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The Myth of Beneficial Bone Meal:
"Add a handful of bone meal to planting holes before installing shrubs and trees"

The Myth

Of all the soil amendments on the market, bone meal seems to be everyone's darling. Credited with stimulating root production and improving flowering, thousands of web sites promote the use of bone meal during transplanting and as a regular fertilizer throughout the year. We are assured that bone meal is "one of the indispensable soil amendments all gardeners should have on hand" and that usage of bone meal is "good for reducing transplant shock and promoting extensive and healthy root systems." Bone meal, as the name suggests, is made from animal bones and is favored by organic gardeners and landscapers as a natural source of calcium and phosphorus. There are nearly 10,000 commercial web sites advertising various formulations of bone meal. How does one decide which is best?

The Reality

Bone meal is primarily calcium and phosphorus, two elements which are usually adequate in **non-agricultural** soils. The NPK analyses of bone meal preparations vary, but are generally in the range of 0-12-0 to 3-20-0. Both calcium and phosphorus are required for plant growth, but both (and especially phosphorus) can cause problems if they occur in high concentrations. It is important to understand that neither element, nor any other mineral, will "stimulate" plant growth beyond what is normal for a particular plant.

Why does the myth of phosphorus-induced root stimulation persist? The answer probably lies in the effect phosphorus fertilizers have on mycorrhizal relationships. When plant roots are in low phosphorus environments, they exude organic acids from their root tips. These acids allow mycorrhizal fungi to penetrate the roots and form the networks that assist plant roots in taking up water and nutrients. Mycorrhizae are particularly adept at extracting phosphorus from the soil.

If phosphorus levels are too high, however, the roots do not exude the organic acids and mycorrhizal connections do not form. This forces the plant to put more resources into root growth to compensate for the lack of mycorrhizae. So in a sense phosphorus will increase root growth – but at an added cost to the plant. The resources expended by the plant in growing additional roots to take the place of mycorrhizae are not available for other plant needs.

Shrub and tree species that are mycorrhizae-dependent have a difficult time surviving in soils where mycorrhizae cannot develop. In particular, seedlings and newly transplanted materials are less efficient in absorbing water and minerals from the soil and are more likely to suffer transplant shock than plants where mycorrhizae are present. Adding mycorrhizal spores to soils where phosphorus is too high is ineffective – the spores will remain dormant.

Interestingly, bone meal (and other phosphorus sources) is toxic to members of the *Protea* family. These plants and others adapted to nutrient-poor soils and easily scavenge necessary minerals. This natural ability is compromised when fertilizers are over-applied.

What can you do if you have added too much phosphorus over the years? If your soil test indicates that phosphorus levels are high, you may be able to tie up excess phosphorus by adding a mixture of other

mineral fertilizers. I've not had to do this myself, but various web sites recommend concoctions of ammonium sulfate, magnesium sulfate (Epsom salts), iron sulfate and zinc sulfate. In any case, levels of soil phosphorus will eventually decrease if phosphorus-containing fertilizers are discontinued.

The Bottom Line

- Bone meal supplies high levels of phosphorus and calcium, elements that are rarely limiting in non-agricultural soils.
- Phosphorus, from bone meal or other sources, does not "stimulate" plant growth; it is only a mineral, not a plant growth regulator.
- High levels of phosphorus, from bone meal or other sources, will inhibit growth of mycorrhizal fungi.
- Without mycorrhizal partners, plants must put additional resources into root growth at the expense of other tissues and functions.
- Before you add any supplementary nutrients to your landscape, have a complete soil test performed first.

For more information, please visit Dr. Chalker-Scott's web page at http://www.theinformedgardener.com.