

WormEzine Vol. 2 No. 2

News and information from Mary Appelhof
about vermicomposting, worms, and other critters that live in the soil.

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For the Small Print, scroll to end.

They laughed when I said worms eat my garbage,
but I showed them how, and now thousands say the same thing ...

A WORD FROM MARY APPELHOF aka Worm Woman

=====

Dear Worm Workers,

Worm bin outside temp 11 degrees F ((minus 12 C), worm bin 36 F (2 C)), worms are alive and well. (This is sort of like a webcam, isn't it? Except, no pix.)

I went to Washington D.C. last weekend to participate in the Peace March and rallies on Sunday. Here is a brief report. I drove from Kalamazoo to Lansing where we left in 3 buses at about 7 p.m. Friday. Slept (?) on the bus, arrived at 7 a.m. Saturday, checked into a hotel, then joined the rally in front of the Capitol at 10 a.m. The trip was exhilarating, but exhausting, as you can well imagine. We were outside in 20s (7-10 C) weather from 10 a.m. to 5-6 p.m., walked many miles and stood for hours. I don't remember ever being so exhausted when I finally found my way back to the hotel. I was not alone! But the day was a bright, sunny day, the energy was marvelous, there were no negative occurrences that I was aware of.

I participated in an event on Sunday that ended up being the civil disobedience event surrounded by police. It wasn't really intentional on my part ... I was just standing at the gate to Lafayette Square in front of the Whitehouse, with police all lined up behind the fence, when a man with a bull horn asked in a very non-violent, non-threatening way to gain admission to the people's park. The police said entrance would be limited to 25. The group came back with "that is unacceptable," and asked everyone to sit down on the street, which we all did (about 60 at that time). Always one to do what I'm told, of

course, I did, too. After discussions with affinity groups, and much going back and forth, with crowds increasing as other, more rowdy groups came up to the area, I eventually told the group I was not willing to get arrested, so I went through the police barrier to watch from the other side. More stories ... finally some people were arrested as they attempted to go over the fence. One woman fell and hit her head, becoming unconscious; emergency vehicles came to take her away. I thought they were the paddy wagons to take away those who were arrested. Some people spilled into the street and went limp, police rather roughly dragged them back to the curb. But I never felt threatened for my, or, really, anyone's safety. No big uncontrollable things happening. Fascinating experience, I'll never forget it.

Feature this month is on flow through systems. I have photographs posted on my website at <http://www.wormwoman.com/acatalog/wormezine.html>

Next month I will be featuring an educational activity described in "*Worms Eat Our Garbage*" as setting up a worm observation chamber. Educators and parents please note that we have some wormy activities on the website that you can download as PDF files. Go to:

http://www.wormwoman.com/acatalog/weog_teachers_center.html

And now, to some large-scale systems. . .

Sincerely,
Mary Appelhof

"Changing the way the world thinks about garbage ..."

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1=====FEATURE=====

Continuous Flow Vermicomposting Systems by Mary Appelhof

An interesting thing happens when people start vermicomposting. Initially they may have been reluctant to start composting with worms because it seemed like such a weird idea. But when they see how the food waste and bedding disappear, the worms multiply, and the vermicompost turns into something valuable they can use in their gardens, they ask themselves, "Why can't this be done on a larger scale?" I asked myself this question thirty years ago. I'll bet you did too, when you first started. It doesn't take much searching in the literature of large-scale vermicomposting technologies to come across the term "continuous flow systems" and "automated continuous flow systems." Other

terms are an “elevated vermicomposting table,” “reactor” or “in-vessel vermicomposting system.” What are these systems like? Are they effective? What are some of their advantages and/or disadvantages?

HISTORY

Continuous flow systems were first developed as part of an extensive research program in the early 80s overseen by Dr. Clive Edwards at Rothamsted in the United Kingdom and funded by the British Government. He brought the basic concepts to the United States when he took a position at Ohio State University. He directs the only laboratory in the states that regularly receives USDA (United States Department of Agriculture), NSF (National Science Foundation), and other funding to provide a scientific research base for the capabilities of earthworms to process wastes and produce plant-growth enhancing media. The systems were designed to meet the following criteria: 1) ease of access, 2) aerobicity, 3) control of temperature, and 4) moisture control.

I have visited several of the currently working systems, and describe them below. Photographs of several models appear on my website at:

<http://www.wormwoman.com/acatalog/wormezine.html>

BASIC DESIGN IS A RAISED BED

A large-scale continuous flow system is basically a linear raised bed with sidewalls and a mesh floor to support the substrate. The beds can be 5-8 feet wide and 50-100 feet (1.5-2.5m by 20-30m) long. A thin layer of newspaper initially lines the bed to prevent substrate falling through; a shallow layer of substrate such as dewatered dairy manure is placed on the on the paper. Worms (usually *Eisenia fetida*) are added at a rate of from 1/2- 1 lb / square foot of surface area (1Kg/.25 sq. m of surface area) of bedding and allowed to settle in and begin consuming the substrate. To achieve pathogen reduction and allow for the majority of the high-temperature composting to occur before adding it to the worms the dairy manure is pre-composted. Thin layers of food (the pre-composted dairy manure) are added on a regular basis, perhaps twice a week.

As worms process the material they leave their castings behind. Fresh food draws them upward. Cocoons laid in the medium hatch and the young worms also populate the bed, moving upward toward the fresh food supply, consuming the bacteria, fungi, protozoa, and nematodes proliferating in the medium. Eventually food resources from the material at the bottom are consumed and it becomes pretty well stabilized. The thin layer of paper keeping it from falling through decomposes and the vermicompost stays on the grid until it is agitated in some fashion, causing it to fall through onto the floor.

AEROBIC CONDITIONS PREVAIL AND WORMS COME UP TO FEED

Continuous flow systems are defined by allowing regular feeding on the top and periodic removal of castings (vermicompost) from the bottom. Since both top and bottom surfaces have access to airflow, it is less likely that anaerobic conditions will develop than, for example, in a windrow system. If the depth of the substrate is allowed to become deep enough, most of the worms will be in the upper layers; separating them from the bedding, usually a time-consuming and labor-intensive task, is not necessary.

Some worms will drop down to the floor, however, so it is unreasonable to expect a perfect separation.

The extent of automation differs in how the feed is applied and how the castings are removed. Feeding can be done by tipping the contents of a front-end loader bucket on the surface and raking the manure to the appropriate depth, ranging from 1/2 inch (1 cm) to 2 inches (5 cm). Thick applications produce heat from the action of thermophilic (heat loving) bacteria. During cold weather, thicker applications may produce sufficient heat to keep the worms more active than they would be otherwise. However, thick applications could result in a “melt down” and kill the worms during hot weather. Gantry systems have been developed to apply even layers of feed on the surface. Similar to a manure spreader, with wheels riding on the edges of the bed, the hopper can be filled with a front-end loader and rolled the length of the bed, spreading feed as it moves along.

WORM CASTINGS FALL TO THE FLOOR ...WITH SOME HELP

What surprises most people about these continuous flow systems is that the castings do not readily fall through the mesh on the bottom of the bed, although two operators I have visited said they will be changing mesh size from 2 x 4 inch (5 x 10 cm) mesh to 2 x 2 inch (5 x 5 cm) mesh for future systems. The vermicompost tends to cake and requires prodding, agitation, or some action to break the clumps of worm castings so they fall through to the floor. Various mechanical breaker bars can accomplish this task. Powered by a winch, cable, or chain, these devices work like a horizontal knife to slice off a measured portion of vermicompost to fall through the grate. After the castings drop to the floor, they are raked from underneath the table by manual labor or gathered by a variety of devices that sweep them to one end where they are then moved off the premises for curing or further processing such as screening.

CONSISTENT HIGH-VALUE PRODUCT ACHIEVABLE

According to Dr. Scott Subler, who produces and packages highly-refined worm castings that he sells to a high-end consumer market, the automated continuous flow vermicomposting reactor enables him to establish a consistency in his product that other systems do not allow.

Continuous flow vermicomposting systems provide a means for producing large quantities of a consistent, high-quality product requiring much less labor than windrow, bed, and batch systems. It is much easier to maintain an aerobic environment with both top and bottom surfaces exposed to air. The trade-off here is that evaporation could dry the beds too much. Capital investment will be thousands of dollars, and most systems will require a building of significant size. Facilities in colder climates will need heat during the winter months. One off-the-shelf system is available. Other systems have been constructed with knowledge of basic requirements, metal/wood construction know-how, and ability to figure out what it takes to get the job done. Working with knowledgeable people on a consulting basis is recommended. It is critical to keep in mind that growing worms requires diverse skills and an intuitive feel for maintaining a healthy and productive population of worms. Knowledge of proper environmental conditions, including moisture, aeration, and temperature; paying attention to potential feedstock

toxicity, and dealing with the regulatory environment for handling large quantities of wastes will all be required of the successful operator.

Anecdotal reports of the value of worm castings as enhancers of plant growth are being strongly supported by scientific research. However, this neophyte industry is plagued by lack of industry-defined standards, product consistency, and product availability. Continuous flow systems have the potential to address serious problems with manure management and food waste; at the same time, produce massive volumes of a consistent, high-value, environmentally-appealing product.

1. =====RESOURCES=====

A. Curt Hawley operates the system that produces high-quality worm castings for Dr. Subler's Living Soil. Pete Bogdanov interviewed him in the Dec. 2002 issue of Casting Call Newsletter. <http://www.vermico.com>

B. Dan Holcombe founded and operates Oregon Soil Corporation. Phone: 503-557-9742

C. Jack Chambers owns Sonoma Valley Worm Farm and wrote an article on his system in BioCycle Feb. 2002, "A Continuous Flow from Vermicomposting." Vol 43, Iss. 2; pg. 34-35. Abstract free, article available online for a fee in the archives of <http://www.jgpress.com>.

D. Dr. Scott Subler is marketing his castings products under the name Dr. Subler's Living Soil. <http://www.livingsoil.com/>

E. Rhonda Sherman has written several articles in BioCycle on vermicomposting, including descriptions of continuous flow systems. See "Vermicomposting systems overview," BioCycle, Dec. 2002; Vol. 43, Iss. 12, pg. 53, 4p.

F. Casting Call Newsletter. Peter Bogdanov publishes a bimonthly newsletter that covers developments in the vermicomposting industry. Principal focus areas are vermiculture, composting, soil fertility, and related issues of organic waste. Call 541-476-9626 or visit <http://www.vermico.com>

G. *IN THEIR OWN WORDS: Interviews with Vermiculture Experts*, edited by Peter Bogdanov, includes interviews with Dr. Clive Edwards and Dr. Scott Subler that describe various aspects of continuous flow systems. Available at http://www.wormwoman.com/acatalog/In_Their_Own_Words.html
IN THEIR OWN WORDS retails for \$15.00; mention that you are a Wormezine subscriber and receive FREE shipping on this product!

3=====Q & A=====

Mary,

I had an old bin that I let go. Do I have to start over again? Can I use straw for bedding? How about bones in the bin? Add coffee grounds? I won a second bin in a raffle which I have yet to set up. I will only use paper with maybe some soaked cardboard –do you think I can overfeed my worms?

Thanks again. Happy Thanksgiving!

Sharlene

Hi Sharlene,

I will try to give you some ideas.

No, I'm sure you don't have to start over. I do believe that adding fresh bedding and making sure it is moist enough are important. In my bins, once there is a large amount of dark, brown bedding which certainly continues to have unprocessed food in it, adding fresh shredded paper or soaked corrugated cartons always seems to make the worms happy. They seem to prefer working on the surface of the bedding at the interface of the fresh carbon source, particularly if it has been moistened.

Straw isn't necessarily the best bedding because the worms crawl up into the individual straws. It also takes a long time to break down. However, it certainly keeps conditions aerobic, and provides a medium to support bacteria and fungal populations that the worms then eat.

Bones? Yes ... all sorts, especially in larger, outdoor bins. The worms (and other organisms) pick the meat and cartilage off the bones. It's amazing.

Yes, it is possible to overfeed your worms. Odor is the best indicator. The thing is, when you overfeed, the worm population seems to increase to provide more worms to handle the demands placed upon them. So, if you want more and more worms, you may have to be willing to put up with a certain amount of odor. Make sure to maintain aerobic conditions. Adding fresh bedding, as I mentioned above, will help to control the odors and maintain an environment more suitable for worms.

Yes, coffee grounds, too.

Mary

4=====COMING EVENTS=====

- A. February 2003. Kalamazoo Gazette will feature vermicomposting in their Home Life section. The original plan was to use a large photograph of a mass of worms, but when the staff saw what it looked like they had second thoughts ... worms? Over Sunday brunch? The current plan is to use artwork of the worms and a smaller photograph of the squirmy mass.
- B. February 22-23. ZERI (Zero Emissions Research Initiative) hands-on Biodigester Workshop with George Chan in New Mexico. George Chan has spent a lifetime designing and installing Integrated Biosystems and Integrated Farming Systems. These systems utilize biodigesters to provide initial processing of human and animal manures, produce methane as an energy source, and further process nutrient-rich water through oxidation ponds, plankton, and fishponds. Used as irrigation water, the nutrient-laden water fertilizes crops, adding value above and beyond that

previously achieved. He is working as a ZERI volunteer with Picuris Pueblo to design and develop a model system in this mile-high "hidden valley" south of Taos.

- C. February 22, Saturday George Chan will give a one-day free presentation at Picuris. Contact Lynda @ 505-986-1454 for the Saturday workshop.
- D. February 23, Sunday's workshop at a nearby farm, workshop participants will construct a digester to help treat wastes for their farm. Contact Robert at 505-986-3855 for the workshop. Fees for Sunday's workshop will pay for the materials for this digester.
- E. March 11, 2003. Mary Appelhof will be showing her video *Wormania!* to residents of Friendship Village, a residence for seniors in Kalamazoo. A previous visit to a senior citizen home was very well received. Some people have been attuned to worms all of their lives ... they loved being able to see the footage of the earthworms moving, foraging for food, hatching from cocoons. For all the grandmothers there, you can believe that Mary will also be reading *Compost, By Gosh!*, as well. After all, isn't it suitable for ages 4-94? You can order your own video *Wormania!* at http://www.wormwoman.com/acatalog/Wormwoman_catalog_Videos_7.html and *Compost, By Gosh!* At http://www.wormwoman.com/acatalog/Compost_By_Gosh_.html

FREE SHIPPING when you order *Compost, By Gosh!* and *Wormania!* We want to help you empower the young people in your lives! Is there a better way to spend quality time with a child than reading a book and sharing a movie? Oh yea, tell us how many children you will be sharing with to get a WORMY surprise for each!

- F. April 21-26, 2003 Earth Week. Various readings of *Compost, By Gosh!* Will take place around the country. Send us an email if you will commit to reading this charming book to a group of children during Earth Week.
- G. June 2002. A third, three-module USA ZERI Training is scheduled for mid-year. The second training session filled, and applications have already been accepted for the third. Sessions will be in Santa Fe, New Mexico. Contact Lynda Taylor @ 505-986-1454 for more info: mail to: lyndataylor@cybermesa.com

5. =====PRODUCT HIGHLIGHTS=====

- A. VIDEO: The Continuous Flow Reactor featuring Scott Subler. This viable, working large-scale vermicomposting system consists of an indoor bed raised above floor level and fed daily in thin layers on the top by means of an automated gantry system. Worms move up to the fresh food, vermicompost drops to the floor where it is harvested virtually free of worms. Dr. Scott Subler presents the benefits of castings and discusses market opportunities. Viewing this video will save hundreds of dollars you could spend on a site visit. Produced by Pete Bogdanov of Vermico. 37 min. VHS. Order by visiting the site below

http://www.wormwoman.com/acatalog/Wormwoman_catalog_The_continuous_Flow_Reactor_46.html

6=====ABOUT THE AUTHOR=====

Mary Appelhof is founder and president of Flowerfield Enterprises, which develops and markets educational materials on vermicomposting. Its publishing imprint is Flower Press, publisher of the how-to book *Worms Eat My Garbage*, the classroom activity book and curriculum guide, *Worms Eat Our Garbage: Classroom Activities for a Better Environment*, *The Worm Cafe: Mid-scale vermicomposting of lunchroom wastes*, and *Diabetes at 14: Choosing tighter control for an active life*, which is not about vermicomposting, but is an invaluable asset for anyone affected by diabetes.

Order *Diabetes at 14* save \$5.00 off of the retail price. Wow that is over 30% off! Make sure to mention the WormEzine to receive the discount!

Compost, By Gosh! is Flower Press' newest publishing endeavor with author and illustrator Michelle Portman. If you are new to the WormEzine list you may not be aware of the opportunity that you have to "Instill in children the belief that they can change the world, and make it FUN!" Share *Compost, By Gosh!* with a young person in your life today.

7===== THE SMALL PRINT=====

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