Tilth Producers Quarterly
A Journal of Organic and Sustainable Agriculture

Is Vermicompost Better than Compost?

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Washington Tilth
Spring 1999

At a recent Biocycle meeting, the point came up that vermicomposting (i.e., composting with earthworms) doesn't involve a heating process such as occurs in making good compost, so without the heat, will weed seeds still be in vermicompost? Are they still viable?

What about human pathogens in vermicompost? What about plant disease-causing organisms? Again, no heating cycle in vermicompost, so what happens to the pathogens that are usually killed by the heating process in compost?

The current mindset is that weed seeds and pathogens, both human and plant disease varieties, are killed in the vermicomposting process, but the mechanism by which they are killed is different than in the composting process.

Wait a minute, am I saying there's a difference between vermicompost and compost? You betcha. The means by which the end product is produced is different. Does that make one "better" and the other "worse"? Not automatically.

In order to decide which will be better for you, you have to know:

- what set of organisms are needed in your soil (what's lacking?)
- what set of complex carbon compounds do you need around the roots of your plants to grow the beneficial bacteria and fungi?
- what organisms and kinds of carbon are in vermicompost as opposed to compost?

Vermicompost is usually bacterial-dominated, but fungal biomass occurs in it too. The ratio of fungal to bacterial biomass runs about 0.50 to 0.90. But do all vermicomposts have the same set of organisms? Do all composts have the same set of organisms in them? No, they don't.

For example, Mary Appelhof started an experiment last spring with worm bins and she sent us the samples to assess for organisms. Because of the newspaper in the bins, the place started off fungal- dominated, The worms started off happy as can be living in a good mix of fungi and bacteria. Protozoa were having a great time. Then, all of a sudden, doom descended, at least from the worm point-of-view. The worms broke into pieces, literally, and died. The bacteria bloomed to several billion per gram of material, while the fungi died. Nematodes took over, to the tune of several thousand per teaspoon of material, while the worms disappeared. Only two species of bacterial-feeding nematodes were found in the - ah - well, it wasn't vermicompost anymore. Nemacompost?

Would the nemacompost have been good to spread on plants? Sure, if you needed huge numbers of bacteria, a huge number of protozoa, and a huge number of two species of nematode. The material would have been fine for lawns, turf, vegetable crops and row crops, especially if those plants have been treated with herbicides that typically kill most of the bacteria. I would not have put that material on bushes, trees or fungal-requiring herbaceous plants like strawberry. These plants need fungi, and there was little fungal biomass in the material. Were there any human or plant pathogens or weed seed left? I wouldn't think so, although this wasn't tested. What would have killed the "bad guys"? Usually four mechanisms are discussed for killing the bad guys in any compost. These are:

- heat
- predation (being eaten by another organism)
- competition for food resources, space, other nutrients
- inhibition, such as being killed by an antibiotic or metabolite
- anaerobic conditions

In a typical compost pile, heat is extremely important as A FIRST STEP in killing pathogens, root- feeding nematodes, and weed seeds. But then competition, inhibition and predation take over as control mechanisms. Compost builds such a wonderfully complex set of bacteria, fungi, protozoa and beneficial nematodes that the bad guys lose. They die, or are eaten.

In vermicompost, heating is minimal, and it better not get to 145 to 150 F for any length of time, or the worms will head elsewhere. It is the others mechanisms that control the bad guys in vermicompost, and it is the worms themselves that do much of this work. They ingest the root-feeding nematodes, the pathogenic bacteria and fungi, and the small size weed seeds. What they don't consume gets released from their bodies as fecal material but in that material, pathogens, root-feeding nematodes and weed seed have a very difficult time surviving the burst of growth of other organisms. Conditions are not right for the bad guys, and they die, or can barely survive at best.

Thus, a different mechanism in vermicompost than compost, but same basic result. Another point most folks don't realize is that no compost (vermi- or otherwise), and no soil is completely pathogen-free. You really don't want it to be completely pathogen free, because you always want the defense mechanism, the biocontrol agent, to have something to practice on. So, a small number of disease-causing organisms is desirable. Emphasize small number though.

The set of beneficial organisms can vary from mostly fungal to mostly bacterial, and it could still be good compost, as determined by the plants, the parent material and the climate in which you are trying to grow the plant.

What we don't know much about is the importance of the difference in kinds of carbon in vermicompost versus compost. Is it important that a compost have more or less of some kind of carbon compound? Some of the kinds of carbon are things like: * sugars - simple, straight-chain, easy-to-eat (table sugar), or complex, twisted, and hard-to-eat because they're so balled up and difficult to chew on (salt water taffy)?

- carbohydrates - simple, straight-chains, or lots of side-chains and nasty compounds stuck on them?
- proteins - just a couple carbons in the protein, no side chains versus something that has a thousand carbons and looks like a fur ball waiting to attack?
- tannins, phenols, etc. - these are all relatively difficult to consume, but some are much less difficult, while others are the reason that cedar stumps cut 100 years ago in the forest in the Pacific Northwest are still there. Most organisms don't really consider tannins or phenols to be edible.

On a scale of simple to complex, which kind of compost has the simplest carbon? Which is most complex? It depends - on what? The material with which you started your compost. If you start with simple sugars, you'll end up with some more complex material, but most of the material will be fairly straight chain, simple substrates in the compost. If you start with complex food sources, you'll end up with more complex food sources in the compost. Bacteria for the most part like the simple stuff and they out-compete fungi for simple carbon sources. It's what their enzymes are best at using. Fungi like the tough, complex stuff and their enzymes are best at attacking and decomposing the nasty stuff.

Which kinds of compounds are more predominant in vermicompost? What did you make the vermicompost with? Were the starting material mostly juicy, high-in-sugar material like kitchen wastes, vegetable products, green stuff, molasses, manures (high N)? Or were they paper, cardboard, and sawdust?

Vermicompost is made with a small percentage of woody stuff, maybe newspaper that has a lot of relatively simple glues, paper sludge, and soybean- based inks that are much less complex today than what was used 15 years ago.

Compost can be made with the same starting materials, but is the end product the same as would be produced by vermicomposting? They can be, if the compost gets the same amount of mixing that occurs in the vermicomposting process.

Do you think that vermicompost isn't mixed? Hum, what do you think worms do? They move through the compost looking for food, and in the process they turn, mix, aerate, and spread other organisms through the compost. You don't have to turn the material, the worms do it for you.

If you had the bacteria in the compost that make pretty much the same slime and waste products that the worms do, and you turn the compost as often as worms turn their compost, then the compost and vermicompost will be the same. Is it likely that these requirements will be matched? Not likely.

Because worms mix the compost like little tiny plows, and also add slime, aerate, and spread all kinds of organisms throughout the material, there are more small aggregates in vermicompost. These are better condominiums for bacteria than what occurs in an compost that is not turned or turned rarely. Lots of small aggregates are like having lots of individual, detached houses. Humans are happier, for the most part, when they have good living space. Bacteria are no different. They would rather live a place with lots of space than in a tenement building or a crowded apartment house. In a compacted soil, that's what happens. Bacteria don't like to live in crowded, unpleasant places with little food, so they move to Texas (which from a bacterium's point-of-view, is about 3 inches away). Or they die since they have no shelter and are easy pickings for protozoa or nematodes. Or they go into dormancy until a new apartment complex is built.

If you have a soil with good structure and no compaction, you probably wouldn't see much difference in the effects of compost versus vermicompost. But if your soil is compacted and has little structure, such as occurs after a few years of conventional tillage, would vermicompost be better than compost? Consider that ANY ORGANIC MATTER is better than NO ORGANIC MATTER. There is an exception: When the organic matter carries a disease that can't be controlled by the other organisms in the compost. This happens in three situations that come to mind:

- when someone puts diseased plant material into the pile and then doesn't bring the material up to temperature or allow the growth of other controlling organisms (i.e., doesn't compost),
- when material is "pasteurized" so there's a source of food for the disease, but no competing, inhibitory or predatory organisms to keep the disease-organisms in check.
- when compost is over-heated (above 160 to 165 F), and the "mid-temperature" organisms went to sleep or died because the material got too hot. As the compost cools, the heat-loving organisms die, and now disease can be blown in or brought in by birds or animals and the disease can take over.

You'll get even better results if you determine what your soil needs, then figure out what's in the compost, vermicompost, or organic matter, and then use good compost, vermicompost, or good organic matter to move the organisms in the right direction for the plant you are growing.

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