Humates & Humic Substances

Bio-Correct Inputs for the Eco-Farmer

by Gary Zimmer

Organic matter, compost, humus, humates, humic acid and fulvic acid are all related to, and are parts of, decaying plant materials. These organic materials are food for soil life and a storehouse for minerals, energy and water. They also serve as mediums on which certain organisms can grow.

Research is proving what farmers have long known to be true: humic substances stimulate plant roots and soil life (mostly fungal populations), chelate minerals (holding them for future use by plants), improve absorption of minerals for root and plant use, and improve the effectiveness of herbicides.

This article will explain the different humic products available and how they presently are being used, while Lawrence Mayhew's detailed review of the current scientific literature on the subject is available in "Humic Substances in Biological Agriculture" *(Acres U.S.A.,* Jan-Feb 2004)

Humate is a common term used to describe dry-mined carbonaceous materials found in areas where coal is mined. They are correctly called *leonardites* or *oxidized lignites.* For many years the most commonly used humic product was a black liquid extract called humic acid, obtained by mixing a strong base liquid material such as sodium hydroxide, or more commonly potassium hydroxide, with a dry humate material. The black humic acid material (not really an acid — the base extraction has a pH of 9-plus), usually a 6- or 12-percent solution, was most commonly mixed with fertilizers, mixed with liquid nitrogen sources for use in transplant solutions, or mixed with herbicides. Its high pH meant that it could cause the liquid mix to jell or precipitate out, thus careful mixing was required. Mixing it with phosphorus materials was a real problem in many situations.

Besides its use in transplant solutions (where it is highly diluted and doesn't cause many problems), my favorite way to use humic acid is to mix it with liquid nitrogen sources. It provides an organic material for the nitrogen to hook to, therefore reducing leaching and loss of nitrogen and buffering the solution for more effective and efficient use. My observations indicate that a rate of one to three gallons per acre, depending on nitrogen needs (which can be reduced with humic acid use), seems to work best.

Fulvic acid, another extraction from dry humates, is truly an acid. It is an acid extraction and has a pH near 3. It can be mixed with any liquid compound without difficulty. It is a part of the original material, but quite different from humic acid. My favorite place to use it is in liquid fertilizer mixes, where it buffers the soluble fertilizer, chelates it, and improves its uptake by the plants. Another common use for fulvic acid is to mix it with herbicides. Besides acidifying the tank mix, which helps the effectiveness of the herbicide, it again also chelates and improves the intake of the chemical. Application rates are from one quart to one gallon per acre, depending on the crop and on the amount and type of fertilizer and chemicals used.

If humic acid is extracted with a base, and fulvic acid extracted with acid, that which remains of the original humate is a large molecule called *humin,* with a sponge-like ability to hold and absorb substances.

My philosophy in agriculture is to use the whole compound wherever possible, not just parts or pieces. Sometimes the parts we leave behind have some real benefits — for example, the calcium, trace elements and rare earths remaining when the fertilizer industry extracts phosphorus from rock phosphates. The same is true for the minerals, vitamins, hormones and other unknown compounds left behind when cytokinins are extracted from kelp. Wherever possible, why not use the whole?

As for humic substances — in the last few years micronized compounds with added suspending agents have been showing up in the marketplace. This is the original humic material ground really fine. It's an expensive process, and the product is not foolproof, as precipitation of materials and spray nozzle plugging have occurred, but the idea makes sense. This material can be used anywhere that humic and fulvic acids are used.

In my biological farming experience — after many observations and much testing — dry fertilizer mixes provide more flexibility and are better buys. They also allow a grower to balance the soluble and slow-release materials. Liquid fertilizers are water soluble — they can leach, tie up in the soil, cause short-term nutrient imbalances, and fail to provide nutrients over the plant's life. They have their place as a "pop-up" to get the crop out of the ground or as a foliar to give a boost, but not as a complete fertilizer program.

How, then, can humic substances and dry fertilizers work together? I've tried bulk spreading dry humates on soils. They're dusty and hard to handle, and I struggled to find any measurable results.

It makes sense to add humic substances to fertilizer materials to provide carbon, a buffering, chelating agent, and some microbial foods. Using the original raw material provides the most benefits for the dollar, but handling that black, dusty humic material seemed unworkable for most fertilizer blenders.

In Australia, farmers and consultants are blending humates with natural phosphates, calcium, sulfur and trace-mineral materials, inoculates with beneficial organisms, and then adding molasses and brewing the batch — just like making compost. The natural humic material has a low pH and a large nutrient-holding capacity, and it feeds microbes. The results look good, and the process makes sense.

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There is still a problem, however, with handling. You certainly can't spread it down the row as with a crop fertilizer. The secret to fertilizing is to create a balance of nutrients, with concentrations where and when they are needed throughout the growing season.

PELLETIZING

To overcome these problems, we at Midwestern Bio-Ag have experimented with pelletizing humic materials and mixing them with calcium sources and rock phosphates. It's not an easy process, and because of the nature of the material, it's difficult to keep it in a hard pellet form.

In our early attempts, something surprising occurred. We found that when a pile of humic substances is premixed with rock phosphates and allowed to sit for a period of time, the measurable soluble phosphorus content goes up! A reaction had occurred: the moist, low-pH humic materials were released, activating the rock phosphate (the same thing that was happening in the brew piles in Australia). The beneficial results in the field have really been noticeable.

My experience leads me to conclude that humic materials belong in a mix with fertilizers. Not only can humic materials buffer fertilizers, but they also chelate, holding nutrients for longer plant use.

Our next step in pairing humic materials with buffers is to make homogenized trace-mineral mixes using sulfate trace minerals paired with humic substances. This should also chelate the mineral for more efficient and long-term use.

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