

A GUIDE TO TESTING SOIL FOR HEAVY METALS

The Safe Urban Harvests (SUH) study collected and tested soil¹ samples from farms and gardens during the 2017 growing season to answer questions about risks of exposure to heavy metals for urban farmers and gardeners in Baltimore and to promote safe growing practices. We have since received additional questions from participants about where, when, and how to test their soil in the future. We have compiled this guide to help answer some of these questions.

WHY SHOULD I TEST MY SOIL?

Most conventional soil tests measure the levels of essential and beneficial elements for plants (e.g., nitrogen, phosphorus, potassium, calcium, copper, iron, magnesium, manganese, zinc). These fertility tests provide valuable information for gardeners interested in improving the health and quality of their soil and produce.

In contrast, the Safe Urban Harvests study measured the levels of heavy metals that are harmful to human health (arsenic, barium, cadmium, chromium, lead, and nickel) in the soil, water, and produce of urban farms and gardens in Baltimore. Heavy metal contamination tests provide valuable information about the presence of harmful metals in soils and can help inform safer growing practices that limit contact with soils with high levels of metals.

WHERE CAN I HAVE MY SOIL TESTED?

There are a variety of labs and soil tests to choose from to accommodate different budgets and preferences. Table 2 [on page 5](#) contains information on these various factors to consider when choosing a testing service, including which labs test the same metals that are harmful to human health as we tested in the Safe Urban Harvests study (arsenic, barium, cadmium, chromium, lead, and nickel).



¹ We also tested irrigation water and produce samples at many sites. Given the findings of our study, we do not feel that testing irrigation water repeatedly is necessary. Once we receive the produce results from the study, we will follow up with a guide to testing produce if we feel it merits re-testing in the future.

HOW OFTEN SHOULD I TEST MY SOIL?

To our knowledge, human health-risk based recommendations for how often to test soil for heavy metals do not exist. However, some state Extension offices have recommendations for frequency of soil testing to measure fertility and conditions for optimal plant growth. University of Maryland Extension recommends nutrient testing at least every 3 years.² Purdue University Extension recommends soil pH and nutrient testing every 3-5 years.³ The University of New Hampshire Extension⁴ and Ohio State University⁵ both recommend testing soil every 2-3 years to maintain optimal soil fertility. The University of Georgia Extension recommends testing soil fertility every 1-2 years.⁶

To minimize the time spent collecting samples and costs, we recommend re-testing your soils for heavy metals as often as you test them for fertility, about every three years. However, we understand this can be cost prohibitive for some groups. Table 1 describes some factors that you may consider when deciding how often to test your soil for heavy metals.

Table 1: Factors influencing how often you might choose to test your soil

You might feel comfortable testing your soil less frequently for heavy metals if:	You might want to test your soil more frequently for heavy metals if:
You have not significantly changed your growing practices.	There is a history of heavy metal contamination on your garden/farm site.
You have not added new imported soil or amendments (including compost brought in from off-site) between tests.	You have added new imported soil or amendments to your site (including compost brought in from off-site).
You don't have any concerns about potential contaminants from run-off or dust from nearby construction or demolition.	You believe your site has been contaminated by runoff or dust from nearby construction or demolition.

2 https://mda.maryland.gov/resource_conservation/counties/FarmingwithyourPlan.pdf

3 <https://extension.purdue.edu/marion/article/4487>

4 <https://extension.unh.edu/blog/test-soil-now-fruitful-2018>

5 <https://ohioline.osu.edu/factsheet/hyg-1132>

6 <http://extension.uga.edu/publications/detail.html?number=C896&title=Soil%20Testing%20for%20Home%20Lawns,%20Gardens%20and%20Wildlife%20Food%20Plots>

HOW SHOULD I COLLECT SOIL SAMPLES FOR TESTING?

Always make sure to follow the guidelines of your chosen soil-testing lab. The following general soil testing guidelines are based on the [University of Maryland Extension's recommendations](#) for soil fertility testing and the Safe Urban Harvests' soil testing for heavy metals methods and can be followed to ensure the soil sample is taken correctly.

Divide your garden into separate areas. Try to pick areas that represent the variety of growing conditions and spaces in your garden. Use a spade or trowel to take a scoop from each area. In total, about 10-12 scoops should be collected. The samples should be taken at a depth of about 6 inches. You can combine the 10-12 samples in one clean container and mix together, or if your budget allows, you can send each separate scoop to the lab for testing for a more detailed analysis of your site. Remove any large debris like rocks, foreign objects, or plant material. Put the sample in the collection bag or envelope sent by the lab.

If there is a particular area of concern in your farm or garden, you may want to take scoops of soil from only this area and send those off separately for testing. For example, a garden bed next to the foundation of an old building might be at higher risk for contamination from lead paint, so you might want to test that bed separately.

WHICH TEST SHOULD I SELECT?

The Safe Urban Harvests study used a digestion process called aqua regia which uses heat and two concentrated acids (nitric and hydrochloric acid) to extract metals from the soil so they can be measured. This method uses very strong digestion acid for measuring the “environmentally available” total of all metals in the soil. We chose to use this strong digestion because we believe it is more protective than other methods. If you would like to compare future soil test results to those we sent you as part of the Safe Urban Harvests study, you should send your soil samples to a lab that uses a similar method, e.g., EPA 3050, 3050B or 3051 (Table 2 on [page 5](#)).

If you have additional questions about the information contained in this guide, please contact:

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Table 2: Soil testing agencies

*Please note we have chosen to highlight the metals tested with the Safe Urban Harvests study. In many cases, these tests include additional metal testing.

Service	Test name	Arsenic	Barium	Cadmium	Chromium	Lead	Nickel	Cost	Soil test method
<u>Colorado State University Soil, Water and Plant Testing Laboratory</u>	Waste Materials Sludges/Biosolids	✓	✓	✓	✓	✓	✓	Call to inquire as prices change	Extractable (AB-DTPA)
<u>Cornell Nutrient Analysis Laboratory</u>	2021 Heavy Metals and Trace Elements	✓	✓	✓	✓	✓	✓	\$30.00/ sample	EPA Acid Digestion Method 3050
<u>Penn State Agricultural Analytical Services Lab</u>	Total Sorbed Metals Test II plus mercury	✓		✓	✓	✓	✓	\$160.00/ sample	EPA method 3050B + 6010
<u>Penn State Agricultural Analytical Services Lab</u>	Total Sorbed Metals Test			✓	✓	✓	✓	\$65.00/ sample	EPA method 3050B + 6010
<u>Umass Amherst Soil and Plant Testing Laboratory</u>	Total Sorbed Metals Test	✓		✓	✓	✓	✓	\$60.00/ sample	EPA method 3050B + 6010
<u>University of Delaware Soil Testing Program</u>	B7 - Heavy Metal Screening Test	✓		✓	✓	✓	✓	\$25.00/ sample	Mehlich extraction screening test
<u>University of Maine Analytical Lab and Maine Soil Testing Service</u>	EPA Acid Digestion Method 3051		✓	✓	✓	✓	✓	\$15.00/ sample + \$10/ element	EPA Acid Digestion Method 3051
<u>The University of Vermont Agricultural and Environmental Testing Laboratory</u>	Heavy Metals Package			✓	✓	✓	✓	\$24.00/ sample	Mehlich extraction (screen only)
<u>The University of Vermont Agricultural and Environmental Testing Laboratory</u>	Total Soil Metals I			✓	✓	✓	✓	\$15.00/ sample	Weak acid modified Morgan extraction
<u>Colorado State University Soil, Water and Plant Testing Laboratory</u>	Routine + boron, molybdenum, cadmium & lead			✓		✓		Call to inquire as prices change	Extractable (AB-DTPA)
<u>NYC Urban Soils Institute</u>	XRF Test	✓				✓		\$10.00/ sample	XRF
<u>The University of Vermont Agricultural and Environmental Testing Laboratory</u>	Total Soil Metals II	✓	✓					\$30.00/ sample	Weak acid modified Morgan extraction
<u>University of Maine Analytical Lab and Maine Soil Testing Service</u>	EPA Acid Digestion Method 3010					✓		\$30.00/ sample	EPA Acid Digestion Method 3051