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A boomless sprayer applies a foliar application of compost extract on fall cover crops in southern Pennsylvania.

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Simple Yet Powerful

Growers can extract their own liquid amendments from bio-rich compost

BY JESSE WISER

Awareness is growing in agricultural circles as to the importance and influence of soil microbiology in crop nutrition, disease and pest resistance, soil aggregation and water infiltration. Research exists and is increasing at all levels around methods to expand and diversify the microbial populations within soil ecosystems. While professional solutions may be sought, a low-cost, high-impact, self-driven process offers tremendous upside: the extraction of liquid biological amendments from microbiologically rich compost.

Producing Biologically Rich Compost

Matt Ball, who runs the composting program at North Carolina State University, defines composting as "managed aerobic decomposition." That's a broad definition for an extremely variable process, and the resulting material — compost — is far from homogenous, even if aerobic conditions are successfully maintained. Feedstock material, temperature, airflow, moisture and time are all variable factors that drive decomposition, and a wide range of outcomes are possible in terms

A sample setup for same-day extraction and application. From left: water source, extraction system, mixing system (for adding microbial foods), collection tank, application system.

of microbial content within materials generally called "compost."

Specific composting methods exist to produce a microbiologically rich compost product. Perhaps the most versatile and efficient is vermicomposting. Among the roles of earthworms within the soil ecosystem is the inoculation of microbes via the worms' digestive process; these microbes then multiply within the worms' castings. Feeding organic materials — preferably already at least somewhat decomposed — to and through a highly concentrated worm population can exponentially multiply the biomass and diversity of plant-beneficial microbes.

A recent study by Dr. Zack Jones of Aggrego Data entitled "The Vermi-Microbiome Project" analyzed a variety of vermicompost samples using DNA sequencing. Dr. Jones demonstrated a high level of bacterial biodiversity across all samples, regardless of feedstock and other factors. Well-represented bacterial genii included those responsible for the production of auxins, gibberellins and other plant growth- and health-promoting compounds.

If a fungal-dominant compost product is desired, the Johnson-Su bioreactor process is both simple and effective. Dr. David Johnson of New Mexico State University has developed an easily replicable, low-cost, low-labor method to control decomposition of carbon-dominant organic materials through static aeration and moisture control. (Earthworms are involved in this process as well, so it could be considered a derivative form of vermicomposting.) The resulting product contains a high level of beneficial fungi, which is often unachievable through other composting methods. The only downside to this process is the time commitment — it can take 9-12 months for the material within a bioreactor to completely decompose.

Regardless of composting method, the microbiological quality of the resulting compost can be assessed prior to extraction. Samples can be sent to labs, such as those certified by Dr. Elaine Ingham's Soil Foodweb School, or tested with simple onsite tools such as the microBIOMETER. Results from these tests can help guide decisions on the concentration and application rate of the liquid amendment to be extracted.

Johnson-Su bioreactors can be easily constructed from obtainable materials such as used pallets, hardware cloth and landscape fabric.

Extracting Liquid Compost Amendments

While there are many benefits of applying compost in solid form, extracting the microbiology into a liquid amendment can increase the efficiency and area of the application. It enables the grower to transfer the microbes directly into the soil — via infiltration or injection — or onto leaf surfaces via a foliar spray. The liquid solution will also contain soluble compounds already produced by the microbes.

Before extracting the liquid amendments, it's important to make sure the mineral content of the water source is suitable for microbiology. It may be necessary to use rainwater (which should also be tested) or to pre-treat the water through a filtration system.

Widely accepted terminology regarding liquid amendments has yet to be ironed out — perhaps it never will be — but it's important to note the difference between what I'll call "compost extract" and "compost tea." The two are produced in crucially distinct manners. Compost extract is a direct liquid extraction from the solid compost. Microbes are held in a static condition within the solution — they maintain homeostasis, but the population remains constant. Because of this, compost extract can be stored for several days, or even weeks, before application. Note that it should be circulated on a daily basis until application to introduce enough dissolved oxygen to prevent the solution from turning anaerobic.

Compost tea, on the other hand, is created by aerating the solution with bubbles of oxygen, which stimulates the microbes to multiply. This shortens the aerobic shelf life of the solution to a matter of hours; this means that compost tea must be made within a deliberate window prior to application. Compost tea is typically produced directly from the compost material; however, compost extract can be used to produce compost tea through a separate aerating process. For instance, an operator may wish to produce a large batch of compost extract and store it for several days, using it to produce one daily batch of compost tea at a time.

An quick aside on compost leachate: Some composters mistakenly consider leachate — the liquid that collects and runs out of the bottom of a compost pile — to be "compost tea" and treat it as beneficial. This is incorrect, and potentially damaging, as it is most likely anaerobic and frequently contains high concentrations of pathogens and/or heavy metals. Please don't make that mistake!

Microbial foods, such as blackstrap molasses, kelp powder and fish hydrolysate, can also be added to compost extract or compost tea, before or

during application. Simeon Kleinsasser, a certified Soil Food Web soil consultant from New York's Hudson Valley, mixes these foods into compost extract while filling his sprayer tank, likening it to "sending the microbes out to work with a lunch pail." These foods help the introduced microbes establish themselves while also stimulating existing microbes within the soil or leaf surfaces.

Applying Liquid Biological Amendments

Application of compost extract and/or tea will depend largely on the desired results. Broadacre applications will provide some benefit, but more specific application methods will yield more intentional results. Soil drenches and injections target the microbial ecosystem surrounding plant roots, while seed coating and root-drench applications prior to planting will import desired microbiology with the crop itself. Foliar sprays, which provide some of the most robust protection from pathogenic microbes, can be applied throughout the growing season.

Spray systems demand particular consideration. Many conventional sprayers are designed for chemical applications and contain features such as rotary pumps and smaller spray nozzles, which can damage the microbiology, especially when applied at high pressures. Diaphragm and centrifugal pumps are safer options. Microbial solutions should be applied at low pressure with larger spray tips to create a droplet, rather than mist, effect.

Benefits of Self-production

Beyond the biological impacts, there are several particular benefits to self-producing liquid compost amendments. Composting organic debris generated by the farm itself and/or sourcing local materials such as fall leaves and wood chips fosters a closed-loop recycling system while minimizing waste. Microbes native to these local materials are best adapted to local environments, and locally sourced organic materials tend to be easy and affordable to acquire. Economic and environmental costs of shipping, including paying for water weight, are eliminated in self-production.

Cost savings are even more dramatic when compared to synthetic inputs. Jay Young, who produces compost extract at his 8,000-acre farm and ranch in western Kansas, estimates cost savings of $200,000 for 2022 alone without experiencing any decreases in yield per acre. With increasing prices of synthetic fertilizers, compost amendments will become increasingly economical — and could even generate an income stream of their own.

Some biological knowledge or consultancy may be necessary to achieve the best results, as may a certain degree of trial and error to discover the best avenues to pursue for each situation within a highly variable process. However, the cost-effectiveness and simplicity of self-produced biological amendments makes this both a powerful and accessible tool for fostering healthy and abundant soil ecosystems. ACRES

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