

Review of Mid-to-Large Scale Food Residuals Vermicomposting

**Rhonda Sherman
Biological & Agricultural
Engineering**

NC STATE UNIVERSITY

Vermicomposting

Vermicomposting is a process that relies on **earthworms** and **microorganisms** to help stabilize active organic materials and convert them to a valuable soil amendment and source of plant nutrients.



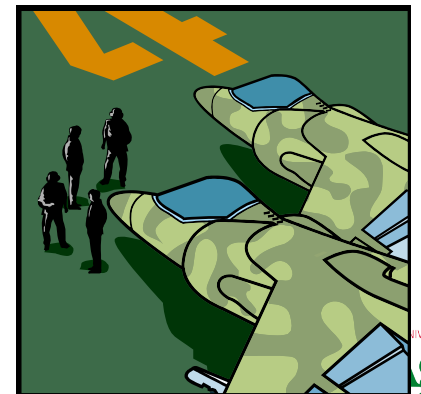
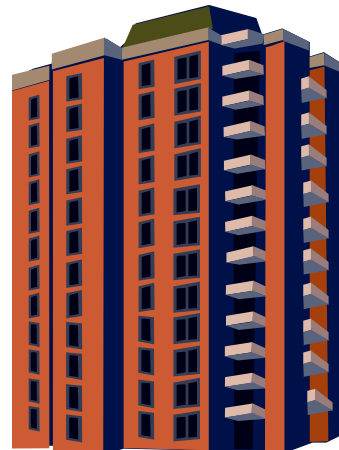
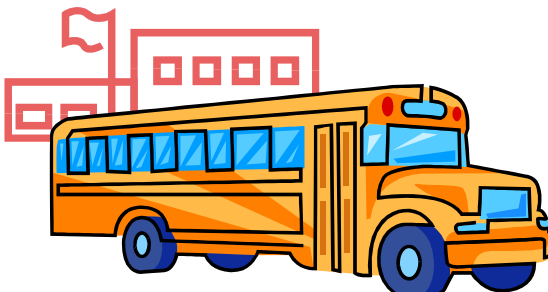
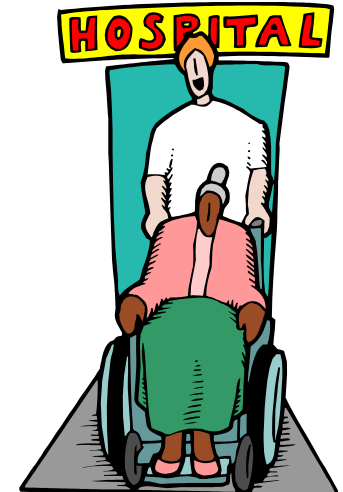
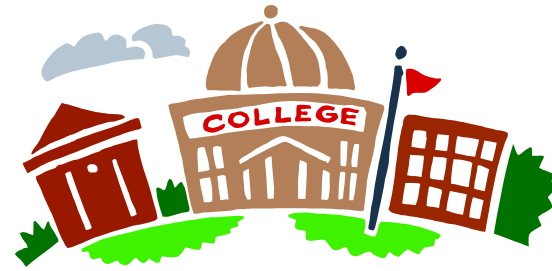
Business Solution: Vermicomposting

- Past decade: increase in businesses doing vermicomposting
- On-site or sent to centralized facilities
- Vermicomposting can save:
 - Waste collection and disposal fees
 - Water usage costs
 - Electricity
 - Wastewater disposal expenses



Types of Facilities

- Restaurants
- Universities & colleges
- Prisons
- Hospitals
- Office buildings
- Schools
- Military bases



Use the Right Earthworm!

- >6,000 species of earthworms
- Most live underground and eat soil
- Some live on top of ground and don't eat soil, they eat rich organic matter
- Only 7 earthworm species suitable for vermicomposting
- ONE species used by most worldwide

Eisenia fetida is #1

- 1 pound (lb) = ~1,000 *E. fetida*
- Eat 25-35% of their body weight daily
- Add 1-2 lbs worms to 1 sq ft surface area of bin
- Do not get from your yard or bait shop
- Buy from a worm grower:
 - [Directory of Vermiculture Resources](#) on my website: <http://worms.ncsu.edu>
 - Prices vary widely, so check around

Suitable Feedstocks for *E. fetida*

- Kitchen scraps & plate scrapings
- Coffee grounds
- Animal manure
- Agricultural crop residues
- Yard trimmings
- Scrap paper
- Organic byproducts from industries
- Sewage sludge



Factors Affecting Breeding & Growth of *Eisenia fetida*



- Temperature: 55°– 83°F (limits 32° – 95°F)
- Moisture: 80% (limits 60 - 90%)
- Oxygen requirement: Aerobic
- pH: >5 and <9
- Ammonia content of waste: Low; <0.5mg/g
- Salt content of waste: Low; <0.5%

Vermicomposting Basics



- Provide 6 inches of bedding
- Add composting earthworms
- Apply layer of feedstock <2 inches thick
- Wait until most of food eaten before adding more
- Cover food scraps with shredded paper or cardboard or cloth or plastic
- Keep bed moist by misting

Choosing Your Vermi-System

- Available on-site area
- Amount of feedstock generated
- Funding available
- Labor needs & availability
- Climate
- Concerns with bears, contamination or other issues



***Some worm bins are purchased
from manufacturers.....***



The Worm Wigwam



The Worm Wigwam Grate





***Some worm bins are designed and
built by individuals....***













Some bins use solar to heat and cool...



Some pre-compost







***Particle size reduction is achieved
in various ways.....***







***A couple quick examples of
businesses that are
vermicomposting....***

Fresh Produce Distributor

- Delivers produce 6 days/week in NC, SC & VA
- 50 refrigerated trucks from 3 distribution ctrs
- 800 square feet of space for vermicomposting
- 7 worm bins (317 sq ft total); 600,000 worms
- 900 lbs wet veggie waste per week
- Dewatered and 300 lbs fed to worms weekly

Future Plans

- Beginning to test aerated static pile bins to compost spoiled veggies and OCC
 - Will decrease dewatering labor and provide homogenous feedstock for earthworms
- Plan to increase vermi-capacity 4-5 fold
- Expansion plans: back-haul spoiled veggies from farms and retail outlets it serves, pick up from university and farmer's markets

Restaurant

- 2006 began vermicomposting in basement in two 14' x 4' bins with 200,000 worms
- Bedding: 6-inches shredded OCC and paper
- Feed weekly: 250 lbs food scraps & 40-50 lbs coffee grounds
- Cover bed with shredded paper menus & beer lists



Restaurant *cont.*

- Kitchen prep scraps go in repurposed 5-gallon buckets
- Pre-compost in 2 Suncast Tumbler bins in alley for 1-2 weeks



Conclusions

- Vermicomposting can save money by reducing
 - waste hauling & disposal fees
 - water usage expenses
 - fertilizer & soil amendment expenditures
- It's about this:




Not this:





New Vermiculture Book

Vermiculture Technology: Earthworms, Organic Waste, and Environmental Management

Editors  Clive Edwards – *Ohio State University*
Norman Arancon – *University of Hawaii-Hilo*
Rhonda Sherman – *N. C. State University*

CRC Press, 600 pages, 35 chapters

Contributing Authors: Australia, Brazil, China, Hong Kong, India, Indonesia, Mexico, Russia, Spain, Ukraine, United Kingdom, United States

NCSU's 14th Vermiculture Conference

October 26-27, 2013

Raleigh, NC

- Benefits & uses of vermicompost
- Vermicomposting technologies
- Vermicompost research studies
- Marketing products
- Testing vermicompost, soil and feedstocks
- Brewing and using vermicompost tea



http://www.bae.ncsu.edu/workshops/worm_conference/

Slide Set Prepared by:

Rhonda Sherman

Biological & Agricultural Engineering

North Carolina State University

E-mail: sherman@ncsu.edu

www.bae.ncsu.edu/people/professionals/sherman

worms.ncsu.edu