

Figure 1. Tomato seedlings top dressed with 0, 4, 8, or 12 percent vermicompost by volume two weeks after seeding.

Vermicompost Is Putting Worms To Work

Cornell researchers demonstrate how to use vermicompost in vegetable transplant production.

by **STEPHANIE BEEKS**
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ORGANIC growers routinely cite “effectively managing plant fertility” as one of the top challenges when growing vegetable and herb transplants. Vermicompost, or worm-worked compost, is seeing increased attention as a substrate component to provide essential plant nutrients and add a beneficial microbial community.

Compost And Vermicompost

Compost is comprised of organic matter that has been decomposed in a controlled manner. Compost is added to organic substrates for the purpose of adding microbes, slow-release fertility and increased nutrient-holding capacity. When used alone in a container, compost holds too much water; therefore most recipes for using compost suggest the maximum that should be used in a mix is 20 to 35 percent by volume.

Compost can be made from many different feed stocks including animal

bedding and manure, yard waste and wood by-products. The feed stock has a great influence on the nutrient analysis of the compost that is created.

Compost traditionally has a low nutrient analysis, which has led to the increased interest in vermicompost. Vermicompost can have twice the available nutrient levels of standard composts

from the same feed stock. This is not a miracle. Instead it is due to additional processing of the feedstock by worms and their associated microbes.

Most vermicomposting operations use red wigglers (*Eisenia fetida*) to digest and fragment the feed stock into finely divided materials. This, along with microbial decomposition and mineralization, serve to

increase the total amount of NPK as well as increase the amount of plant-available nutrients (such as ammonium and nitrate nitrogen). An example of this nutrient enriching process is shown in Table 1.

Worm Power LLC of Avon, N.Y., begins creating its product with dairy manure and bedding, which is then composted. The compost is then added to worm beds in an indoor facility. In the example in Table 1, the total nitrogen in the material increases from 0.4 percent for raw feedstock, to 1.0 percent for finished compost and to 1.7 percent for finished vermicompost. During this process, nitrate increases from 9 to more than 2,000 ppm.

Due to its higher nutri-

Table 1. Nutrient analysis of dairy manure during the different phases of composting at Worm Power, LLC. Analysis is on a fresh weight (as received) basis.

Compound	Raw Dairy Manure Feedstock	Thermophillic Compost	Vermicompost
% Dry weight			
N	0.4	1.0	1.7
P ₂ O ₅	0.1	0.4	0.7
K ₂ O	0.2	0.9	1.5
ppm			
Ammonium-N	757	10	64
Nitrate-N	9	9	2,222

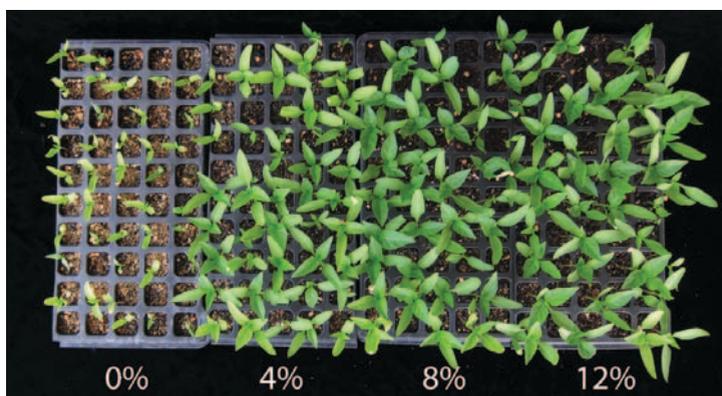


Figure 2. Pepper seedlings top dressed with 0, 4, 8, or 12 percent vermicompost by volume two weeks after seeding.

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ent content, vermicompost has a higher soluble salt content than compost and should be used at a lower rate to avoid burning seedlings from high salts.

Compost Teas And Extracts

A compost tea is a liquid made by brewing or steeping compost in water. Compost tea serves to transfer nutrients, microbes and organic matter from the compost into a liquid. A traditional compost tea is aerated by adding air or oxygen to the tank while brewing. This process serves to promote the population of aerobic microbes. This addition of air requires specialized equipment.

Compost teas can also be made anaerobically, which are then referred to as extracts. This is a passive process where air/oxygen is not introduced during the steeping process. This process is commonly referred to as a non-aerated or passively aerated extract. This method does not require specialized equipment. The extract also has a much longer shelf life than an aerated tea.

Worm Power has recently begun selling a non-aerated vermicompost extract the company produces at its facility, as well as tea bags for home gardeners to prepare their own extracts, called Worm Power Shower. Table 2 lists the nutrient composition of Worm Power's commercially prepared extract. Compared to a conventional liquid fertilizer the extract

Table 2. Nutrient comparison of Worm Power vermicompost extract and a conventional fertilizer prepared at 100 ppm N.

Element (ppm)	Vermicompost Extract	20-10-20 at 100 ppm N
Nitrogen (N)	29	100
Potassium (K)	291	83
Phosphorus (P)	12	22
Calcium (Ca)	41	0
Magnesium (Mg)	13	0
Iron (Fe)	0.8	0.25
Manganese (Mn)	0.1	0.125
Zinc (Zn)	0.16	0.125

is lower in plant-available nitrogen but high in other macro- and micro-nutrients.

Testing The Efficacy Of Vermicompost

We recently conducted experiments at Cornell University to determine the suitability of Worm Power vermicompost and vermicompost extract as the sole nutrient source for production of organic vegetable and flower seedlings in the plug stage. The Worm Power materials are listed for use in certified organic production by the

Organic Materials Review Institute (OMRI).

In the trials, we used 'Rutgers 39' tomato and 'Celebrity White' petunia as plants with a relatively high fertilization requirement. We also used 'California Wonder' bell peppers and 'Rocket' snapdragons as plants with a lower fertility requirement. The substrate used in our trials was Sun Gro Sunshine #1 Natural & Organic mix, which is also OMRI listed. We

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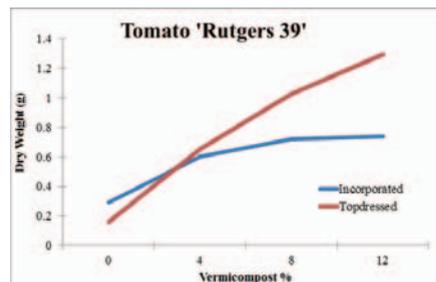


Figure 3. Dry weights of tomato seedlings fertilized with vermicompost, either top dressed or incorporated.

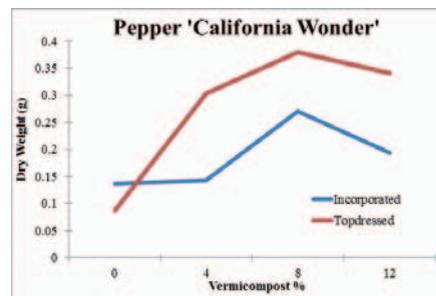


Figure 4. Dry weights of pepper seedlings fertilized with vermicompost, either top dressed or incorporated.

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Table 3: Suggested usage rates for Worm Power vermicompost products. Lower rates should be used if additional fertilizer sources are supplied in the mix or added later. Always conduct your own trials when using a new material.

	Seed Starting	Top Dress On Seedlings	Liquid Extract on Seedlings
	Blend into germination mix by volume.	Sprinkle seedlings 2 weeks after seeding. Rates shown are percentage of cell volume.	Prepare Worm Power Shower following label directions. Use beginning 2 weeks after seeding, water so cells are moist, but do not overwater.
¹ Heavy Feeding Vegetables	10%	10%	5 times per week if Worm Power liquid is the only fertilizer. 3 times per week if Worm Power is blended in potting mix, or another fertilizer is used.
² Light Feeding Vegetables And Flowers	5%	5%	

¹ Heavy Feeding Vegetables: tomato, lettuce, cole crops, spinach, cucumbers, squash, corn.

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used 200-cell plug trays with a fairly large volume of 20 cubic centimeters.

Top Dressing Vs. Incorporation

We first trialed vermicompost solids for vegetable and flower plug production. We tested two different methods of applying the vermicompost: incorporated into the Sun Gro mix prior to seeding the trays or applied as a top dress to the trays two weeks after the seeds were planted. In both cases, vermicompost was applied at treatment rates of 0, 4, 8 or 12 percent by volume added to the mix. No additional fertilizer was added.

After four weeks, seedlings were evaluated for germination rates and seedling biomass (dry weight). Germination rates of pepper and snapdragon were reduced when vermicompost was incorporated at the highest rate (12 percent). This decrease was likely due to high salts (electrical conductivity) and high pH from using vermicompost at this rate.

In general, plant biomass increased with vermicompost addition. For example, tomato seedling size was double (incorporated) or triple (top dressed) control plants when applied at the 4 percent rate. With the exception of tomatoes, vermicompost growth benefits topped out at the 8 percent rate. Peppers and snapdragons had slight reductions in biomass when rates greater than 8 percent were used, again likely due to high salts.

Moderate Rates Of Solid Vermicompost Increased Growth

We suggest trying vermicompost at a 5-percent rate for flowers and light-feeding vegetables and 10 percent for heavy feeding vegetables. When we compared incorporation at seeding to top dressing two weeks later, top dressing was a more

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Figure 5. Tomato seedlings fertilized with 3 cups of vermicompost extract at 0, 1, 3 or 5 times per week.



Figure 6. Tomato seedlings fertilized with 3 cups of vermicompost extract at 0, 1, 3 or 5 times per week.

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effective application method. We attribute this to the fact that when incorporated at seeding, some of the plant-available nutrients leached out before the seedlings were ready to use them, whereas top dressing supplied the nutrients when the seedlings needed them.

Regular Applications Of Extracts = Larger Plants

We then trialed Worm Power vermicompost extract in plug production. The same plant varieties, plug tray size and Sun Gro mix were used as outlined with the solid vermicompost. Two weeks after seeding, we began treatments.

Trays were drenched with about 3 cups of vermicompost extract per tray (4 mL per cell) at either 0, 1, 3 or 5 times per week. This was enough to keep trays moist but not saturate them. Plants were watered daily as needed when extract was not applied. Germination and growth was again evaluated after 4 weeks.

Extract application had no effect on germination rates, but plant size increased in proportion to the amount of extract applied. The five-times-per-week treatment produced the largest plants and could be used as a suitable fertilizer for producing organic seedlings (Figures 5 and 6), although seedlings were smaller than their counterparts from the first vermicompost trial. The extract alone is low in

plant-available nitrogen. Thus, for optimal growth, extract drenches should be combined with vermicompost solids or other organic fertilizer treatments.

Overall we found that vermicompost can be successfully used as the sole fertilizer source for organic vegetable and flower plug production. The results of the above trials as well as additional germination trials conducted in collaboration with Harris Seeds (Rochester, N.Y.) and Worm Power were used to develop more general guidelines for using Worm Power vermicompost products for use in flower and vegetable plug production (Table 3).

Using Vermicomposts In Your Operation

Remember, not all vermicomposts are the same. The feedstock composition and process followed will greatly influence the final nutrient analysis. Work with your supplier to obtain maturity tests and nutrient analysis for every batch you bring in. Always conduct your own in-house trials on a small scale when using new materials. Finally, certified organic producers should always consult their certification agents before purchasing and using any new materials. **GG**

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