University of Kentucky
College of Agriculture,
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Cooperative Extension Service

Center for Crop Diversification
Produce Food Safety Publication
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Food Safety Modernization Act (FSMA): Produce Safety Rule Agricultural Water, Part 2

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Introduction

Although the compliance dates for the Produce Safety Rule Agricultural Water have been extended, growers are encouraged to start familiarizing themselves with the process of water sampling. In continuation to *Food Safety Modernization Act (FSMA): Produce Safety Rule Agricultural Water, Introduction* that discussed the different types of water sources, how to calculate a water sample and a brief overview of how to properly take a sample, this paper will explain in detail how and where to take water samples for testing. In addition, it will also provide details on how to read and understand the results of your water test and how to build a water profile. Finally, it will include a list and map with the locations of all labs with approved methods to make compliance as simple as possible.

Sampling 101

1. Prepare a Sampling and Analysis Plan (SAP), which describes the sampling locations, numbers and types of samples to be collected, and the quality control requirements of the project.

2. Check with the laboratory before collecting samples to ensure that sampling equipment, preservatives, and procedures for sample collection are acceptable. It is best to obtain sampling supplies directly from the laboratory that will be performing the analyses. Gather all equipment and supplies necessary for sampling.

3. The acids and bases used in the preservation of many types of samples are dangerous and must be handled with care. Always wear gloves and eye protection when handling preservatives. When opening a preservative bottle, particularly a glass ampoule, break open the ampoule away from yourself and others. Have acid/base neutralization supplies (baking soda) on hand in the event of a spill.

4. Collect samples in an area free of excessive dust, rain, snow or other sources of contamination.

5. Select a faucet for sampling that is free of contaminating devices such as screens, aeration devices, hoses, purification devices or swiveled faucets. Check the faucet to be sure it is clean. If the faucet is in a state of disrepair, select another sampling location.

6. Collect samples from faucets that

Kentucky Labs Eligible for FSMA Water Testing

Lab / Facility Name	Address	Telephone number
Waters Agricultural Laboratories, Inc.	2101 Calhoun Road Highway 81 Owensboro KY 42301	270-685-4039
HydroAnalytical	2413 Nashville Road Bowling Green KY 42101	270-745-5287
Fouser Environmental Services	165 Camden Avenue Versailles KY 40383	859-873-6211
Hall Environmental Consultants	1376 Danville Loop 1 Road Nicholasville KY 40356	859-885-3331
Microbac Laboratories	2520 Regency Rd Suite A Lexington KY 40503	859-276-3506
Beckmar Environmental Laboratory	3251 Ruckriegel Parkway Louisville Ky 40299	502-266-6533
Logan/Todd Regional Water Commission	248 Tower Street Guthrie KY 42234	270-483-6990
White Mills Laboratory/Hardin County Water District No. 2	1300 Cave Road Glendale KY 42740	270-862-3213
Mineral Labs, Inc.	309 Parkway Drive Salyersville, KY 41465	606-349-6145
Microbac Laboratories	2520 Regency Road Lexington KY 40503	859-276-3506

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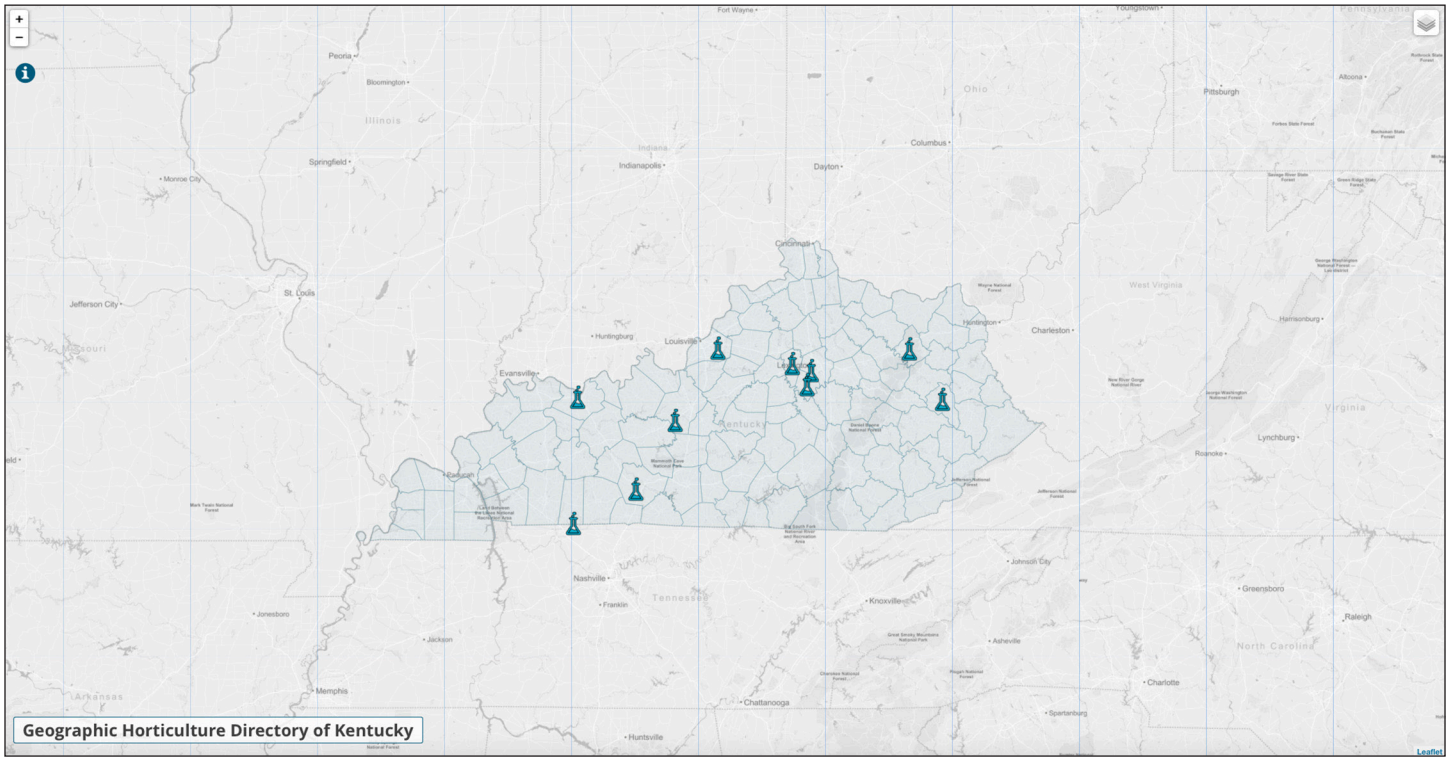
Figure1. Map of water testing facilities in Kentucky with FSMA approved testing methods



are high enough to put a bottle underneath, without contacting the mouth of the container with the faucet.

7. Allow the water to run just a bit before collecting the sample. Generally 2 to 3 minutes will suffice, however longer times may be needed, especially in the case of lead distribution lines. Generally, the water temperature will stabilize, which indicates flushing is completed. Once the lines are flushed, adjust the flow so it does not splash.

8. Use a sample tag to record the site location, the name of the sampler, date and time of collection, method of collection, type of analysis to be completed, and preservative used. Attach the sample tag to the bottle.

9. Fill out the chain of custody form with the sample collection information.

10. Deliver or ship samples to the laboratory to ensure that holding times are met.

11. Return empty preservative containers to the laboratory for proper disposal.

Water Testing Facility Map

A map of water testing facilities available in Kentucky (**Figure 1**) can be found by following the link http://www.uky.edu/ccd/maps. Once you are on this web page click on the "Geographical Horticulture Directory of Kentucky." Using the features tab in the upper right-hand corner check the box labeled "Water Testing Lab" and uncheck the other boxes. Then, click on the water lab of interest and you will be able to see the name of the lab, address, and contact information. You will also be able to see if the lab offers on-site testing or if you would need to drop off the sample. It is always a best practice to contact the lab before you use them so that they can inform you of any extra details that you may need to know.

Importance of Evaluating Water Quality

1. Water testing is the only way to quantitatively determine the microbial quality of water being used.

2. The water quality profile is a long-term management strategy, which will enable growers to understand:

- The quality of the water source
- Appropriate use of each source
- Determine corrective actions if the microbial water quality profile exceeds numerical Geometric Mean and Statistical Threshold Value criteria in accordance with FSMA PSR (Produce Safety Rule)

Water Test Result Interpretation

Figure 2 is an example of a report that growers will receive after they submit their water sample for testing. This report will generally have the lab name, farm name, date and time when the sample was taken, date and time when the sample was received, test requested

Figure 2. Example of water sample report a grower can expect to receive from the lab that is compliant with PSR requirements.

Water Labs, Inc.
CERTIFICATE OF ANALYSIS

ABC Farms
123 Farm Lane
Lexington, KY 40514

Date Reported	06/01/2018
Date Due	06/09/2018
Date Received	05/31/2018
Customer #	A1234

Produce Irrigation

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 01									Sampled 05/31/2018 @ 8:43	
Sampled By Customer										
E. coli			43.9	MPN/100mL			SM9223B (Colilert-18)	1.0	06/01/2018 15:44	ABC

by the grower, results, and testing method. For the example above, Colilert-18, which is an accepted quantification method for FSMA, was used. In this testing method, results are given in MPN/100mL (Most Probable Number). This is the number that growers will use, along with other sample results, throughout the year, to develop a Microbial Water Quality Profile (MWQP). Specifically, in this example, the number that will be recorded is 43.9 MPN/100mL.

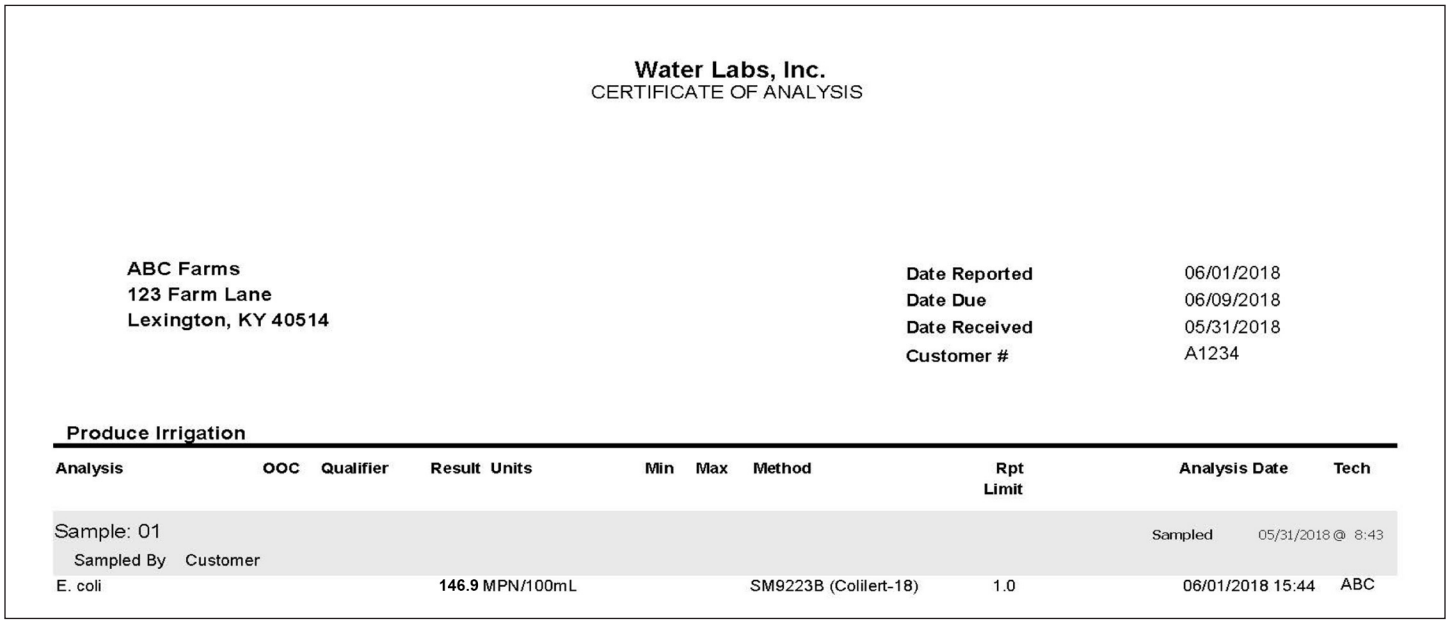
To better interpret the results, it is important to understand the units that the results are reported in and how they relate to the water quality. Units of MPN or Most Probable Number of coliforms, as seen in the example, is the statistical probability of the number of organisms per 100mL of the sample. Another unit that is often seen is CFU, or Colony Forming Units, which is the actual number of colonies that microbiologists can see growing per 100 mL of sample. The reason for getting results in MPN versus CFU or vice versa is based on the method that the lab chose to use. Methods that yield MPN are often faster and cheaper than those that yield CFU and therefore are more common. However, whether MPN or CFU is used, the number should still be compliant with the PSR requirement of GM - 126 or less CFU generic *E. coli* per 100mL water AND STV- 410 or less CFU generic *E. coli* per 100 mL water (Vijayakumar, P.P. (2018) - http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/FSMA_Water_Introduction_Final_update.pdf).

As discussed previously, an MWQP will be created for records. There are two different profiles, one for groundwater and one for surface water. Both have initial testing requirements as well as annual testing requirements, but the number of samples differs. Groundwater has an initial testing requirement that a sample must be taken at four (4) or more times during the growing season or over the period of a year. To maintain compliance with testing requirements, one (1) or more sample must be taken and included into the profile every year after that initial year. Surface water is a little more demanding and it requires samples to be taken twenty (20) or more times over a period of 2-4 years for the initial profile. However, after the initial profile is complete, only five (5) or more samples have to be included in the MWQP to maintain compliance. It should be noted that profile samples must represent the water being used and must be collected at various times before harvest. **Figure 2** is an example of a result that is compliant. 43.9 MPN/100mL is less than the 126 or less CFU generic *E. coli* per 100mL water GM. **Figure 3** (see next page) is an example of a result that is NOT compliant with the 126 or less CFU generic *E. coli* per 100mL water GM. If a grower receives a result that is not compliant with the PSR requirements, then the grower will have to take corrective action such as one listed below.

Corrective Actions

In accordance with FSMA Produce Safety Rule, three

Figure 3. Example of water sample report a grower can expect to receive from the lab that is NOT compliant with PSR requirements.



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ABC Farms
123 Farm Lane
Lexington, KY 40514

Date Reported	06/01/2018
Date Due	06/09/2018
Date Received	05/31/2018
Customer #	A1234

Produce Irrigation

Analysis	OOC	Qualifier	Result	Units	Min	Max	Method	Rpt Limit	Analysis Date	Tech
Sample: 01									Sampled 05/31/2018 @ 8:43	
Sampled By Customer										
E. coli			**146.9**	MPN/100mL			SM9223B (Colilert-18)	1.0	06/01/2018 15:44	ABC

main types of corrective measures are allowed in case of any deviation with the microbial water quality profile or if the water does not meet the quality criteria:

1. The risk from production water may be reduced by maximizing the time for microbial die-off (0.5 logs/day) between last application and harvest. The 0.5 logs/day die-off rate equals approximately 68.38 percent microbial die-off after one day, and 90 percent die-off after two days.
   - The microbial die-off can be between last water application and harvest or
   - Between harvest and the end storage and/or
   - Removal during activities such as commercial washing

As an example, for the above-mentioned corrective action, if the microbial water quality profile shows a GM of 1,000 CFU generic *E. coli* per 100 mL of water:

- A time interval of 1 day with a 0.5 log per day (or 68.38 percent) reduction results in a GM of 316 CFU/100 mL (31.62 percent of the 1,000 CFU remaining).
- A time interval of 2 days would result in a GM of 100 CFU/100 mL (10 percent of the 1,000 CFU remaining), meeting the GM criterion of 126 CFU/100 mL. In this situation, the grower must wait two days before harvesting the produce to meet the FSMA water quality profile requirement.

2. Re-inspecting water system for identifying the potential source of the problem along with making necessary changes to prevent the problem from reoccurring.

3. Treating the water source (any chemicals used to treat water must be EPA registered and labeled for intended use)

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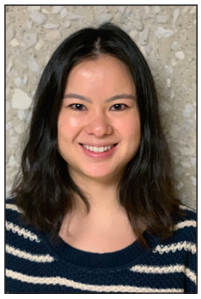

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