The Value of Compost

Compost is like any other product we buy and use, there is a huge variation in price, quality and value. So how does one determine the value of compost?

Two major factors affect the value of compost. These are; Microbial content and Processing methods and feedstock's used. These two areas determine many of the possible benefits from compost from disease control, pH and nutrient value, to aeration and water holding capacity and many more properties (good or bad).

MICROBIAL

Microbial Inoculants versus Compost:

- best inoculants product on market has only 200 species of bacteria and 20 species of fungi
- good compost or compost tea, 25,000 species of bacteria, 10,000 species of fungus, many species of protozoa and beneficial nematodes to cycle nutrients
- commercial inoculants will sell for about $1.00/oz wholesale. Quality compost at 1,200 pounds/cubic yard can have an inoculant value of many hundreds of dollars or more. This is why good compost at a rate 1 ton/acre or as compost tea at 20 gallons/acre can make a large difference.

Salt: Microbes in compost reduces the negative effects of soils with high sodium (salt), reducing compaction and hardpan

> Bacteria – uses sodium (Na) in cell walls, hence removes from the soil profile as an active chemical
>
> Fungus – use chlorine (Cl) ion in cell walls, hence removes from the soil profile as an active chemical

Functions of microbes found in good compost:

- Disease suppression (competition, inhibit, consume) – requires high levels of fungus
- Improve nutrient retention in soil
- Mineralize nutrients and make them available to plants
- Improve soil structure (more water and oxygen)
- Decomposition of toxic materials (phenols, tannins, pesticides)
- Produce plant growth promoting compounds
- Improve crop quality (flavor, nutrients, and yield)

Mychorrizal spores do not move through the soil, must have aeration and root contact to work, can only live 48 hours without a root unless in dormant spore form.

Note: It may take 2-3 yards or even much more of a lesser quality compost to give the same numbers of beneficial microbes as in good compost.

PROCESSING

Turning of Piles – The process of turning or mixing of compost piles is beneficial IF not done too many times. Turning kills the beneficial fungus required for disease control. As a result piles become dominated by thermophilic bacteria the piles break down quickly and become very hot (often over 170^{o} F). Many beneficial microbes die off and nitrogen and sulfur are released as gases lowering the value of the compost.

Example: We only need 130^{o} F during processing to kill root feeding nematodes. Good nematodes such as bacteria and fungal feeders go dormant at 130^{o} F and do not die until 170^{o} F is reached. Similarly for beneficial fungus, protozoa, etc.

Time frame – many toxic chemicals that may be present in composting feedstock's take time to breakdown, a process know as "half life". Longer time frames allow for slower composting, ensuring a better diversity and higher levels of microbes, nutrients, and complete removal of any possible contaminants.

Example: Herbicides are used on many plants from hay and straw for animal feed to turf grass from lawns.

Herbicides contamination – This is a major problem for some producers and users of compost. Many new herbicides are very resistant to breaking down and may cause users of low quality compost problems. Clopyralid and Picloram are commonly used on fields to grow hay for cattle feed. A cow can eat the hay and the cow's urine will kill plants. The same problem occurs in the cow manure. The half-life of these herbicides in a compost pile is about 90 days IF fungus is present. Hence, in fast composting these chemicals are often still present and may cause problems when the compost is used.

Another herbicide that might survive and be found in quickly made compost is Atrazine. Atrazine is a triazine herbicide, according to the National Toxicology Program, it is "immunotoxic" disrupting the function of the immune system (for example decreases interferon production which fights viral infections). According to the EPA, testosterone, prolactin, progesterone, lutenizing hormone, estrogen, and thyroid hormone are all affected. According to the University of Iowa it causes babies of low birth weight and higher birth defects when exposed to water with levels well below the EPA limits. It also causes genetic damage in laboratory studies. Other studies have shown a link between atrazine exposure and certain types of cancer.

Note: In 2002 the Texas Commission on Environmental Quality (TCEQ) tested the NWR compost and there was zero herbicides found.

FEEDSTOCK'S: The materials used to make compost will affect the quality, determine the type of usage and amounts required to achieve a given result.

Poultry manure (chicken, turkey, ducks, etc.) – these manures tend to be high in certain nutrients but are also very high in salt. Arsenic is often fed to poultry feed to make them gain weight faster. This toxic metal tends to accumulate in the manure and even further concentrated in the compost. Hence poultry manure compost may not be a good choice near a lake or stream or if high sodium levels are present in the soil.

Cattle manure – cattle manure tends to have high salt levels (remember the salt blocks in pastures). Since cattle are typically fattened off in feedlots there is an extra risk of e-coli and salmonella exposure if not composted properly in addition to the herbicide issue from hay. Because of the disease possibility cattle are often given drugs like Ivermectin. Ivermectin is given to cows to protect them from parasites, it is so toxic that it will kill insects that eat and process dung which prevents its decomposition and then it kills plants.

Horse manure (also sheep, zebra, camel, etc.)- These animals have a much wider diversity and more beneficial microbes in their guts; hence they tend to produce higher quality compost.

Green waste- Consists of grass and leaves from a municipal recycling program. Generally makes a superior feedstock since it comes from yards that are well fertilized and watered.

Good compost can be made from any feedstock; it just depends on the objectives of the producer. Objectives range from getting rid of a waste as quickly as possible (feedlot or slaughter house), remove organic material from landfill to save space (waste company), or manufacture products for use in horticulture. Different objectives require different methods to produce and store compost.

Unfortunately there are a lot of vendors selling products that are not compost or compost that has been stored and handled incorrectly. A few warning signs to look for are:

ODORS:

1) Anaerobic organic acids that have a strong odor from putrefying organic matter. The odor varies depending on feedstock and what is going on, however they are all very bad.

Acetic acid - vinegar smell, loss of N_2 and P, alcohols present (only 1 ppm kills roots)
Butyric acid - sour milk smell, alcohol
Valeric acid - vomit smell, alcohol
Putrescine - rotting meat smell, alcohol

2) Ammonia – implies an immature compost (phytotoxic) and a loss of nitrogen

3) Rotten egg (H_2S) - implies an immature compost (phytotoxic) and a loss of sulfur
COLOR:

Pure “black” compost does not have good fertility and indicates anaerobic decomposition or other problems. Sulfur is gone (H_2S), nitrogen is gone or in wrong form, alcohols present. Good compost is a deep chocolate brown when dry.

Industrial wastes are often used to blacken products for marketing purposes.

Smelter wastes are sometimes used as feedstock to blacken products. Copper sulfate ($CuSO_{4)}$ or other sulfur compounds may be present. Sulfur (S) is a fungicide and kills the beneficial fungus.

Boiler Ash (bottom ash) is another industrial waste product used to color or blacken products. Boiler ash is high in salts and extremely alkaline. The alkalinity is so strong that it will chemically burn raw wood black in a couple days. Products tend to be alkaline with high salt, with very high carbon to nitrogen ratios. Some ashes may contain large amounts of heavy metals. Products will often turn a bleached grayish color in a few weeks. These type products are very common in the Houston area.

Dyes – many types of dyes are now available in many colors. Some producers use a black dye to color ground up pallets and call it compost. Some dyes are safe to use but many may contain heavy metals as the coloring or sticking agent.

FILLERS

Some producers cut their product with pine bark (a worthless, nutrition less filler often burned black by boiler ash) or sand or both.

Rice hulls and rice hull ash are common fillers used to cut compost.

Old pallets are often ground up and dyed black and then used as a filler.

NAMING

Many products that are called compost are given *names* to encourage unsuspecting buyer to purchase them. They may have words like black or humus in them. Currently there are no standards or restrictions on what type materials may be called compost.

Example: Spent mushroom substrate (SMS) is called mushroom compost for marketing purposes. Many of the starting materials are the same as used in composting. Often enough salt (NaCl) is added so nothing can live in the substrate except the species of desired mushrooms. Once the mushrooms have removed the nutrients and yields are declining, the substrate is replaced with fresh material. The old material must be disposed of, hence the name mushroom compost to encourage people to purchase it.

SCREENING:

Screening is an extra step some producers use to ensure more uniform and higher quality compost. Screening plants are like very large flour sifters, as they remove the larger undesirable material. Compost is often screened to different sizes for use in different applications. Material larger than 1" in diameter is generally not fully composted and not ready to use, hence screening will remove this material. If a person wants to apply compost to a lawn or other turf area it needs to be screened small enough that the compost will filter down between the blades of grass. Another usage requiring fine screened compost is the machinery to fill potting flats in a nursery. For both of these usages 3/8" screened compost is typical. Screening will temporarily lower the fungus hyphal diameters as shown by microbial testing. Additionally it costs a lot more to screen material to smaller sizes.

CONTROLS

Ask for the Solivita Compost Maturity test. This is an inexpensive test produced by the Woods End Research Laboratories for measuring compost maturity. Compost is placed inside a small plastic bottle with an indicator stick or marker and the lid replaced. After a period of time the color of the indicator is compared to a color chart with maturity numbers assigned to them from 1-8. If the number is low then the compost is green or immature and not ready to use. If the number is 6 or 7 it is ready for most applications. If the number is 8 then the compost is very mature and ready to use by even the most sensitive seeds.

Ask for test reports. Producers whom are concerned with value and quality at least run chemical analysis of their products. Vendors where quality and service is valued will run biological test analysis in addition to the chemical. The biological is reports are for more valuable in determining compost usage and quality.

Buy from a reputable dealer and know what you are getting.

REGIONAL ISSUES

In some states the landfill dump rates are very high such as Minnesota where they are average $58 per ton. Hence an operator can sell compost very inexpensively and still be profitable. In Texas we have some of the lowest landfill rates in the country hence the cost of processing has to come from the sale of the product not from disposal fees. Our soils tend to be poorer in Texas hence a greater need for compost.