

# Green Thoughts

*Conversations and ideas about growing at the Spring Gardens*

The harvest for tomatoes carried into November. Meteorologists accurately predicted a killing frost for the first week in November so people were out at their plots beforehand harvesting in anticipation of the end. Some even came

*So long 2017*

out at night with flashlights. It was a very productive year. Bumper crops of

*So long 2017*

Philly-grown ripe tomatoes, safely stored indoors just before the frost, carried some of us through Thanksgiving and almost into December. And it wasn't just tomatoes. The beans were excellent. Okra flourished. Beets of various sizes were delicious over a long growing season. Beautiful flowers were scattered over many plots. Even I ended up with some eggplant. While the first frost wasn't particularly late, trees kept their leaves longer than I can ever remember. For the first time, our sidewalk trees – a little leaf linden and a callery pear – were full of leaves at Thanksgiving.

Most plots have been put to bed for the winter. Some are covered with salt hay. Others have been covered with black plastic. Still other plots have been left to sit uncovered. And still others have cold-hardy seedlings – spinach, lettuce, arugula, broccoli and Brussels sprouts - under polypropylene cloth doggedly growing whenever the temperature allows. We'll report next year on how things go.

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## **Lead in the soil**

Fellow gardener Nina wrote in about her concerns about lead in the soil of her plot in response to my writing that Penn State had tested the lead in my plot and said it was 105 ppm. Penn State wrote that if soil lead is less than 150 ppm, "there is no need to be concerned about lead exposure from these soils":

*Hi Ed,*

*Thanks for sharing your thoughts on gardening. A very cool idea and nicely laid*

*out.*

*I thought you might be interested to know a little more about my experience with lead testing. My plot tested for 250 in some areas, with the lowest area around 180. This is a massive amount of lead, with 50 being what one could expect to be naturally occurring. It's considered low for Philadelphia, but still not low enough for me to use the plot for food or play. The University of Michigan (another excellent*

*extension school) considers 100 ppm to be the cut off for intervention (lower than the EPA or Penn State). This means no composting and avoiding leafy greens along with the common sense things like washing hands and what not. I'm concerned that so many people are composting and returning their leaded greens back into the soil. Many are also growing lettuce and spinach and the like, which have shallow root structures that spread in the areas with the highest lead concentration and that are the best at taking lead up. The fruits and veggies that grow deeper tend to have less of a problem. So while your level of 105 is pretty low, it's still double what occurs naturally and it would still be smart to take basic precautionary steps. I'm happy for you that your soil is at a level so much lower than mine.*

Nina's points are important and we need to think about them. I searched on-line for wisdom about lead and found the following from the U of Minn extension service by Carl Rosen. I abbreviate the article.

### **Sources of lead in the environment**

At high concentrations, lead is a potentially toxic element to humans and most other forms of life. Background concentrations of lead that occur naturally in surface agricultural soils in the United States average 10 parts per million (ppm) with a range of 7 to 20 ppm<sup>1</sup>. Soils with lead levels above this range are primarily the result of lead contamination.

Studies conducted in urban areas, have shown that soil lead levels are highest around building foundations and within a few feet of busy streets<sup>2,3</sup>. Although lead in

paint and gasoline is not presently used to any great extent, once lead has been deposited, it moves very little through the soil and can persist for a long time. Therefore, lead contamination of soils from these sources continues to be a concern.

The focus of this fact sheet is to outline the risks to human health from lead contaminated soils and how to minimize these risks.

### **Lead in garden soils and plants**

*The most serious source of exposure to soil lead is through direct ingestion (eating) of contaminated soil or dust.* In general, plants do not absorb or accumulate lead. However, in soils testing high in lead, it is possible for some lead to be taken up. Studies have shown that lead does not readily accumulate in the fruiting parts of vegetable and fruit crops (e.g., corn, beans, squash, tomatoes, strawberries, apples). Higher concentrations are more likely to be found in leafy vegetables (e.g., lettuce) and on the surface of root crops (e.g., carrots).

Since plants do not take up large quantities of soil lead, the lead levels in soil considered safe for plants will be much higher than soil lead levels where eating of soil is a concern (pica). Generally, it has been considered safe to use garden produce grown in soils with total lead levels less than 300 ppm. The risk of lead poisoning through the food chain increases as the soil lead level rises above this concentration. Even at soil levels above 300 ppm, most of the risk is from lead contaminated soil or dust deposits on the plants rather than from uptake of lead by the plant.

### **Removing lead on roots, leaves, or fruits**

There is more concern about lead contamination from external lead on unwashed produce than from actual uptake by the plant itself. If your garden is close to busy streets or highways, remove outer leaves of leafy crops, peel all root crops, and thoroughly wash the remaining produce in water containing vinegar (1 percent) or soap (0.5 percent).

### **Precautions for garden soils**

To minimize absorption of lead by plants a number of control measures may be taken:

1. Maintain soil pH levels above 6.5. Lead is relatively unavailable to plants when the soil pH is above this level. If needed, add lime according to soil test recommendation. Lead is also less available when soil phosphorus tests are high..
2. Add organic matter to your soil. In soils with high lead levels, adding one-third by volume organic matter will significantly reduce lead availability. Organic compounds bind lead and make it less available to the plant. When adding organic matter, the pH should also be maintained above 6.5. Good sources of organic matter include composted leaves, neutral (non-acid) peat, and well-rotted manure. Avoid leaf mulch obtained along highways or city streets as it may contain higher than normal lead levels.
3. Because of the possibility of bare soil exposure to children through hand to mouth activity, soils with lead levels exceeding 100 ppm should not be used for gardening. If soil exposure to children is not a concern, then plants

can be safely eaten from soils with soil lead levels up to 300 ppm.

### **Residential bare soil standards**

The Minnesota State Legislature has established a bare soil standard of 100 ppm<sup>4</sup>. This level of 100 ppm is currently lower than the levels used by the United States Environmental Protection Agency and most other States. A level of 300 ppm is commonly used, which is based on measured risks of eating soil by young children. Eating soil by young children is of particular concern since intestinal absorption of lead is approximately five times greater in children than adults. It is assumed that about half of the lead in the soil eaten by children is absorbed. The amount absorbed from soils (bioavailability) is dependent on many variables including the health, diet, and age of the child.<sup>5</sup> Whatever soil lead limit is used depends on the frequency and duration of exposure before an assessment can be made.

The dietary exposure that results in blood levels of concern has been estimated to be 60 micrograms of lead per day for children 6 years or younger<sup>5</sup>. Given a soil lead level of 100 ppm (100 micrograms per gram), eating approximately two teaspoons of this soil per week would be required to give the same amount of lead found in a diet that can cause elevated blood levels of concern. This calculation is based on the assumption that half of the lead in the soil eaten by children is absorbed. For a soil that has a lead level of 300 ppm, eating about three quarters of a teaspoon per week could cause elevated blood lead levels of concern.

According to Minnesota State Rules, residential soil containing more than 100

ppm lead does not have to be removed unless the presence of paint chips is visible. Covering bare soil with sod or other materials is adequate. If your soil tests high in lead (greater than 100 ppm), it is recommended that children in the area under the age of six have a blood lead test. Contact your local health department or private physician for information about blood lead testing.

### **Remediation of lead-contaminated soils**

Currently, the best ways of dealing with high lead soils are to 1) immobilize the lead by raising soil pH and adding organic matter followed by planting of sod, 2) mixing or covering the high lead soil with clean (low lead) soil, or 3) eliminate the lead by physically removing the soil. Information and guidelines on removal of high lead soils can be obtained from the Minnesota Pollution Control Agency.

For more information on the abatement of lead, call your local health department or the Lead Program of Minnesota at the Minnesota Department of Health, P.O. Box 59040, Minneapolis, MN 55459-0040.

<sup>1</sup> Holmgren, G.G., M.W. Meyer, R.L. Chaney, and R.B. Daniels. 1993. *Cadmium, lead, copper, and nickel in agricultural soils of the United States of America*. Journal of Environmental Quality 22:335-348.

<sup>2</sup> Rolfe, G.L., A. Haney, and K.A. Reinbold. 1977. Environmental contamination by lead and other heavy metals. Vol.2. Ecosystem Analysis. Institute for Environmental Studies. University of Illinois, Urbana-Champaign. 112pp.

<sup>3</sup> Singer, M.J. and L. Hanson. 1969. Lead accumulation in soils near highways in the Twin Cities metropolitan area. Soil Science Society of America Proceedings 33:152-153.

<sup>4</sup>Minnesota Department of Health. 1993. Minnesota Rules Chapter 4761.0300. Residential Lead Abatement. Standards.

<sup>5</sup>Carrington, C.D. and P.M. Bolger. 1992. An assessment of the hazards of lead in food. Regulatory Toxicology and Pharmacology 16:265-272.

<sup>6</sup>Contact the University of Minnesota at 612-625-3101 for more information on lead testing.

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Very interesting. We each have to judge for ourselves about what to do about lead. Finding out the lead concentration and the pH of our plot soil is a good starting point. I am reassured that fruits such as tomatoes and peas take up very little lead. Also, soil with high pH (elevated by limestone) cuts down lead uptake into plants. In high lead soils I'm still not sure how much lead toxicity is due to eating plants or due to inadvertently ingesting the soil itself, as the article implies. As we learn more, this topic will be continued in later issues.

### **Sweet Potatoes**

Fellow Spring Gardener Liz Vaughan writes to tell us about her latest discovery:

*I had a surprise experience this fall. Sweet potatoes! Late last spring, on the plant clearance rack, I bought a small tub of 6 sweet potato sprouts. I put them in my garden plot during early summer. Over time their beautiful vines were everywhere and took up at least half my plot with dark green and purple leaves. By October, I decided it was time to see what the vines were producing. First, I noticed the soil was loose underneath the spot where each sprout was originally planted. Then, when I started digging down - beautiful sweet potatoes were just laying below the surface. All in all, I probably harvested 70+, potatoes! My family and friends enjoyed the harvest and everyone agreed the home grown potatoes were better than store bought - very sweet!! For me, I had to do very little maintenance over the summer and the outcome was fun and amazing!!*

## The Children's Area



Photos by Liz Vaughn

Thanks to Doris for creating a whimsical space for toddlers to play in this past summer. On the north side of the plot (right) she created a wooden teepee covered with pole bean plants. On the south side of the plot is a tunnel covered with black eye Susan vines. A secret garden place for those in the know.

### Hibernation

With the coming of the winter solstice Green Thoughts will take a snooze until the days get significantly longer. Have a wonderful holiday season and Happy New Year.

Please send your ideas, thoughts, suggestions and observations to:

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that address can also be used for getting on the mailing list for **Green Thoughts**, or getting off.

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