in combination with the Handwashing activity in this module, which also uses UV fluorescent powder.

VARIATIONS

- Assign participants various roles (harvester, packer, etc.). Have them conduct harvest and packing activities as usual, while adding UV fluorescent powder to the harvesters' hands and/or tools. Afterward, shine the UV light on all food contact surfaces as well as participants' faces, clothing, cell phones, etc.
- Simulate the customer receiving and using the produce. Designate one or two participants as customers. Add additional powder to the seller's hands if desired. Give the customers shopping bags with other produce items in them for receiving the contaminated produce. Have them cut up the produce and use the UV light to see how the powder transfers to a cutting board, knife, shopping bag and other produce in the bag.

3. Handwashing

OVERVIEW

Using UV fluorescent powder applied to hands, produce and food contact surfaces, participants will visualize the effects of handwashing.

MATERIALS NEEDED

- UV fluorescent powder, gel or lotion, which is sold under brand names such as "Glo Germ" or "GlitterBug" for the purpose of food safety education.
- UV light
- Dark room or viewing box. Viewing box instructions can be found on page 23.
- Handwashing sink or portable handwashing station
- Soap
- Hand sanitizer
- Printed or digital Handwashing Playlist

FACILITATOR BACKGROUND INFORMATION

- Pathogens, commonly called germs, can be spread via fresh produce and sicken those who eat it, especially if it is eaten raw, such as in salad, carrot sticks, etc.
- Following good handwashing practices is an effective way to reduce the risk of pathogens getting on to fresh produce that comes into contact with workers' hands or surfaces that hands have touched.
- UV fluorescent powder is a commonly used tool in health care and food service industries to teach how germs can spread.

*DIY viewing box instructions can be found on page 23

3. Handwashing (continued)

PROCEDURE

- Facilitator shows participants the UV fluorescent powder and explains how the harmless powder is made up of tiny particles that are roughly the same size as bacteria.
  - Explain that the powder will be used to demonstrate germs on their hands. Explain how germs are microorganisms too small to be seen and that handwashing is an effective way to remove germs from hands, though not all handwashing techniques are equally effective.
    - Ask, “Have you ever been in a public restroom and see someone do the splash and dash?” Explain that the use of soap and scrubbing all parts of the hand thoroughly for 20 seconds is the most effective way to wash your hands.
- Facilitator asks for a volunteer to have powder applied to their hands.
  - Sprinkle a generous amount of powder on the person’s hands. Have them rub their hands together and show them to the class.
  - Darken the room or retrieve the viewing box. Shine the UV light on the person’s hands to demonstrate how the powder glows when illuminated with a UV light, but is otherwise invisible.
- Facilitator asks for two additional volunteers to have powder applied to their hands. Once three participants have powder on their hands give each volunteer one of the following sets of instructions:
  - Rinse hands with water only.
  - Use hand sanitizer only.
  - Wash hands using soap and water.
- Invite each participant to apply powder to their own hands and test out different handwashing scenarios and techniques.
  - Try washing for two seconds, five seconds, 10 seconds and 20 seconds
  - Do different scrubbing techniques work better than others?

3. Handwashing (continued)

PROCEDURE (continued)

- Facilitator concludes the activity by going over recommended handwashing technique:
  - Wet hands and apply soap.
  - Rub hands together for 20 seconds.
  - Rinse hands.
  - Turn off the faucet with a paper towel.
  - Open door with a paper towel.
  - Dispose of paper towel in wastebasket.
- Discuss how the restroom setup of a different farms might look different, but can still be effective (e.g., port-a-jons, portable sinks, indoor vs. outdoor locations, etc.)
- Ask participants to share their reactions to this activity.
  - What did you learn?
  - What surprised you?

DIVE DEEPER

Watch the purple paint handwashing video to observe an ideal method for distributing soap and scrubbing hands.

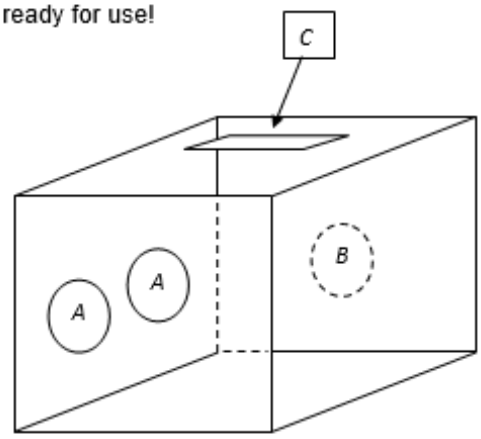
CONNECTIONS TO OTHER MODULES

Use this activity in combination with the cross contamination activity in this module, which also utilizes UV fluorescent powder.

There is an activity to build a portable handwashing station in the module "What Am I Going to Do About Produce Safety?"

Instructions for preparing a dark box

1. You will need to have: used cardboard or a medium sized box, craft knife/cutter or scissors, and duct tape.
2. Close and tape all the exposed parts of the cardboard into a box shape, or tape the corners of the box to make it strong.
3. Make two circular holes with diameter of approximately 15cm on one side of the box so that the hands of the participants can go through (positions A).
4. On one end of the box (position B) make a circular hole with diameter of approximately 15cm so that the facilitator can place the UV light inside to illuminate the box.
5. On the top of the box (position C) make a square hole approximately 10 -15cm x 20cm long, so that participants can look inside the box.
6. The dark box is ready for use!



Another example:

Glo-germ Activity Instructions: Hygiene Promotion Box

Source Link: https://watsanmissionassistant.org/?mdocs-file=10108