Lead in Soils

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SOURCES OF LEAD

Lead is a heavy metal and often occurs naturally in the soil in concentrations ranging from 10 to 50 mg/kg or parts per million (ppm). Low-level lead contamination is common in urban areas because of the widespread use of lead in man-made products and industrial processes. Airborne lead emissions from local industries may have settled in area yards over many decades. There are many sources of lead exposure.The most common are deteriorated paint in older housing, and dust and soil that are contaminated with lead from old paint, drinking contaminated food and water, and past emissions of leaded gasoline. Gardeners should be aware of this risk and consider whether the area that the garden might pose a risk. A little bit of lead is normal; about 10 to 50 parts per million worth of lead occurs naturally in soil. Elevated levels of lead often exist in urban areas, however. We know soil lead levels
are associated with elevated blood levels because of studies that show high blood Pb levels during environmental conditions (like dry weather) that result in more suspended soil dust.

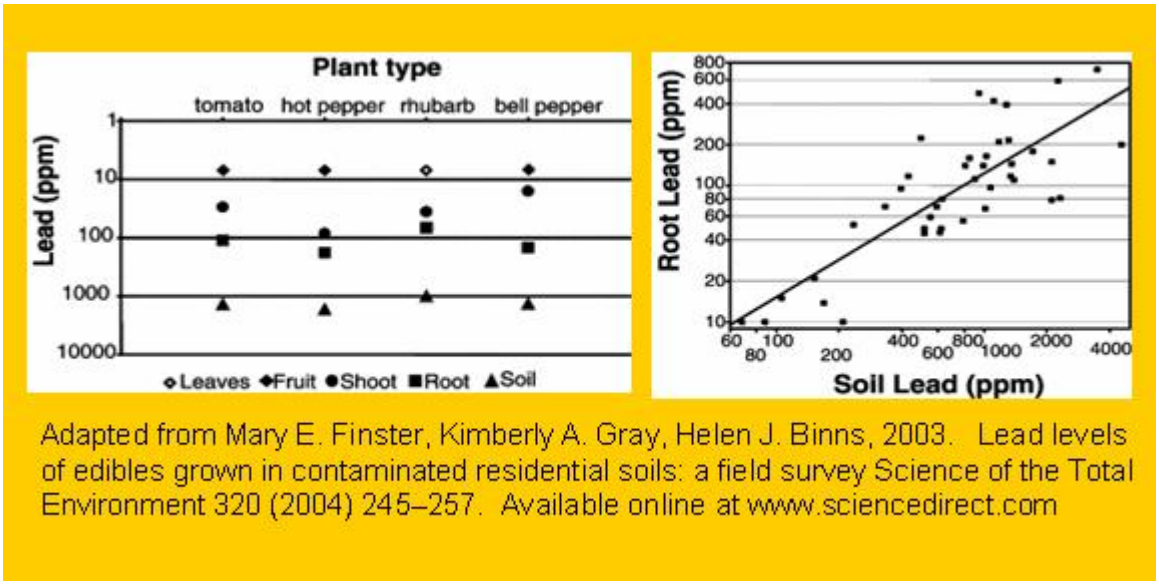
Some states have stricter standards, but the Environmental Protection Agency allows concentrations of 400 ppm Pb in soil where children play and 1200 ppm in other areas of bare soil. The EPA doesn't have specific standards for a safe level of soil lead for vegetable gardening, but various organizations and researchers have attempted to come up with a number - somewhere between 300 and 600 ppm.

WHEN TO WORRY

High blood-lead levels (more than 10 ug/dL in children) are often found where homes were built before the 1940s or where the site is downwind from some industries (eg: lead smelters), and near busy streets. Lead can be deposited on floors, windowsills, eating and playing surfaces, or in the dirt outside the home. Areas adjacent to roads and in the drip lines of older housing often contain elevated levels. Exposure to high lead levels can cause a range of health problems and is associated with learning disabilities in young children. Kids under seven years of age are at the greatest risk of lead poisoning. A 2003 survey of 77 Chicago neighborhoods showed 6% of children suffered from lead poisoning. For more on this go to: http://www.childrensmemorial.org/professionals/childsdoc.asp.

The distribution of lead blood poisonings do not seem to be closely related to high blood levels http://urbanleadpoisoning.com/

Finster, Gray and Binns conducted a study on lead in yards and gardens in two Chicago communities and found the majority of gardens sampled contained lead in levels higher than the 400 ppm level that is recommended for safe vegetable production. Plant translocation and contamination by dust increased with the amount of lead in soils. Vegetable fruits did not take up dangerous amounts of lead but the amounts contained in root crops and leafy greens and herbs were high enough to cause concern. If soil exposure to children is not of concern, then plants can be safely eaten from soils with lead levels of up to 300 ppm for leafy and root type vegetables, and 500 ppm for fruits and vegetables. If young children play in the area where a soil test is higher than 100 ppm the children should have a blood test for lead. Contact your local health department or private physician for additional information. The Center for Disease Control has identified a blood lead concentration level of 10 µg/dL as the level of concern above which significant health risks occur.



Adapted from Mary E. Finster, Kimberly A. Gray, Helen J. Binns, 2003. Lead levels of edibles grown in contaminated residential soils: a field survey Science of the Total Environment 320 (2004) 245–257. Available online at www.sciencedirect.com

Recommendations for Urban Gardeners

- Try to put your garden away from where Pb dust may accumulate (ie, away from roads and the frames of old homes)
- Have your soil tested for Pb
- Test new topsoil before using it and annually retest the garden soil to monitor for re-contamination
- In contaminated areas, use raised beds lined landscape fabric to create a barrier between roots and original soil
- Herbs, leafy crops, and root crops collect more lead in their edible parts that fruiting crops do, so avoid growing those types plants in contaminated soil

- Do not use plants grown in contaminated soils for compost
- Cover bare areas of soil with mulch or grass to prevent contaminated Pb dust from moving
- Keep soil pH above 7; this helps lock lead into insoluble forms (not accessible to your body or to plants)
- Wash hands and produce with soap and water

Soil Testing and Lead Analysis

It is a good idea to collect and combine several (6-10) sampled of the whole garden area because lead concentrations can vary greatly. Most labs advise samples be taken from the top 3-6 inches. Lead does not move to any great extent in soils and unless mixing occurs, it generally stays concentrated near the surface. Mix the sub-samples thoroughly in a clean plastic container, remove about one cup, and submit to the laboratory in a clean container.

Most commercial labs analyze total or near-total lead (chemical symbol is Pb) using an acid digest followed by use of ICP to quantify Pb. Common EPA tests are EPA 200.7 or 200.8, SW846 6010B or 602. This is too bad in some ways because this assay is not the best estimate of lead bioavailability. Determining when and where lead levels pose a risk to human health is challenging. Higher blood lead levels are frequently observed in urban settings even in instances where soil lead test levels are low. Soil composition influences risk as soils differ in their ability to reduce lead solubility and thus its bioavailability. Solubility is important because lead is absorbed by the body primarily from the fluid phase in the small intestine. Soil mineral composition also influences risk as smaller particles tend to stick to hands and increase the chance for ingestion. This, and the price of lead tests, which typically run around $30 a sample, might explain why testing is not more routine.

If you have your soil tested, it will most likely be for "total Pb" using the "EPA method." But keep your ears perked for other methods that may be available in the future:

X ray fluorescence may be an alternative to help garden coordinators evaluate risk. Experts at the Waste Management Resources Center advise against the use of this instrument for quantitative results, they note this is a rapid, convenient, and cost-effectively method for metal analysis on-site. It may be most useful for qualitative-screening in large sites. Problems include the high detection limits, poor correlation to standard methods (inductively coupled plasma), and interference issues that can lead to false positives. Conventional analytical methods have to be used if one wants to accurately analyze the concentrations of metals: EPA FAQs on Xray fluorescence.

Labs that test:

Soil Test Lab List: http://www.urbanext.uiuc.edu/soiltest/

Web Resources

Lots of Web resources exist to help you better understand Pb and other urban gardening issues. We have a list of helpful sites on the Resources for Urban Gardeners page at http://asap.sustainability.uiuc.edu/groups/Urbansoil/usqipublicdocs/usqiresources?portal_status_message=Changes%20saved

Pb Research

Lots of research has been done on Pb and urban soils. We have posted a number of interesting at www.asap.sustainability.uiuc.edu/groups/Urbansoil/usqipublicdocs/usqiabstracts

You can read about our research in our USQI website:

http://asap.sustainability.uiuc.edu/groups/Urbansoil/usqipublicdocs/usqiabstracts

References Cited

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