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Good Agricultural Practices (GAPs): Irrigation Water Treatment for High *E. coli*

What should you do if your water test results show that levels of generic *E. coli* exceed the maximum recommended amount? Before investing in a system to clean and sanitize your irrigation water, do a **visual survey of your water sources** to investigate what is causing the elevated microbial counts. Below are several strategies to consider.

Check Surface Water for Environmental Contamination

While performing a survey of your water sources, ask yourself:

- Is there evidence of animal intrusion into the water source (livestock, domestic, or wild animals)? Is it possible to fence animals out or prevent birds from landing?
- Are animal pastures, buildings, or manure storage located uphill from water sources? Is it possible to build a berm to divert runoff away from the water source?
- Has it been unusually rainy? Although it seems like rain would dilute bacterial counts in water sources, high amounts of precipitation can increase *E. coli* counts.
- Are backflow prevention devices installed and properly functioning?
- Is the irrigation intake valve floating above the sediment? If the intake is pulling up sediment, it may lead to higher bacterial counts.

If Your Water is from a Well, Check the Structural Integrity of all Parts

Inspect the well casing:

- Is it cracked or corroded?
- Are there any areas that allow leaking and contamination into the well?
- If so, can the cracked areas be patched?
- Is the well cap broken or missing?
- Do any seals appear to be broken or missing?

What Can You do When Microbial Counts are High?

If possible, **switch to an alternative water source** with acceptable test results while bacterial counts remain high in the original source. If there is not an alternative water source, is it possible to switch to a **less-risky irrigation method**? For example, you can use trickle/drip irrigation instead of overhead irrigation.

After making any changes to reduce contamination, give the water source a few weeks to settle out, then take another water test.

If you survey the water sources and cannot identify a potential source of contamination, and a resulting test does not show a decrease in levels of *E. coli* bacteria, then **mitigation measures might be necessary**.

There are Several Disinfection Options for Agricultural Water Sources

"Shock" the well with chlorine. Often used for new wells, shock chlorination is a one-time treatment designed to kill bacteria in the well. It is cheap and often effective. This is the only disinfection option that treats the water source. When shocking the well, a 200 ppm chlorine solution (often using household bleach, or sodium hypochlorite) remains in the well and plumbing system for several hours to overnight. Afterwards, the water is pumped until there is no chlorine smell and chlorine test strips register low levels.

Colorado State University has published a detailed guide to shocking wells, *Bacteria in Water Wells*, which can be found at: http://extension.colostate.edu/docs/pubs/natres/06703.pdf.

Install an Ultraviolet (UV) filter. Often used in dairies, a UV filter can effectively and quickly kill microorganisms in water. UV filters can be fairly expensive upfront and do require electricity. The operating costs and upkeep, however, are minimal. UV filters may be more appropriate with wells and trickle irrigation due to the relatively slow water output.

Antimicrobial chemicals:

Chemical injector system. For relatively low-flow irrigation systems (such as trickle irrigation and postharvest water), you can use a chemical injector or chemilizer to inject small amounts of sanitizer into the irrigation system. Chlorine bleach or peroxyacetic acid (PAA) can be used very effectively. As small concentrations of sanitizer are mixed into the irrigation water, microorganisms are killed off and the sanitizer is degraded.

This system will also prevent iron-forming bacteria from clogging drip emitters. Setting up this system will require you to test the levels of chlorine at the beginning of the system and at the emitters. Chlorine concentrations of 4 ppm or less in the released water are desired.

More information on treating drip irrigation systems with sanitizers can be found at: http://www.netafimusa.com/files/literature/greenhouse/Maint_Treatment-with-Chlorine.pdf and at: https://prod.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_068454.pdf

Calcium hypochlorite chlorination system. This type of system uses calcium hypochlorite tablets, similar to swimming pool chlorination, to sanitize water. It is suitable for high-output water needs, such as overhead irrigation. As water is pulled in through the intake, pressure builds up and a small amount of water is diverted and run through the chlorine tablets. The chlorinated water then mixes with the rest of the water as it runs through the system, diluting the sanitizer to low levels. Information about the commercial product can be found in the sources.

Sources:

Accutab Irrigation System. http://accu-tab.com/Applications/Food-Safety-Irrigation/Irrigation

Colorado State University, *Bacteria in Water Wells.* http://extension.colostate.edu/docs/pubs/natres/06703.pdf.

Netafim. USA.*Recommendations for the Treatment of Drip Irrigation Systems with Chlorine.*. http://www.ext.colostate.edu/pubs/natres/06703.html

U.S. Department of Agriculture, Natural Resource Conservation Service. *Manual for Chlorine Treatment of Drip Irrigation Systems*. https://prod.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_068454.pdf

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