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# Lead in Urban-grown Vegetables

With increasing numbers of urban residents growing their own food, there has been some concern over the safety of eating the 'fruits' of their labors. Lead, in particular, has been singled out in this regard because its presence in the urban environment often can be dramatically greater than in the surrounding countryside.

There are two primary sources of lead affecting city-grown produce; gasoline emissions and lead-based paint from demolished buildings. After a building comes down, paint residues get incorporated into the rubble that covers a potential garden site.

Air-borne gasoline emissions are more insidious in that they can add lead to the soil as well as directly onto plant surfaces. Our research has dealt with these two aspects of lead pollution: (1) lead in the soil taken up by plant roots as well as (2) lead deposited directly onto leaves.

Lead in soil is not particularly mobile; that is, it isn't easily taken up by plant roots. However, if there is sufficient lead in the soil, it can be absorbed by plant roots and leaves of vegetables but is largely excluded from the fruiting parts of these plants (e.g. tomatoes, corn, beans, squash, eggplant, pepper). We found that by knowing the amount of lead in a particular soil it is difficult to predict whether vegetables grown in that site will contain corresponding amounts of lead. This is due to several factors. By far the most important factor was the amount of organic matter in the soil. Lettuce plants grown in soils with low levels of organic matter took up much more lead than those grown on soils with high levels (greater than 25%). With soils of very high organic matter content (40-50% or greater), no lead uptake was found even if the lead present in the soil was as high as 3,000 ppm.

Decomposed forms of organic matter seemed to be better able to bind the lead in the soil and thus make it insoluble to plant roots. The addition of organic soils (muck soils) or well-rotted manure-to-mineral soils containing high lead stopped lead uptake by lettuce plants better than the addition of fibrous peat moss or un-composted ground up leaves.

The addition of phosphorus to high lead soils also stopped the uptake of lead by lettuce plants. The level of phosphorus necessary to accomplish this, however (200 ppm), was more than is required by plants for normal growth; whereas, increasing the organic matter percentage in soils benefits soil structure and water holding capacity. Organic matter can also be acquired inexpensively by urban residents.

Other than phosphorus or organic matter, a third soil variable that can influence lead uptake is soil pH. With another heavy metal, cadmium, soil pH levels above 6.5 effectively inhibit cadmium uptake by plant roots. With lead also, low soil pH (under 6.0) increases lead uptake

but unlike cadmium, higher pH levels, (most often found in urban soils), do not prevent its uptake.

In soils that contain large quantities of lead, adding one-third by volume organic matter while keeping soil pH levels above 6.5 should adequately prevent lead uptake by plant roots. A less controllable aspect of lead contamination in urban vegetables is the lead that is deposited from air-borne gasoline emissions onto plant leaves. To see whether air-borne lead is a major factor, we set up a chamber where the emissions from a gasoline engine were periodically blown over lettuce plants growing in unleaded soil during a typical growing season. 'Gassed' leaves were found to contain significantly more lead than ungassed controls. However, the gassed leaves were subjected to different washing treatments to ascertain whether any lead had been absorbed into the leaves or was simply adhering to the surface. Washing with water alone removed only a small amount of lead from the leaves. Washing with dilute (1%) vinegar or dilute (0.5%) dishwashing liquid, however, removed the lead to control levels. Therefore, lead from air-borne emissions is only surface-adhering; and can be removed totally by washing. If you are growing vegetables near a busy road it would be advisable to plant farthest from the road preferably with a barrier (a fence or hedge), screening the vegetables from the road. Also, wash all produce extremely well, preferably with a little vinegar or soap in the wash water.

It should be emphasized that the amount of lead taken up by plants for the most part forms a negligible input into our total diets. Even in soils with fairly high lead levels, much of it cannot be taken up by plant roots and is naturally excluded. However, lead-contaminated soils can be a greater health hazard directly to young children than eating vegetables grown there. Ingestion of lead-contaminated soil through hand-to-mouth activities can cause a significant problem. Also in this same regard, any soil adhering to plant leaves, roots or fruits should be meticulously washed off if the soil has been found to be high in lead.

This work was carried out primarily in the greenhouses at Cornell University using soils from contaminated areas of New York City as well as artificially contaminated soils. Other work was carried out in various urban garden sites in New York City directly.

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