

# FAQs About Cadmium in Fertilizer:



## Reducing Cadmium Exposure in Your Garden

### Can I reduce my cadmium exposure by growing my own vegetables?

Maintaining vegetable gardens can be a great way to increase your consumption of vegetables, reduce food costs, and control contamination from cadmium and other toxics. Analytical results from both the *PPRC Survey of Cadmium Contamination in Northwest Vegetables* and from the FDA's most recent *Total Diet Study* suggest that growing your own vegetables may significantly reduce cadmium exposures.<sup>1</sup>

The gardening choices you make can directly affect the cadmium content in soil and in vegetables, even if you live in an urban area. You can likely reduce the amount of cadmium available for plant uptake by carefully evaluating soils, fertilizers, and other soil amendments, as well as by improving soil health, growing winter cover crops, and following best management practices. You do not need to be an expert or invest a huge amount of money in testing.

Personal home gardens and urban places set aside for community gardens are ideal places for growing your own clean, healthy vegetables. Many cities and counties have started programs to promote converting unused spaces to urban farms. If you can find one of these programs, join it. If you can't, create one! Choosing an appropriate garden location can help minimize exposures to harmful toxics.

If you are engaged in urban gardening and are concerned about possible soil contamination, we recommend reading the short guide, [Soil Safety Resource Guide for Urban Food Growers from the Johns Hopkins Center for a Livable Future](#). In addition to providing best practices to prevent exposure to heavy metals, this guide lists health resources commonly used in the Baltimore area.<sup>2</sup> For help finding similar resources in your own area, we recommend consulting with your city or county government, your state environmental or health authority, or contacting PPRC for help ([www.pprc.org](http://www.pprc.org)).

## How can I minimize plant uptake of cadmium?

The simple answer is to minimize the amount of cadmium in garden soil and to optimize the conditions that will reduce cadmium uptake in plants. Key steps are to:

- Create growing conditions that minimize the need to apply fertilizers and soil amendments,
- Use low cadmium fertilizers and soil amendments (compost) when they are necessary,
- Reduce the amount of residual cadmium already in the soil, and
- Use non-chlorinated water for irrigation when possible.



*Vetch, pictured above, works well as a nitrogen fixer, as do many other legume plants, such as peas and beans.*

### **Create growing conditions that minimize the need to apply fertilizers and soil amendments**

Restoring soil health and balance in depleted, non-fertile soils is an important factor for growing clean, healthy vegetables. You can restore soil by rebuilding the soil food web. The soil food web is the living community of soil microbes, fungi (mycorrhizae), and invertebrates that break down old organic materials and release nutrients for growing new healthy plants without chemicals. Restoring soil to healthy levels can reduce the bioavailability of metals in the future.

Jeff Lowenfels has written a series of three books, specifically for gardeners, on restoring soil health. They provide fundamental information and clear instructions to understand and improve basic soil growing parameters. These books are:

- *Teaming with Microbes, the Organic Gardener's Guide to the Soil Food Web, Revised Edition* <sup>3</sup>
- *Teaming with Nutrients, the Organic Gardener's Guide to Optimizing Plant Nutrition* <sup>4</sup>
- *Teaming with Fungi, the Organic Gardener's Guide to Mycorrhizae* <sup>5</sup>

One simple way to build soil health is to add organic nutrients and soil supplements that will maintain neutral pH, improve soil structure, and provide plants with nutrients. Crop rotation, fallowing fields, and using nitrogen-fixing cover crops can also put nutrients back into the soil and allow soil microbes to reestablish. At the end of the growing season, forward thinking gardeners plant cover crops and allow them to grow through the winter in mild climates or remain dormant through the winter in climates with snow cover. In the spring, gardeners can then turn these plants under the soil or remove the surface portion at planting time. Nitrogen-fixing cover crops can greatly reduce the need for added nitrogen fertilizer (the first component of tri-part fertilizers), and a critical nutrient for plant growth. A few common and effective nitrogen-fixing cover crops are vetch, red clover, and sweet pea. These plants will survive even in snowy conditions to grow robustly in the spring before planting season.

# How can I minimize plant uptake of cadmium? continued

## Use low cadmium fertilizers and soil amendments (compost) when they are necessary

If you need fertilizer because the macro and micro-nutrients in your garden soil have been depleted and you are early in the process of restoring soil health, then choose a fertilizer, preferably organic, that provides the nutrients you need but has a low cadmium content so that you are not contributing more cadmium than necessary to your garden soil. California, Oregon, and Washington all require registration of fertilizer products that includes a report on the common heavy metals. You can do a search across the databases for the lowest cadmium content for fertilizers available in your market. We recommend choosing a fertilizer with cadmium content less than 20 mg Cd/kg P<sub>2</sub>O<sub>5</sub>.

Because the state database will likely report the number in ppm (mg Cd/kg total weight of the product), you will need to check the percentage by weight of P<sub>2</sub>O<sub>5</sub> in the product and then convert to mg Cd/kg P<sub>2</sub>O<sub>5</sub>. An example of how to do so is provided in the box below. This product was chosen randomly from the Washington database and should not be considered an endorsement of the product.

### Example Calculation of Cadmium Content for Comparison to Fertilizer Limits

**Product:** Whitney Farms Organic & Natural Tomato & Vegetable Food 3-4-2

**Guaranteed Phosphorous (P<sub>2</sub>O<sub>5</sub>) = 4%**

**Cadmium:** 0.249 ppm (mg Cd/kg product)

$$\begin{array}{r} 0.249 \text{ mg Cd} \\ / \text{ kg product} \end{array} \times \begin{array}{r} \text{kg product} \\ / 0.04 \text{ kg P}_2\text{O}_5 \end{array} = \begin{array}{r} 6.225 \text{ mg Cd} \\ / \text{ kg P}_2\text{O}_5 \end{array}$$

If you can, select low-cadmium compost as a soil amendment. Before you add compost, you will want to consider not only the cadmium content per unit of phosphorous, but also the total cadmium loading to the soil.

State of the art compost processing does not remove cadmium. Although the composting process reduces the volume of organic material, if the organic material entering a composting facility is high in cadmium, then the cadmium in the compost will also be high. The same is true of the compost that you make at home. If your food and garden waste have high cadmium, your compost likely will as well.

For purposes of complying with fertilizer cadmium limits, the guaranteed P<sub>2</sub>O<sub>5</sub> and cadmium content of commercial compost is reported the same way as for fertilizer. But because compost frequently has a much lower guaranteed P<sub>2</sub>O<sub>5</sub> content, the cadmium per kg P<sub>2</sub>O<sub>5</sub> applied in compost will be much higher. An example calculation for compost cadmium content compared to fertilizer limits is provided below.

### Example Calculation of Cadmium Content for Comparison to Fertilizer Limits

**Product:** Whitney Farms Natural Premium Planting Compost Blend 0.1-0.05-0.1

**Guaranteed Phosphorous (P<sub>2</sub>O<sub>5</sub>) = 0.05%**

**Cadmium:** 0.363 ppm (mg Cd/kg product)

$$\begin{array}{r} 0.363 \text{ mg Cd} \\ / \text{ kg product} \end{array} \times \begin{array}{r} \text{kg product} \\ / 0.0005 \text{ kg P}_2\text{O}_5 \end{array} = \begin{array}{r} 726 \text{ mg Cd} \\ / \text{ kg P}_2\text{O}_5 \end{array}$$

While comparing high carbon compost to low carbon fertilizer may seem a bit of an apples and oranges comparison, the guaranteed P<sub>2</sub>O<sub>5</sub> content in compost makes compost subject to cadmium fertilizer limits. In the two examples provided, the compost cadmium content is higher than fertilizer both per unit product and per unit P<sub>2</sub>O<sub>5</sub>. But the critical question is this: Based on application rates for the two products, is total cadmium loading to the soil higher or lower?

# How can I minimize plant uptake of cadmium? continued

## Reduce the amount of residual cadmium in the soil

Some cover crops effectively take up metals from the soil. This concept is similar to what is called phytoremediation, a practice employed in more highly contaminated areas—such as lands contaminated by metal ore mining and processing—whereby plants take up and store contaminants from the soil. Two types of plants have been investigated for removing soil cadmium: hyperaccumulators, which accumulate higher concentrations in the plant tissue than occur in the soil, and phytoextractors, which readily take up cadmium but with transfer factors less than one (i.e., the concentration accumulated in the plant is less than the concentration in the soil).

For relatively low-level cadmium concentrations in garden soil and fertilizers, any type of cover crop that takes up and extracts cadmium can be helpful. We have not identified any species that are both nitrogen fixers and cadmium extractors so you may want to alternate cover crops or sow a cover crop that mixes nitrogen fixers with cadmium extractors.

Vegetables can also extract cadmium from the soil. You can remediate soil by removing the contaminated part of the vegetable from the food supply and soil. For example, you can grow radishes, eat the radishes, which have lower cadmium storage than the tops, then remove the leafy tops from both the food chain and your compost. Spinach, lettuce, and cilantro also are fairly effective at accumulating cadmium from the soil. If you grow these crops in soil that may have significant cadmium from past fertilizer applications or industrial releases, you might want to select a few plant samples and have them analyzed in a food testing laboratory. If you do not add any significant cadmium to your garden soil, the amount of cadmium in your vegetable crop should be lower the next year. If you do note plant uptake in your vegetables, do not place any crop waste in your compost.

## Metal Hyperaccumulators

Metal hyperaccumulation is a characteristic present in over 500 plant species (about 0.2% of angiosperms—plants that have flowers and produce seeds).

Cadmium hyperaccumulators are also frequently zinc hyperaccumulators. A variety of hyperaccumulator species have been studied for cadmium phytoremediation, including but not limited to:

- various species of the genus *Alyssum* (mustard family)
- *Thlaspi caerulescens* (mustard family)
- *Nocca brachypetala* (mustard family)
- *Arabidopsis halleri* (rock cress, mustard family)
- *Viola basoshanensis* (violet family)

For anyone interested in phytoremediation extraction of compost, the [review done by Hemen Sarma on metal hyperaccumulation may be useful reading.](#)<sup>9</sup>

## Residential Soil Testing in the Northwest

If you suspect that your soil has been contaminated by past or present activities, then you may want to collect and analyze a soil sample. Northwest residents have a few free resources for assessing environmental soil contamination. For example, the [Dirt Alert program](#)<sup>10</sup> in King County, Washington, will analyze soil for arsenic and lead for those state residents that live in the path of the Tacoma Smelter plume. [The Oregon Health Authority](#) also provides guidance for concerned residents. For more resources on assessing soil contamination, go to [www.pprc.org](http://www.pprc.org).

## Irrigate using non-chlorinated water when possible

If available, non-chlorinated well water is a better option than using a city's chlorinated water supply for growing foodstuffs. Chlorine can make cadmium more available for plant uptake. However, rainwater collected from rooftops, especially galvanized metal rooftops, can contain the metals cadmium and zinc at notable levels, so select your water source carefully.

# Conclusion

Growing your own vegetables may significantly reduce cadmium exposures. You can reduce cadmium uptake by improving soil health, using low cadmium fertilizers and soil amendments, growing cover crops, and using non-chlorinated water for irrigation.~

## Disclaimer

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This series of fact sheets on cadmium in fertilizer is not intended to discourage growing or eating vegetables. Vegetables are critical to life; the healthiest and tastiest ones often come from gardens. The information presented here is intended to help provide a better understanding of cadmium, how it gets into our food supply, how it can affect our health, and how we can minimize our exposure.

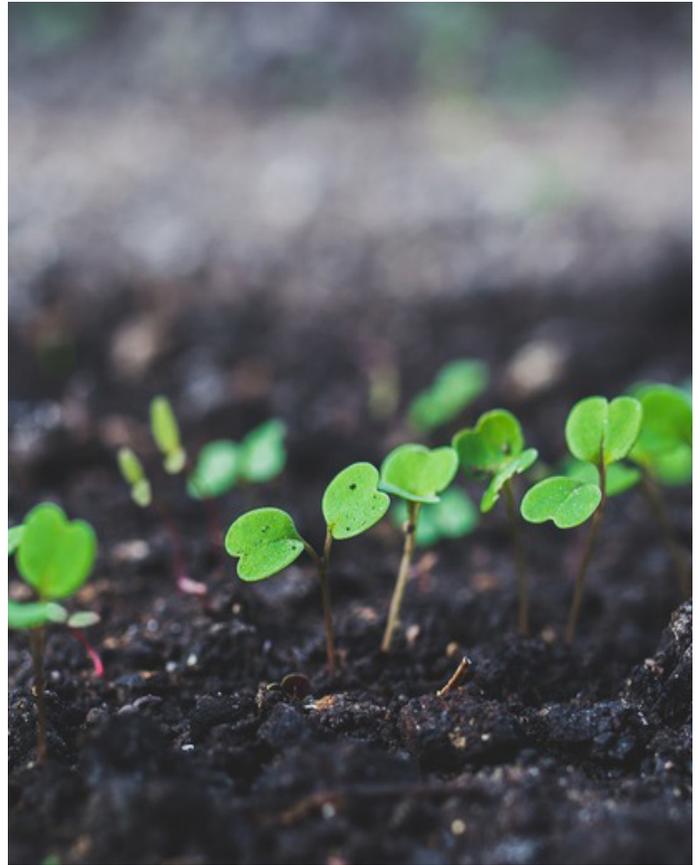
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