

## **Are all N created equal?**

Traditionally, and in my opinion, fundamentally, the principles of crop nutrition on organic farms should be operated within a fairly 'closed-system'. In other words, the ideal situation is one in which the use of nutrient inputs from external (off-farm) sources are minimized, while use of natural nutrient cycling (e.g., biological nitrogen fixation, composted animal manures, green manures, etc.) are optimized. For many organic farmers the "ideal" situation is one they are still working towards, and as a result must supplement their current fertility management with other sources of nitrogen. Determining what form of fertilizer to use, how much and when to apply are often the same questions that conventional producers face, however organic farmers have a few extra for an added challenge. Organic producers have stringent protocols on the use products such as raw manure and are limited to sources of N that are deemed acceptable by their certifying body.

First step in crop nutrition management is to determine how much available N is recommended for the crop (For an excellent reference on crop fertility requirements check out the Canadian Organic Growers web site, [www.cog.ca](http://www.cog.ca), and look for the Organic Field Crop Handbook). Short season crops (e.g., oats, peas, barley) have obviously less N demand than high-yield season crops (e.g., potatoes, corn, hemp). From this number (e.g., corn the recommended rate would be 150 pounds per acre), the N released from your soil organic matter (OM) should be subtracted. Conservative estimates give a 10-pound credit for each percent of soil OM (up to 4 percent). The last calculation prior to determining N fertility requirement is to assess the N credit provide by cover crops, compost, manures, and other organic fertilizers.

**Cover crops/Green Manures** The N credit provided by legume cover crops, or green manures can be quite significant when grown in a crop rotation system that permits adequate time for sufficient biomass production. Incorporating a healthy stand of alfalfa, hairy vetch, or red clover early in the season may be sufficient in providing the N requirements for the subsequent crop. Legume green manures can contain 100-200 pounds of N per acre. The most dramatic N effect usually occurs within a few weeks following the killing of the cover crop/green manure. In the tissue decomposition process, N is converted from its organic or plant form to its inorganic forms, such as ammonium and nitrate, which can be used by the plant. In estimating how much actual n is available to the subsequent plant, one must be careful not to assume a direct transfer of organic N to inorganic N. Much of the organic N will become immobilized, meaning that it is not readily accessible to the plant this year, and much of the N will become inorganic, but then turn into a gaseous form through a process called denitrification. So, the upshot of all this is that a conservative estimate is to assume half of the N is available for the subsequent crop.

**Animal Manures and Composts** Manures and composts contain and release N in varying amounts. For example fresh dairy manure incorporated immediately should provide between 5-10 pounds of available N per ton. In contrast, fresh poultry manure will likely provide 3 times that amount (Note: the proper use and timing of application of

fresh manures must be checked with your own individual certifying body). Mature compost generally contains about 1 to 3% total N, depending on the species (i.e., ruminant vs. monogastric), the composting method, and the age of the compost. As compost ages, the availability of the N it contains tends to decrease. The amount of N available in the year of compost application is also somewhat variable. Conservative estimates would suggest 10%, but in most cases it would be higher. Laboratory analyses of manure or compost can be beneficial in determining the nutrient content and availability.

**Organic Fertilizer Materials** Animal by-products (e.g., blood meal, crab meal, fish meal, feather meal, guano, etc.) and plant-derived materials (e.g., alfalfa meal, soybean meal, etc.) are often commercially available as nitrogen fertilizer materials. Many of these materials have additional benefits in that they also contain other nutrients, however the drawback is usually when addressing the economic viability of their use. A study conducted at the University of California demonstrated the importance of assessing cost per unit of N. Feather meal (7% N) application had the highest crop yields, followed by liquid fish (3.5%), fish meal (10% N), seabird guano (11% N), and lastly compost (2% N). However, an economic evaluation of the different materials revealed a different trend. Compost treated plots produced the highest gross economic return per fertilizer dollar, because the compost had such a dramatic cost advantage over all other materials.

So, what does all this mean? The calculations should be used as general guidelines and if they are getting too complicated, then you're trying too hard. For most experienced organic farmers, the "calculations" are done with their eyes. Basically, if the field has sufficient organic matter, and the cover crop or green manure was highly productive, and the current crop does not have high nutrient demands (i.e., is not a heavy feeder like corn or potatoes), it is quite possible you will need no supplemental N. If you do require supplemental N, remember not all forms are as effective and perhaps more importantly not all forms are economically viable. Lastly, if you are consistently not meeting the needs of your crop through use of cover crops/green manures and animal manures and compost, it is probably more feasible to change your rotation and choose a crop with lower N requirements than continually look for costly external inputs.

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