



## Tools for On-Farm Food Safety

### Water Testing 101 Agricultural Water Quality Testing and Interpretation

Water is extremely important in ensuring food safety since it can potentially contaminate produce with disease-causing microorganisms. Since water is used for irrigation, chemical applications, postharvest washing, and other purposes, routine water testing should be included in your on-farm food safety strategy.

Although the Agricultural Water Standard (Subpart E) under FSMA's Produce Safety Rule is currently under revision, it might be helpful for produce growers to understand the general quality of their water from surface, well or municipal sources, applied to fruit and vegetable crops during their growing activities. Farmers can use the information in this fact sheet to understand how to evaluate water quality used in growing produce.

#### Water testing frequency

If your farm's water source is:	Test:
<b>Municipal/public water system</b>	Not required, but consider testing at outflow if farm distribution system is old, recently modified or potentially compromised. <sup>1</sup>
<b>Well water and springs (drilled, dug &amp; driven point wells/ground water sources)</b>	At least one time per year <ul style="list-style-type: none"><li>• Beginning of the season</li></ul>
<b>Surface water (ponds, streams, rivers, lakes, ditches)</b>	At least 3 times per year <ul style="list-style-type: none"><li>• Start of the season</li><li>• Peak use</li><li>• Prior to harvest</li></ul>

**Water testing terminology:** Test results can be reported in several ways. Below are short descriptions of common bacteriological test methods:

**CFU** – colony forming unit; an estimation of bacterial population based on the number of colonies that form in or on nutrient agar, or on a filter placed on top of an agar plate.

**MPN** – most probable number; an estimation of bacterial population based on a series of positive and negative test results. Most common for total coliform or generic *E. coli* (usually not used with other bacterial tests).

**P/A** – presence or absence of target bacteria (commonly total coliform or generic *E. coli*) in the water sample depending on the test requested. The results may also be reported as detected or not detected, or undetected, or less than 1 in the volume tested. No bacterial colony count is given, meaning the extent of the contamination is not reported, only the existence of contamination.

**Quantify or quantitative** – this means an actual concentration of generic *E. coli* is determined (must specify when requesting the test). This level of information can be helpful for evaluating the extent of the contamination, best treatment protocols, and post-treatment effectiveness. Quantitative results are necessary for calculating statistics, like the geometric mean of a set of water samples.

#### Testing for pathogens

Total coliform and *E. coli* are fecal indicator bacteria. Their presence indicates the potential for contamination of water with harmful bacteria, such as *Salmonella*, that are found in feces. The presence of these indicator organisms does not automatically mean that your water actually contains disease-causing bacteria, but it does

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<sup>1</sup> Most municipalities will provide public water system test results upon request.

indicate that the water has been exposed to a potential source of bacteria. Depending on the level of bacteria and the intended use, corrective action may be necessary.

**Total coliform** are present in both soil and feces, so their presence does not necessarily imply fecal contamination or an imminent health risk. However, total coliform in water samples are used to indicate intrusion of outside water in a 'closed system' like municipal or piped well water. A properly constructed and maintained closed water system should not have total coliform present. Their presence would indicate that the system is not completely closed, since the presence of bacteria in this group indicates the possibility, but not the certainty, that disease organisms may be present in the water.

Absence of total coliform means there is a low probability of disease-causing organisms. This reliably predicts the bacterial safety of drinking water relative to the hundreds of possible diseases. It is impractical to test for every type of disease-causing organism. For a public water system, a positive test would mean an 'Immediate public health threat; public notice and boil order to users (within 24 hours) due to the higher likelihood of disease organisms being present in the water.'

**E. coli** is a specific species within the total coliform group. In general, *Escherichia coli* only originate in the intestines of animals and humans, and have a relatively short lifespan in the environment. The presence of *E. coli* indicates a strong likelihood that human or warm-blooded animal waste has entered the water source. *E. coli* testing provides an indicator of fecal contamination.

**Giardia** has a protective outer shell that allows it to survive outside the body for long periods of time and it is tolerant to chlorine disinfection. This means that, especially in treated water, *Giardia* may be present even when fecal indicator bacteria were killed off by chlorination. Drinking water and recreational water are the most common sources of transmission, but food or soil are also known sources. Humans, dogs, cats, birds, cattle, beavers, deer and sheep are known hosts.

**Cryptosporidium** is very similar to *Giardia* and can survive for long periods of time outside a host. It is also resistant to many common disinfectants, and highly resistant to chlorine. Hosts are similar hosts to *Giardia*; transmission can be by food, poor hygiene or water.

Specific tests are required to determine the presence of *Giardia* and *Cryptosporidium*, as there are no effective indicator organisms, especially in treated drinking water. Note that most county health departments do not test for *Giardia*.

**Collecting water samples:** Testing labs will generally provide sterile bottles for collecting 100-ml samples along with instructions on how to collect and ship. Sample water under the same conditions you would normally use for irrigation unless you suspect contamination. Ideally water samples should be collected as close as practicable to the point where water contacts the produce.

**Water used for drinking and washing of hands and produce** - collect at the tap.

**Overhead or drip irrigation water** - collect from the pump discharge vent or a sample-shunt valve.

**Surface water** - collect directly from the water body. Avoid wading and stirring up residue during collection; and avoid sampling after a heavy rain or during high flow. Collect the sample from the shore by attaching the sample bottle to a pole and submerging the bottle to the level of the intake pipe.

**Interpreting water quality results:** Guidelines for agricultural water used for irrigation, fertilizer and other production applications are based on the Environmental Protection Agency's recommendation for recreational (swimming) water. Water exceeding 126 CFU or MPN/100 ml under repeated sampling (or a single sample of 410 CFU or MPN/100ml) should be retested, not used, or used in a way that reduces the potential for contaminating produce.