BEGINNING FARMERS

Produce Safety

Activity 2: Water Sampling

In this two-part activity, you'll learn how to take a water quality sample, practice taking samples of different water sources, and review test results.

KEY WORDS

Bacteria: Single-celled microorganisms that can multiply inside or outside of host organisms, such as a person, farm animal, or wild animal. Most can multiply 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.

Generic E. coli: A type of bacteria found in the intestinal track of animals, including humans. Testing water for generic E. coli is the standard protocol for produce safety as generic E. coli is an indicator of the likelihood that water contains disease-causing microorganisms.

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

SUPPLIES NEEDED

- Water sampling kit
- Handwashing station with soap, water, paper towels and waste basket
- Hand sanitizer or alcohol wipes
- Ice

Alternate Supplies

- Sampling pole (if sampling a pond, river, stream)

How Do You Do This?

Part 1 - Taking the Sample

1. Wash hands. (Wet hands, apply soap, scrub for 20 seconds, rinse, dry with paper towel, turn off faucet with paper towel, and dispose of paper towel in waste basket).
2. Have ice on hand so that the sample can be immediately placed on ice.
3. Open the test kit but do not take out the bottle.
4. Turn on the faucet or hose and let it run for several minutes. This is to flush out any dirt or debris from the system that could affect the sample.
5. Apply hand sanitizer or wipe hands with an alcohol wipe.
6. Take out the sample collection bottle but do not open yet. There is usually a preservative tablet or powder in the bottle. Do not remove this. If you think it's going to fall out when you are taking a sample that requires plunging the bottle into water, you can gently tip the bottle so that it goes into the cap for safe storage while you sample. Remember not to touch the inside of the bottle, cap or the preservative.
7. Open the bottle, being careful not to touch the inside of the bottle so as not to contaminate the sample.
8. Place the bottle under the hose or faucet stream to collect at least 100 mL.
9. Replace the cap and place the sample on ice immediately. E.coli bacteria can grow or die off in the sample between the time it is collected and the time that it is delivered to the lab, so it is important to store it properly on ice and deliver it to the lab within six hours of taking the sample.

If sampling surface water (e.g., pond)

1. Follow steps 1-7 in the above section.
2. Secure the bottle to a sampling pole. Quickly plunge the bottle into the water, avoiding any plants, algae or bottom sediments that may be present. Make sure to collect at least 100 mL of water in the bottle.
3. Replace the preservative and cap and place the sample on ice immediately.

Part 2 - Reviewing the Sample

1. Compare all the test results that the group has taken and discuss why certain locations might be more likely to have generic E. coli bacteria present.

What Does it Mean for My Farm?

Questions for discussion with co-learners:

- Where does the water used on your farm come from (e.g., city water, pond, well, etc.)?
- How do you and your crops access water (e.g., spigot, hose, watering wand, drop irrigation, sprinkler sink, etc.)?
- Can you think of ways bacteria might get into your water supply?
- Do you think you might want to test the water used on your farm?

Where to get supplies and testing for your farm:

County health departments have water sampling kits for the Drinking Water Laboratory at the Michigan Department of Environment, Great Lakes and Energy (EGLE). MSU Extension also maintains a **list of water testing laboratories** that meet FDA Food Safety Modernization Act requirements.

RESOURCES FOR ADDITIONAL LEARNING

Keep Growing Detroit Resources:

- **Connecting Your Site to City Water**
- **Rainwater Catchment Safety & Use Tips**
- **Building a Rain Barrel**
- **8-by-12** and **12-by-14** Irrigation Station - DIY Manuals

Water Testing

Water testing can be tricky. If water testing is done incorrectly, you risk unsafe food or costly and unnecessary fixes.

The first step in getting a water sample is understanding what tests you need. A widely accepted thing to test for in irrigation water is generic E. coli bacteria. Labs use different methods to test for generic E. coli. The results of some of these methods are labeled as colony forming units per 100 mL water (CFUs/100 mL) and others are labeled as Most Probable Number (MPN). For folks wanting to use safe water in farming, these labels are roughly equivalent.

Now that you know what to test for, you need to find out where the labs are. County health departments all have bottles and forms for the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Drinking Water Laboratory. In this fact sheet we'll talk about water testing using the EGLE forms and materials. When using supplies from another testing facility, addresses and forms may change, but how the test should be taken and how quickly you need to get it to the lab will not.

On the EGLE request for water analysis, choose Test Code NPEC-LO regardless of the sample source. The results will be reported in colony forming units (CFUs) per 100 mL of water. Results from the state lab will be on record at both the state and the county. Record all sampling information (including results) on the water testing log sheet.

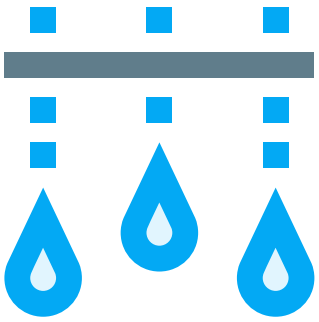
When opening the sampling bottle, it is important not to touch the inside of the bottle. We often carry E. coli on our skin and may inadvertently contaminate the sample. Even if your hands are washed, you may still have trace amounts of bacteria on your skin that can alter the test results. It is best to use an alcohol wipe or hand sanitizer prior to opening the bottle.

A curated list of water labs that do generic E. coli testing for farmers can be found at http://bit.ly/MIagwaterlabmap2.

Water Testing (continued)

Remember that accurate results depend on proper sample collection and handling. Without an accurate test, you may need to spend a lot more time and money on food safety than you have to.

Once you get your results back, the next step is figuring out what they mean. The water testing results on the following page are an example of what you might get back from a testing agency. As reported on the test results, the water sample had 1600 Most Probable Number (MPN) of coliform and 45 MPN of E. coli per 100 mL. Take a minute to find each of these numbers on the report. It's very easy to look at the wrong number and use it to make management decisions. The coliform number is a measure of total coliform. Some of these coliform might be from poop in the water, and some might just be living in the soil. It's a pretty good bet that MOST of the coliforms measured will not make a person sick.



The E. coli number tells us a little bit more about the quality of the water. First, any E. coli in the water sample lets us know that there is definitely poop in the water. There also is a greater chance that some of the E. coli might make a person sick. That said, does this mean the grower has to do something to reduce the E. coli? The answer is that it depends.

If we are using water for irrigation or crop sprays, 45 MPN will likely be alright. If you are using the water source for postharvest washing, however, it's not acceptable. Likely, a grower would either need to find an alternative water source that has no detectable generic E. coli or they need to treat the water.

Testing water can give you information you can use to better assess what to use that water for. Knowing the quality is the first step; implementing practices to mitigate any risks is the next step. Recording what you did is the final step. If a grower has specific questions about reading a water test or has difficulty tailoring food safety practices to their farm, they are welcome to contact the Agrifood Safety Work Group at gaps@msu.edu or (517) 788-4292.

Sample Water Test Report

Below is an example of a water test report recieved from a testing lab. The value that we are most interested in from a produce safety standpoint is the E.coli MPN per 100 mL. Most Probable Number (MPN) is a scientifically validated method for estimating the amount of bacteria in the sample. In this farm's 100 mL sample of water, it is estimated that there are 45 E. coli. This tells us that there is definitely poop in this water. This information allows the farm to make managment decisions about when it is safe to use this water for farming. This water cannot be used for handwashing, washing produce, or any postharvest activities. If the crop will not be harvested right away, it's probably OK to use this water for irrigation and sprays as the bacteria will have time to die off in the sunlight before harvest.

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Name: Berrien Conservation District
3334 Edgewood Rd.
Berrien Springs, MI 49103

Date: February 14, 2022

Laboratory Analysis Report

Sample	Sample Date	Code	Coliform MPN per 100ml	E.coli MPN per 100ml	Nitrate (N) ppm
Galien River: Lancor Farm 17505 Gardner Rd. Galien, MI	2/10	11:30AM Outside	1,600	45	< 1

EGLE Lab #8000
MI Dept of Environment Great Lakes & Energy

< = Less than
MPN = Most Probable Number

Method: Standard Methods for the Examination of Water & Wastewater 9223B with Quanti-Tray, 4500NO3D

Great Lakes Scientific maintains accreditation to ISO/IEC 17025:2017 for the specific tests listed in PJLA Certificate # L21-759. The results above relate only to the analysis tested and to the samples as received by the laboratory. Limits of detection and measurement variability are available upon request. This report may not be reproduced, except in full, without written approval of Great Lakes Scientific.

Lab Director: Wayne E. Gleiber, Ph.D.

Microbiological testing started: 02/10/22 5:00PM

Report No. 20819
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Steps to Taking a Good Water Sample:

1

Do not open the sampling bottle until you are ready to collect the sample. Airborne bacteria can also alter test results.

2

When sampling from your irrigation system, water should be collected directly into the sampling bottle. Water that is collected into another container could pick up contaminants along the way. Run the water for several minutes to flush dirt and debris out of the system.

3

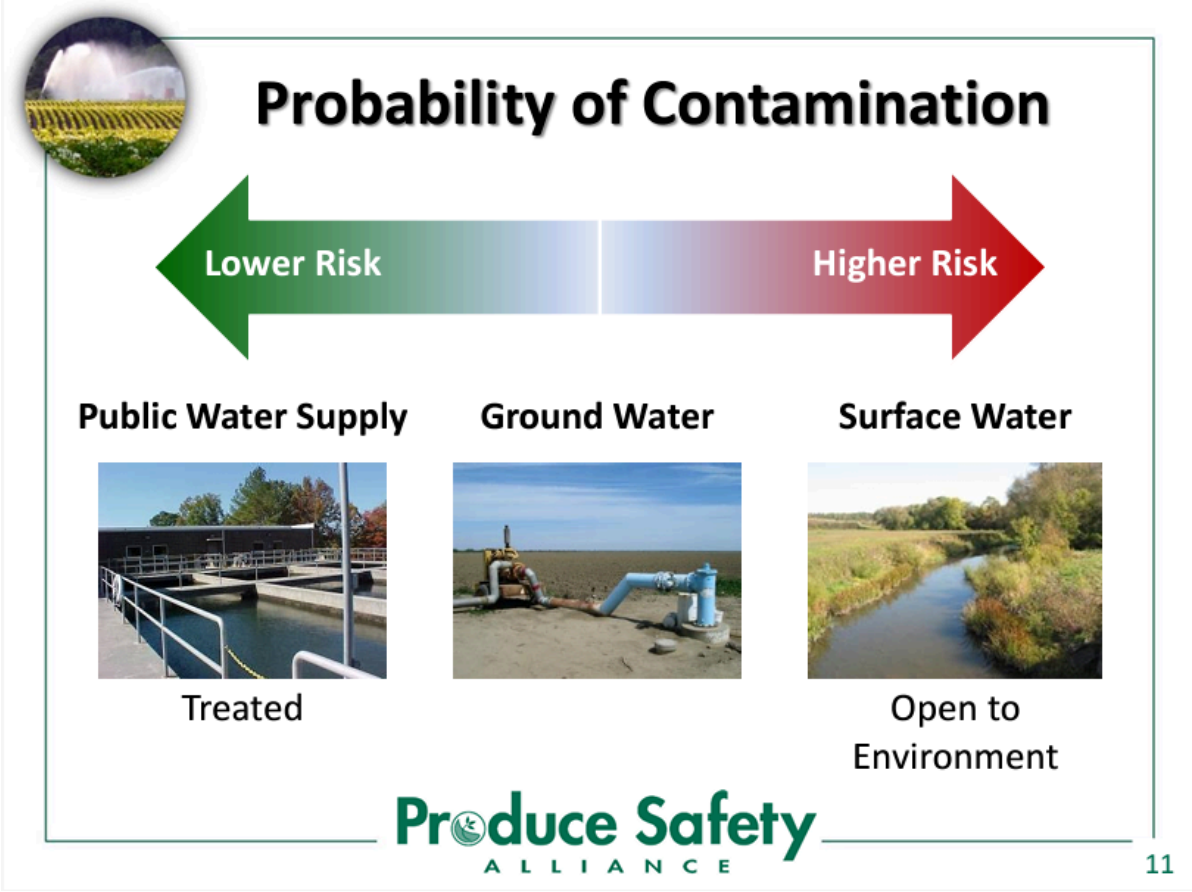
When taking a sample from a pond, lake or stream, secure the bottle to a sampling pole. Quickly plunge the bottle into the water, avoiding plants, algae and bottom sediments. Make sure there is at least 100 mL in the bottle. Keep in mind that there is usually a preservative tablet or powder in the bottle. Keep the preservative safely stowed in the cap while you sample, then add it to the water.

4

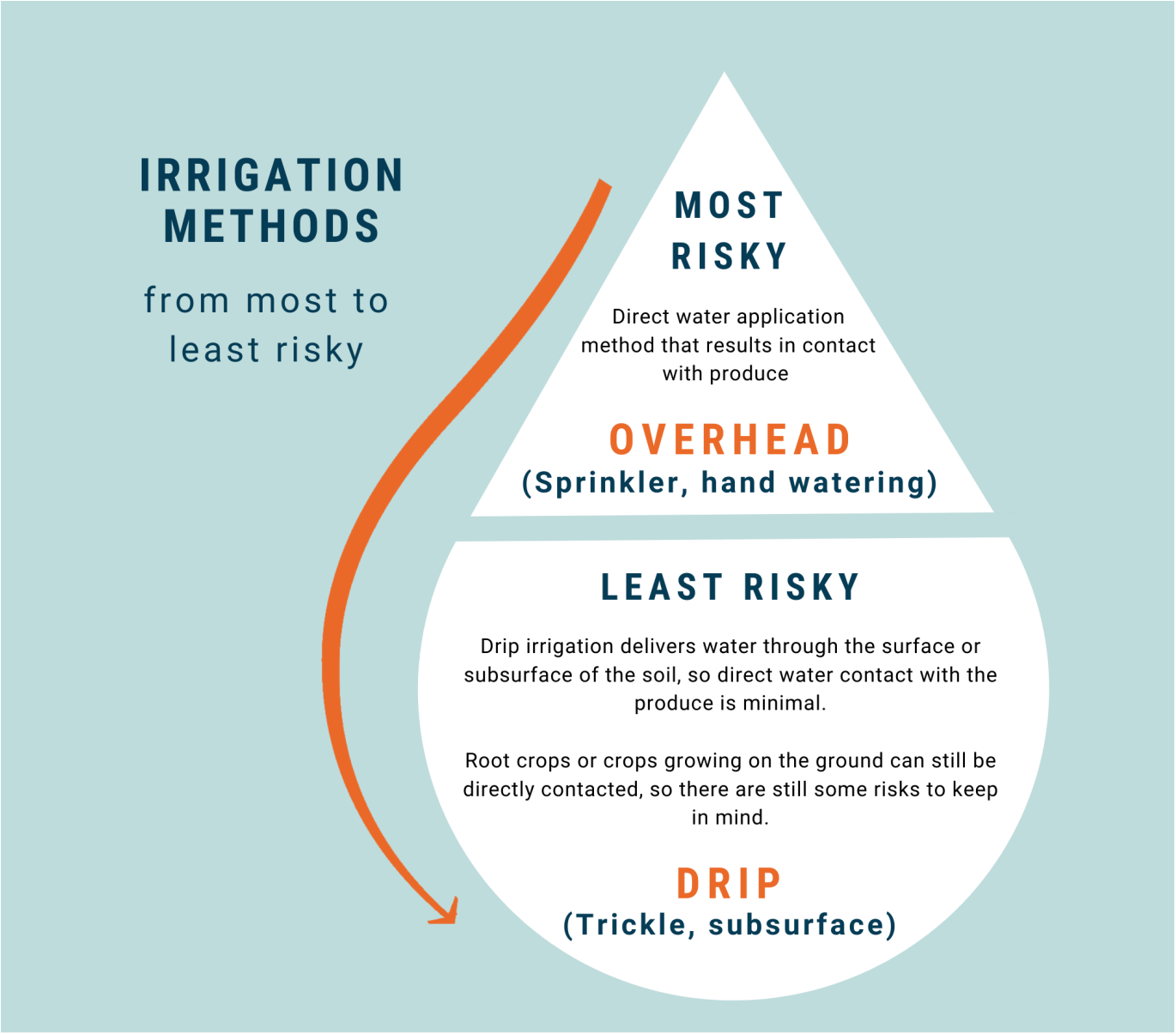
The sample must be put on ice immediately and delivered to the testing lab within six hours. E. coli can grow or die off between the time the sample is collected and the time the sample is delivered to the laboratory, so collect, store and transport the sample properly within six hours, on ice.

Probability of Water Contamination by Water Source

This graphic from the Produce Safety Alliance Grower Training Curriculum shows the spectrum of risk based on the source of water. Public or municipal water is treated and presents the lowest risk. Ground water may be very low risk or higher risk depending on the condition of the well; for example, whether it is capped or open to the environment. Surface water is the riskiest source because it is open to the environment. Surface water includes natural sources such as ponds or streams, but also rainwater systems such as barrels or cisterns. The risk of surface water being contaminated can be reduced by using drip irrigation, water treatment or application intervals for irrigation and sprays.



Risk Levels of Different Irrigation Methods



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