ENVIRO-BRIEFS

No. 7

Crop Fertilization and Heavy Metal Accumulation in Soils

Trace elements and heavy metals occur naturally in all agricultural soils. Several of them are either essential or beneficial to plants as well as animals. However, they can become toxic if accumulated in excessive amounts. Proper fertilization, which results when both agronomic and environmental considerations are included in the development of a nutrient management plan, can prevent or greatly reduce the potential for such toxicities.

In recent years, there have been reports of heavy metal contamination from fertilizers manufactured from industrial byproducts. However, more than 97% of the mineral fertilizers used in North America are made from natural sources such as atmospheric gases and mineral deposits. Further, according to the U.S. Environmental Protection Agency (EPA), typical rates of heavy metal additions to soils in mineral fertilizers are well below U.S. biosolids annual pollutant loading rates and the Canadian Fertilizer Act limits. In other words, fertilizers are safe.

The only heavy metal of concern is cadmium (Cd). It occurs naturally in phosphate rock, the mineral most commonly used to make phosphorus (P) fertilizers. During the manufacturing process, much of the Cd in the ore is carried through to the final fertilizer products. Cadmium is also present in organic fertilizer sources such as animal manures and biosolids. Further, it can be added to the soil through atmospheric depositions as a result of forest fires, volcanic eruptions, and air pollution due to industrial output.

Sewage sludge can contain high levels of Cd and has been blamed for contamination in some areas. However, biosolids such as sewage sludge are applied to only limited areas and affect a relatively small proportion of agricultural land. Manures are of concern because more than 90% of the Cd ingested by animals passes into the manure. And, manure helps to mobilize soil Cd, making it more available to plants.

Cadmium buildup and availability in the soil are affected by several factors in addition to fertilization, including soil organic matter content, soil pH, crop species grown, and crop rotation. While there should be concern about Cd, adoption of measures that might limit the use of P fertilizers and crop production are not necessary. For example, using a worse case scenario of applying a P fertilizer source high in Cd, it would take almost a thousand years to reach the EPA cumulative limits in the soil.

It is important that we understand and utilize all our management options in taking the necessary steps to protect public health and the environment. It is just as critical that we maintain a profitable and productive agricultural system. **Fortunately, the proper use of crop fertilization allows us to accomplish all these objectives, including the safe management of heavy metals.** EB

Relating to parts per million…

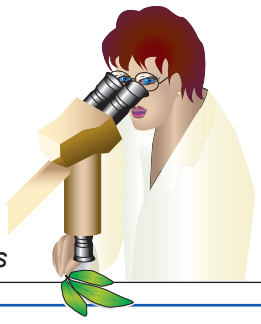
Concentrations of "heavy metals" in some fertilizers, animal manures, and biosolids such as sewage sludge are typically indicated in parts per million (ppm), or sometimes in parts per billion (ppb). Concentrations are monitored to assure the levels are within set standards. To help put these units in perspective, here are a few examples for comparison.

One part per million is equivalent to:

- *one minute in two years*
- *a single penny in $10,000*
- *one inch in 16 miles*

One part per billion is equivalent to:

- *one minute in 2,000 years*
- *a single penny in $10 million*
- *a pinch of salt in 10 tons of potato chips*



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