Sustainable and Organic Agriculture Program
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Vermicompost Research Update 2009

What is vermicompost?

Vermicompost is compost generated by worms and associated microorganisms. Vermicompost is locally produced in Hawaii from plant wastes, manures and other organic by-products. There are several commercial producers of vermicompost using both *Eisenia fetida* (Red wigglers or Tiger worms) and *Perionyx excavatus* (Blue worms) in the State, with feedstocks ranging from chicken and pig manure to kitchen scraps and cardboard. The benefits of vermicompost to seedling vigor and plant health are attributed in large part to high concentrations of plant available macro- and micro nutrients, plant growth promoting organic acids and high microbial activity, all of which may confer tolerance to stress (Arancon et al. 2004; Hoitink, 1997; Zhang et al., 1998).

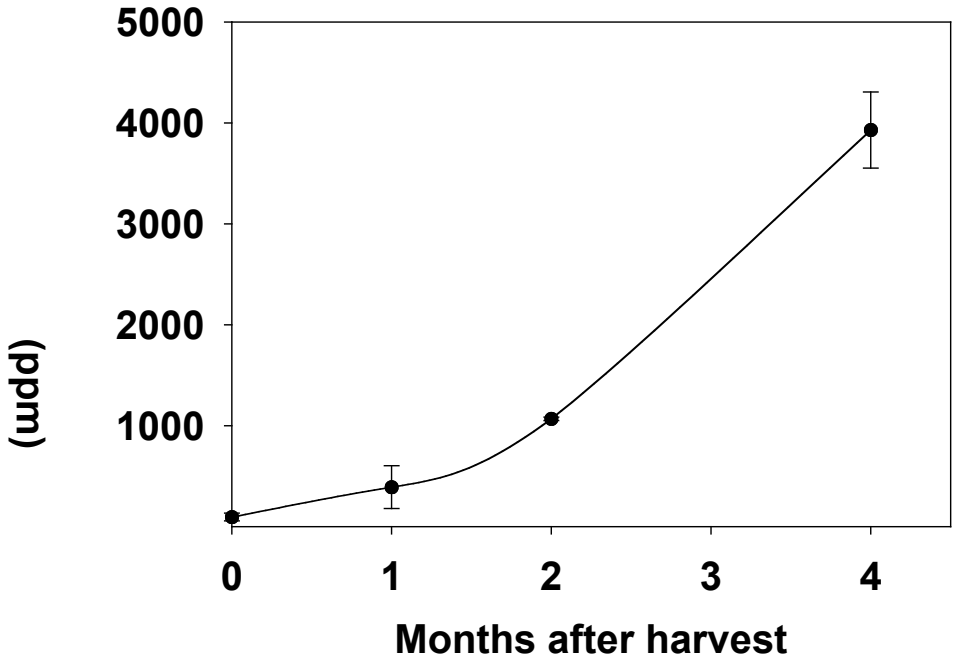
Vermicompost quality

Vermicompost quality will vary depending on many factors including worm species, raw material used, and age of the compost. Vermicomposts are generally of finer structure, contain more nutrients, and have higher microbial activity than other types of composts. This makes them particularly valuable as plant growth promoters. Select quality charateristics of commercially available vermicomposts that have been evaluated by the University of Hawai'i are listed in Table 1. Analyses of thermal (turned) composts produced in the State are also included in table 1 for comparison. One benefit of vermicomposts is the relatively large amount of plant available nitrogen that they contain in the form of nitrate (NO_3^-). This is partly due to the enclosed nature of vermicomposting that reduces losses of NO_3^- and other nutrients. Note the relatively high NO_3^- content of the thermal chicken manure/motalities compost in the last row of Table 1; this compost was produced under cover, compared to the other thermal composts produced in open air. Allowing vermicompost to cure (stored in aerated container) after harvesting for 3-4 months can also dramatically increase the NO_3^- content. The high variability in mineral nitrogen content in the UH food waste vermicomposts (Table 1) was a function of time after harvest (Figure 1).

Table 1. Some quality characteristics of composts produced in Hawaii. Values are means±standard deviation.

Type/ Source/ Primary feedstocks	# of Samples	Total Carbon %	Total Nitrogen %	C:N	NO_3^- ppm	NH_4^+ ppm
Vermicompost						
Hawai'i commercial						
Chicken manure	21	20±3	1.6±0.4	13:1	1,748±636	29±18
Rabbit manure	9	21±3	1.8±0.3	12:1	2,391±882	59±50
Pig manure	6	25±1	2.0±0.1	13:1	2,924±1,542	61±67
Horse Manure	6	25±1	2.0±0.2	13:1	4,000±1,045	18±18
UH experimental						
Food waste	33	26±5	1.8±0.3	13:1	1,212±1,230	122±252
Mainland commercial						
Steer manure	6	16±1	1.1±0.1	15:1	629±231	118±50
Green waste	6	19±2	1.2±0.1	16:1	1,348±49	28±6
Other compost						
Hawai'i commercial						
Steer manure/ greenwaste	6	18±1	1.1±0.2	16:1	103±77	58±34
Greenwaste	7	21±3	0.7±0.5	30:1	118±80	183±24
Hawai'i farmer produced						
Chicken manure/greenwaste	6	8±1	0.7±0.0	11:1	593±39	23±4
Chicken manure/mortalities	6	21±0	2.9±0.1	7:1	1,748±553	--

Figure 1. Nitrate (plant available nitrogen) increases with time after harvesting vermicompost.

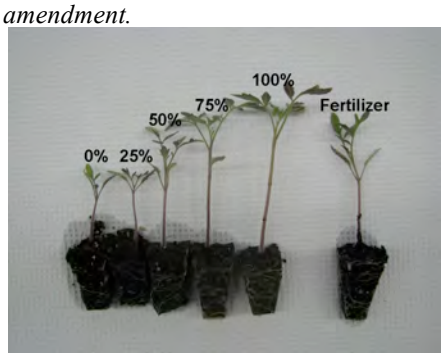


Using vermicompost effectively

Growing medium

The combined action of worms and microorganisms results in a product that as a component of potting media can improve crop vigor and, subsequently, yield and nutritional quality (Arancon et al. 2004). Preliminary work at the University of Hawaii indicates that locally produced vermicomposts are a highly acceptable replacement for peat in producing vegetable seedlings (Fig. 2; Radovich, 2007b). This agrees with the work of others in the U.S. and Europe (Hashemimajd et al., 2004; Zaller, 2007). Vermicompost may also confer resistance to several important vegetable pests including nematodes and fungal diseases (Arancon, 2002; Hoitink et al., 1997).

Figure 2. *Four-week-old tomato 'Kewalo' seedlings grown in a peat-based media amended with locally produced vermicompost at rates of 0, 25, 50, 75 and 100% (v/v) with no additional fertilizer amendment.*



"Compost tea"

Growers have found that extracting compost with water and applying the resulting "tea" to crops can extend the benefits of a small amount of compost over a larger area, but there are few scientific studies investigating the influence of compost quality, extraction method and others factors affecting plant response to compost tea. Our lab has been funded by USDA WSARE to evaluate compost tea effects on plant quality, nutrient content and yield. The project was developed in consultation with the Hawaii Organic Farmers Association and commercial growers statewide. Extension agent Jari Sugano (PEPS), Dr. Nguyen Hue (TPSS), Dr. Norman Arancon (UHH), Dr. Stephen Talcott (Dept Nutrition Food Science, Texas A&M) and three commercial growers are project collaborators. Numerous other CTAHR faculty are cooperating on the project. Work led by Ph.D. student Archana Pant (TPSS) in the lab and greenhouse has demonstrated the potential for compost tea to promote plant growth with both organic and synthetic fertilizers. Her results are particularly exciting because compost tea not only positively influenced yields but also affected the concentrations of phenolics and carotenoids in plant tissues. These compounds can impact the sensory and nutritive quality of vegetables.

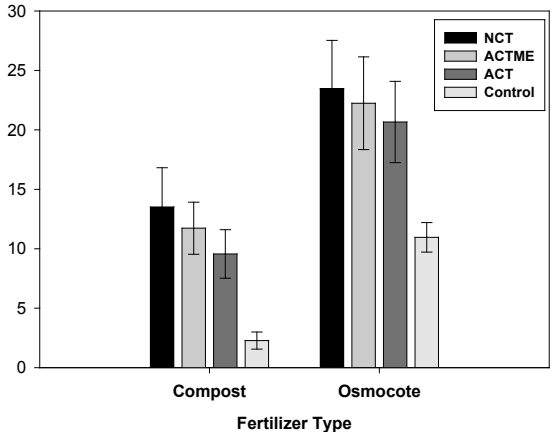


Figure 3. *Effect of compost tea extraction method on pak choi shoot growth in the greenhouse. Each value is the mean of 10 replications. Error bars represent mean standard error.*

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