Connections: Nutrient Cafe

Sally Brown
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Most people reading this column would probably think that CB HOPKINS CaFe is just a TGI Fridays wannabe, and that plant fertility can be summed up in three letters: N, P and K. Well the truth of the matter is that the CB HOPKINS CaFe is a mnenomic to help remember just what the perfect plant café in the sky would list on its menu. It is part of the whole phrase: CB HOPKINS CaFe Closed Monday Morning Mgr Cu Zoon that is often used to teach the essential elements needed to grow plants. Carbon, boron, hydrogen, oxygen, phosphorus, potassium (chemical symbol K), iodine, nitrogen, sulfur, calcium, iron (chemical symbol Fe), chlorine, molybdenum, manganese, magnesium, copper, and zinc to be exact.

For most plants grown in most soils, the big three are in fact N, P and K. These elements fall into the category of macronutrients — nutrients that plants require in large amounts. Many of the other offerings at that ideal plant café in the sky are only required in very small amounts and are generally referred to as micronutrients. The success of the green revolution was largely based on the discovery of how to synthesize nitrogen fertilizer from nitrogen in the atmosphere. Mining calcium phosphates and turning them into phosphorus fertilizer didn't hurt either. Prior to this most P fertilizer came from bat guano deposits (real world term bird poop) and animal manures.

It turns out that sulfur is another macronutrient, needed in large quantities for plants to grow. And in an interesting twist, a major source for sulfur for the last 50 years or so has been air pollution. Burning high sulfur coal resulted in large quantities of sulfur being deposited on soils. So in addition to acid rain, we got a good dose of soil fertility. Emissions regulations have drastically cut down on sulfur emissions. In the years since these regulations have been in place, plants have been using the excess sulfur in the soils that coal plants brought them.

At the recent meeting of the Soils Science Society of America, a symposium was devoted to sulfur because at this point, much of that excess sulfur has been used up and there are now deficiencies. Sulfur fertilization, which had been ignored during all those decades of pollution, is now becoming an important part of plant nutrient management. After the meeting I met with Steve Fransen, a forage grass specialist from Washington State University. He is getting terrific yields growing switchgrass for biofuel, but only when he adds sulfur to the soil. Without the sulfur he is seeing stunting and bleaching, classic signs of sulfur deficiency.

Enter the Amendments

Why am I talking about plant nutrients in general and sulfur in particular? Because organic soil amendments, including manures, composts and biosolids, contain them all, every last plant nutrient. As soils are farmed over and over with growers relying on synthetic fertilizers that typically provide only the big three, it is likely that soils will start being depleted of these other nutrients. By adding organic amendments to soils, we can replenish the stores of all nutrients, everything that CB HOPKINS CaFe has on the menu.

This is important for several reasons. Resource depletion is a potential concern for a number of these nutrients. This is most obvious for phosphorus, with world supplies from mineral deposits potentially running out in the next 50 years. When mineral reserves are exhausted the only places we will be able to get phosphorus will be from soils and residuals. Many soils currently contain excess P as farmers were encouraged to over fertilize for many years. In fact, research on P in the U.S. currently focuses on how to reduce P availability for over fertilized soils. Too much P in soils is a problem if it erodes into water because P is generally a limiting nutrient in surface waters. (It gives you that nice, bright green algal bloom that can kill fish.)

This tide is likely to turn soon as P fertilizers become more costly, with a new focus on how to solubilize what P is in soils. And there will be new interest in residuals as a source of P. After mineral reserves are exhausted we will be back to bird poop and animal manure. Except now those sources of P can be supplemented with some human manure and food scraps. These residuals are derived either directly or indirectly from plant materials and so it makes sense that they contain all required plant nutrients. The expression you are what you eat comes to mind.

What else is good about relying on residuals for plant nutrition? Synthetic fertilizers require energy to produce. Even though nitrogen is plentiful in the atmosphere, converting it from gas to fertilizer pellets costs about 4 kg of CO_2 for every kg of nitrogen. Phosphorus is also energy intensive to produce. While I haven't done the calculations for the rest of the nutrients, you can be sure that anything that requires mining mineral ore and converting it into fertilizer pellets uses some energy.

The wide range of necessary plant nutrients, contained in all organic residuals is yet another critical reason why these materials should be returned to the soils instead of buried or burned. When you burn these materials, you get a lot of empty calories. When you put them on the menu at that plant nutrient café, you get to have your cake and eat it too.

Sally Brown — Research Associate Professor at the University of Washington in Seattle — authors this regular column. Starting with this issue, the name of the column has been changed to simply "Connections." Email Dr. Brown at slb@u.washington.edu.

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