



## GARDENERS' GOLD – THE MAGIC OF VERMICAST

Earthworm castings, also called *vermicast* or *vermicompost* – truly deserves its reputation as “Gardeners’ Gold.”

The product you purchased from one of our Zero Waste schools or harvested from your very own home worm bin is produced by Hawaii’s local composting worms, *Eisenia fetida* and *Perionyx excavatus*. Vermicast is best used fresh and moist. It contains thousands of species of living organisms – most microscopic – although you may see some tiny earwigs, millipedes, or isopods still busy processing the bits of decaying organic material clinging to the vermicast.

### What exactly is vermicast?

Vermicast is the residual product of decaying organic material that has passed through the gut of earthworms – in essence, it’s the worm’s poop.

School and household composting worms are typically fed food waste including fruit rinds, skins, and peels; vegetable trimmings, stale bread, moldy tortillas, soggy cereal, leftover pasta, muffins, and rice.

How is food waste transformed to vermicast? When a banana peel, for example, begins to decay in an environment with oxygen present, it becomes microbially active. Legions of bacteria, fungi, protozoa, etc., secrete enzymes to break molecular bonds, decomposing – breaking down – the

plant tissue. The softened material is then ingested by worms.

A calcium compound is secreted into the worm’s esophagus, neutralizing the acidic food. This creates within the worm’s gut the ideal environment for bacteria, who increase their population 1,000+ times. The worm derives its own nourishment from these bacteria as they die off inside the worm’s gut. The surplus bacteria is excreted in a cast held together with intestinal mucus.

The bacteria also contribute their own slime to protect them from inhospitable conditions.

Within a single 10-milligram earthworm cast, there are several billion bacteria of 500 to several thousand species, comprising about 90% of the weight of the cast. Another 5% is composed of fungi, nematodes and other critters, plus tiny bits of still-decomposing material.

### How does it work?

Vermicast is much more than a fertilizer containing plant nutrients such as nitrogen, phosphorus, potassium, and magnesium. It is a powerful living package that stimulates growth of the all members of the **soil foodweb**. Vermicast promotes *living* soil.

Vermicast added to the soil carries to the root zone a diverse and populous

consortium of microbial life that hold within their bodies a rich compliment of plant nutrients and growth-enhancing compounds. Vermicast contains a variety of organic matter harboring a storehouse of nutrients that do not wash away.

The plant is delivered an on-going, reliable food source when bacteria and microscopic fungi feed on organic matter, releasing some of the nutrients to the soil and storing others for their own energy and reproduction. When nematodes and protozoa in turn feed upon them, the nutrients stored in the bacterial and fungal bodies are released to the soil in a plant-available form.

When soil rich with organic material supports protozoa numbers on the order of 20,000 per gram of solid matter, for example, 400 pounds of nitrogen per acre are released through their predation on bacteria.

In other words, when we feed organic matter to the soil, the *soil life* feeds nutrients to the plant. Vermicast adds a concentrated dose of life to the soil.

### Increases soil aggregation

Unlike chemical plant fertilizers, the nutrients stored in organic matter and the bodies of the microbial life are not lost through irrigation to contaminate ground water. Hair-thin fungal tentacles, called hyphae, wrap around soil and organic matter particles in their search for food, forming aggregates

that are the basis for good soil structure. Thus, both the fungi and organic matter are held in the soil.

Bacteria exude sticky glues that enable them to cling to solid particles of mineral and organic matter, ensuring they too remain in the soil and, like the fungi, aid in the formation of aggregates. Aggregates in the soil are responsible for important soil qualities such as infiltration, water retention, porosity, and aeration.

### **Protects against disease**

Nutrient retention and nutrient cycling are not the only benefit of vermicast. By inoculating the soil with the rich, diverse, microbial life present in good vermicast, the plant root is protected from disease and attack by root-feeding organisms.

You may hear that worm castings contain a “natural pesticide,” but this is not exactly true. Nothing in worm castings kills other organisms, rather, the concentrated beneficial microbes delivered in the vermicast are present in such numbers and vigor that they actually out-compete disease-causing organisms.

Because the diversity of organisms aids in ensuring everyone present has a predator, no one organism in the root zone is easily able to reach populations sufficient to cause significant damage.

Plant roots exude foods that encourage colonization by microbial life beneficial to the plant, reducing the number of possible infection points. Some microorganisms exude compounds inhibitory

to pathogenic organisms, further reducing the chance for pathogen blooms sufficient to cause plant damage.

When we add vermicast and the microbial life it supports to the soil, we aid in increasing the complexity and diversity of organisms to the root zone, thus aiding in disease and pest suppression.

### **Transformative**

The transformation from sterile, chemically-damaged soil to rich and complex living soil is indeed miraculous, and much deserved praise is heaped upon our wonderful worms for the key part they play. You can restore and replenish your soil by using vermicast as a soil amendment, or in liquid form as vermicast tea.

### **How to use vermicast**

Vermicast won't burn, poison, or rot plants – it is stable and non-compacting. Castings can contain up to eleven times the amount of nitrogen, phosphorous and potassium available in soil that has not been worked by worms. Although a concentrated plant fertilizer, vermicast is even more valuable in its role in building communities of beneficial soil organisms.

Use vermicast as a soil amendment.

Castings, unlike compost, should only go where roots are. Vermicast typically doesn't provide the bulk organic value of compost, so you'll want to use castings only around the root zone of plants. Vermicast should not be used as a top dressing, where it could dry out.

Use castings mixed into your planting medium. Tender, leafy, delicate plants

like lettuce, kale, etc., don't want as much, while heavy fruiting and flowering plants like tomatoes, peppers etc., benefit from more.

For greens,, use 20% or less, for flowers and fruits, 20% to 30%.

For a 4” start, mix 1/4 cup right into the planting hole, where the roots will be. For transplanting seedlings, line the bottom of the row with vermicast to a depth of two inches, working it in to the soil before planting.

For houseplants, add one heaping tablespoon vermicast per gallon volume in the pot. Stir it lightly into the surface soil, then water. Apply twice during the growing season.

Mature shrubs, ornamental and fruit trees will benefit from vermicast. Put vermicast two to three inches from the base of the plant and in a circular pattern continue out to the drip line. Water and work the castings into the soil immediately after application.

On your lawn, pre-water the area you will treat. Broadcast the castings like you would any commercial fertilizer. Re-water the lawn afterward to begin leaching nutrients into the root zone.

### **Vermicast tea**

First of all, let's clear up the confusion about the liquid that drains out of your worm bin. This is not worm tea, or compost tea, or any kind of tea. Liquid that percolates through the worm bed may pick up soluble nutrients from the vermicast – the nutrients *leach* into the liquid – and this liquid is called *leachate*.

In addition, leachate may contain fruit juice, anaerobic bacteria from deep within the bin, and a wide variety of other odds and ends. It's inconsistent from day to day and very dilute, since we drench our worm beds daily.

It will certainly do no harm if you water plants with leachate – any water with a few nutrients is beneficial to moisture-and-nutrient-starved Hawaii vegetation, but it does not deserve the accolades promoted on YouTube videos – it is vastly inferior to a true tea. The practice in Hawaii is to let it drain away under our worm bins. Let it go.

A true vermicast tea is made from finished vermicast and is well worth the effort!

With the flexibility and ease of using the solid vermicast, why go to the extra bother of generating a liquid? Because as aqueous extract, vermicast has additional beneficial applications. Tea is most commonly used as a foliar spray or soil drench.

Leaf surfaces, like plant roots, harbor a rich microbial population that protects the leaf, and thus the plant, from infection and attack by pathogenic organisms. When the microbial consortium present on the leaf surface is reduced by pesticide or environmental damage, it exposes leaf surfaces,

opening infection points. We can re-inoculate the leaf with the diverse communities of microbial life found in vermicast by making a tea to use as a foliar spray. It is known also to control white fly, aphids, and other infestations.

A simple liquid vermicast tea used for a soil drench can be made by placing several ounces of vermicast in a mesh bag and seeping it in a small bucket of water for two or three days, stirring vigorously twice a day.

Use this liquid to water your plants every other watering to restore health and vigor.

There are commercial tea brewers available that take the perfection of vermicast tea to even greater heights. Seeping vermicast in agitated, aerated water, then adding a nutrient mix for microbial growth makes an even better brewed tea. The water is agitated to extract as many of the organisms clinging to the solid matter as possible, and the nutrient mix provides those microbes dislodged into the liquid with a food source (such as molasses) on which to grow and reproduce. The blend of food and oxygen in the tea enables the microorganisms to grow to numbers rivaling those found in the solid matter. Brewed teas should be used within 24 hours.

### **Comparison with compost**

How does vermicast and vermicast tea compare to compost and compost tea made by the standard thermophilic method?

Studies are currently underway at the University of Hawaii College of Tropical Agriculture to determine the nutrient value and bacterial/fungal content of vermicast created from different sources, such as home food waste vs. horse or chicken manure. Vermicast samples are also being compared to standard compost.

Preliminary studies indicate that vermicast is higher in nutrients and higher in microbial life. This is not to discredit standard compost, which is ideal for adding bulk as well as organic material. Think of vermicast as a richer, more refined, premium product.

Vermicast cannot be replicated in a laboratory by mere humans,. Only our wonderful worms produce this amazing, complex, living product. Care for your worm colony and your worms will reward you endlessly with the single best soil restorative known on earth.

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Want to learn more? Our recommendations:

- The Growing Solutions website, [www.growingsolutions.com](http://www.growingsolutions.com). This is an excellent commercial tea brewer developed here in Hawaii – their website is loaded with excellent information and stories about tea.
- Google “The Grass is Greener at Harvard” and find this 2009 article printed in the New York Times - fascinating!
- Watch the movie, “The Biggest Little Farm,” available on Netflix. Our favorite film, ever.