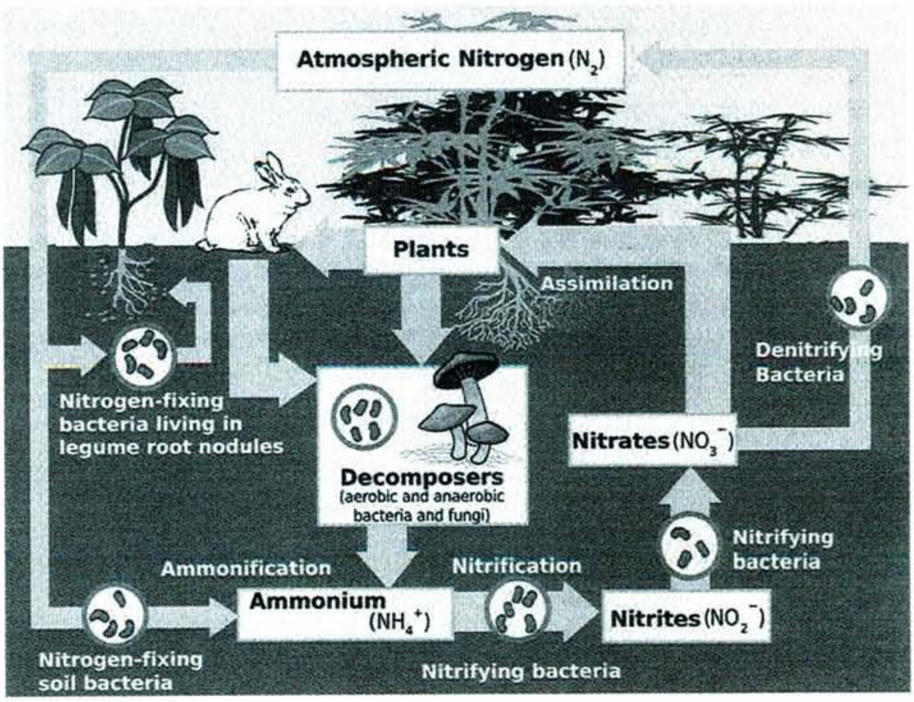
Letting Nature Supply Your Nitrogen Needs

by Dr. Phil Wheeler



Human activity is affecting planet Earth to such an extent that natural scientists are naming this time the beginning of a new geological age/epoch called Anthropocene (the recent age of man) and ending what was the Holocene epoch (about 17,000 years ago to present). We are no longer observers of nature, but significant influencers of what is happening to nature. The sheer weight of humans and their livestock is now bigger than the Earth's wild animal population and there are more trees on farms than in wild forests. Our activities are rapidly increasing the amount of CO_2 in the air. That is an established fact, the effect of which is the only thing in dispute, i.e. will it get warmer or cooler and will we be wetter or dryer? The temporary(?) warmth is obvious in the Arctic.

Although growers usually help to absorb CO_2 by growing crops, their improper handling of crop residue or improper feeding of livestock can add the CO_2 back into the air. However, farming's bigger polluting effect concerns nitrogen. Plants have always used N from the air by a variety of natural methods. Now the rate we are taking N out of the air is 50 percent higher than what nature has done for millions of years. Most of this industrially created N is now used for fertilizer. This industrial process was originally used to make munitions prior to WWI. The process was denied Germany, which probably shortened their ability to wage war.

Taking N out isn't really the problem; it is the later consequences that matter. Chemical N leaches into the aquifer. We are all familiar with ocean "dead" zones where the oxidized N and P have fed algae blooms that starve aquatic life for oxygen and the concept of "Blue Babies" that occurs when excess nitrate in the water causes babies to turn blue from lack of oxygen in their blood. Even though people don't turn blue, they may have, and not be aware of, a reduced amount of oxygen in their blood which can affect their energy levels.

So, as growers, we must do our part in mitigating our impact on natural systems by taking every opportunity to use naturally occurring N and cease the use of industrially created N. There are five main ways we can get the nitrogen we need to grow our crops without resorting to man-made N. The good news is that you will be raising healthier, more valuable crops in the process of using nature's supply of N and can achieve comparable yields (or even greater yields).

LEGUMES

One of nature's original methods of building available N is with N-fixing plants called legumes. Legumes can be anything from small white clover to large shrubs and trees. They all have the ability to take N_2 gas out of the air that is circulating in the soil and use a biological/chemical process to fix the N_2 into ammonium ions and/or more complex amino acid molecules. There is a microorganism called rhizobia that establishes itself inside the root nodule to complete the process. Since each legume may have need of a different rhizobium it is best to buy the inoculant that matches it the first time you use that particular legume. If you are not farming conventionally/chemically, the organisms will usually survive, and you will not have to keep buying new inoculum for the repeated crop. The amount of N fixed by a given legume varies widely, but 30-60 lb per acre is common.

The legumes usually need the trace mineral molybdenum to make the process happen efficiently. Hopefully, you all remember to dig up your legume of choice, carefully cut open the visible nodule on the root and check its size and color. The larger the nodule, the more the fixation potential. The darker the pink, purple or maroon, the more molybdenum you have in your soils to make the process work. If you have dull grey nodules, you need to add some molybdenum. The easiest, least costly way is to use fish, seaweed and ocean liquid or dry products that contain traces of "Molly B" on a regular basis.

AZOBACTER

Nature's second process of supplying N involves freestanding microorganisms called azobacter or azotobacter. These organisms don't have to use a root nodule to change the N_2 gas to ammonias and other important compounds. They basically absorb the N_2 gas and release ammonias and the other compounds. The other compounds are very significant, including amino acids (the building blocks of protein): glutamic, methionine, tryptophane, lysine, and arginine. This means your plants are receiving N in a form that they can use without expenditure of valuable internal energy that can be used for increased production. Azobactor also produce vitamins B1, 2, 3, 5, 6 and 12 and vitamins C and E. In addition, the phytohormones indoleacetic acid, gibberellic acid and cytokines are produced. If you add up the cost of buying all the compounds separately, modern azobactor products are a real bargain. Conventional farming kills off these organisms and robs the grower of what amounts to free N and a whole slew of growth factors. Thanks to a technology breakthrough, cyst forms of Azobacter that can operate on a leaf surface to produce ammonias and all the other compounds for uptake by the plant are available in the marketplace. The amount of N produced in the soil and on the leaf is conservatively listed at 40-50 units/lb per acre per application. The azobacter can also deny surface space to disease pathogens. (Believe it or not, "good" nematodes are also great ammonia and amino acid factories.)

MANURE

The next major natural source of N is from the waste products of livestock. Stable manure will also contain urine, so now you have ammonias, nitrates, urea and some protein N. Much of this can be wasted if manure is not handled properly. Manure pits are the most common treatment/process that seeks to save/stabilize the N. However, without peroxide, biology and carbohydrates added to aerate and fix the N, much of it is lost and odor is a problem. Composting is the best way for sustainable growers to handle manure as the composting process, when done properly, kills pathogens, stabilizes the N and other nutrients, increases microbial activity, and creates other valuable enzymes, hormones and growth factors. Generally compost is used at 1-2 tons per acre providing 14-28 lb N (cow) and/or 60-120 lb N (poultry) the first year.

There are several ways to preserve more N from your manure when composting. Adding clay improves moisture retention and increases aggregation. Adding KS+, a natural mined acidic mineral, at the beginning of composting (or better yet, at the source of the manure) stops N volatilization, kills pathogens, and reduces odors very quickly, and creates better amino acids for easier uptake by plants.

PROTEIN BY-PRODUCTS

The fourth way to get N for your crops is to use a protein by-product: blood, feather meal, cottonseed meal or fish products. Protein nitrogen is composed of amino acids which are available for direct use by a plant without the use of internal plant energy to process them. Comparing protein N to industrially produced N is complex. First, usually about 80 percent of the applied chemical N is lost either up (volatizing) or down (leaching). Second, research shows that the protein N in fish is equivalent to about five times the amount of remaining chemical N. Simply put, 100 units of chemical N winds up being 20 units used by the plant and that 20 units of chemical N has the equivalent effect of only 4 units of fish protein N. The added efficiency of protein N from fish comes from the additional microbial stimulation of "good guys" like azobactor. Five gallons of a 4-1-1 fish product can get you the same result or better than 400 lb or 40 gallons of 28 percent.

HUMUS

The fifth natural source of N for your crops is from recycling previous years' plants into humus. Humus is the product of plant residue broken down by microorganisms. You can build your humus levels through cover cropping and proper handling of crop residue. The humus building process is greatly enhanced in biologically active soil. Humus is produced as either active or passive factions from the plant residue. The active faction feeds your next crop, while the passive faction builds long-term humus levels. The usual figure for the amount of N released by humus is 40 lb per percent of humus per year. To be on the safe side, I use a figure of 30 lb per percent of humus. Research shows that large amounts of chemical nitrogen do stimulate microbes to eat plant residue, but the carbon volatizes instead of forming humus. Another vital and positive side effect of microbial N versus chemical N is that mycorrhizae have a much better chance to do their job of producing glomalin (long lasting carbon compounds) which is the true soil "glue" that gives soil structure through flocculation and enables plants to increase the access of N from the air.

Keeping in mind the usual rule that says it takes a pound of N to produce a bushel of corn, let's see how much N we can come up with using sustainable methods. We will assume you properly incorporated your crop residue in the fall with carbohydrates and bacteria and added protein N if the residue was brown. You have also planted a mixed legume, grain cover crop to take down next spring. Your current humus reading is only 2.5 percent. Let's delineate and calculate N sources and amounts for next year's corn: Humus (30 lb x 2.5 = 75 lb N); Crop Residue (30-40 lb N); Legume plow down (30-60 lb N); 5 gal of a 4-1-1 fish product (22 lb equivalent N); 250 ml nitrogen fixing azobacter in the row (40-50 lb N); Sidedress fish and azobactor and/or foliar feed azobactor (20 lb N); "A few good nematodes" (10 lb N). And it all adds up to (75 + 30 + 40 + 22 + 40 + 20 + 10 = 236 lb N [low end] or 277 lb N [high end]). Add more to that number if you spread raw manure or compost this fall or next spring. See? You have enough N to grow at least 200 bushel corn without one pound of manufactured N!

Meanwhile, you haven't added nitrates to the groundwater, killed off any of your beneficial microbes or burned out your humus with artificial, costly processed N. Please break your high N addiction now! Make sure you handle this year's crop residue correctly, plant a cover crop and get ready for an all-natural N spring of 2012.

A special update: I have previously written about how plants "signal" the microorganisms in their root zones by extruding carbon-based compounds from the roots. Scientists have now measured parts of this process and claim that about 66 percent of the energy/sugars produced by the photosynthetic process end up being exuded to influence microbes (including azobactor) in the root zone. They also discovered that the type of extrudate changes as the plant goes from growth to reproductive stages. This reinforces Dr. Ream's concepts of plant and fertilizer energy patterns and the concepts of mineralization and microbial stimulation for optimum plant health and production.

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