Principals and Practices of Commercial Scale Vermicomposting and Earthworm Husbandry

Thomas Herlihy
RT Solutions, LLC - Worm Power

NC State Vermicomposting Workshop
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RT Solutions, LLC
DBA Worm Power

- Created solely to develop professional horticultural products based on vermicomposting technology
- Own & operate “state-of-the-science” vermicomposting facility
- Internationally recognized technology leader
Background – Our Story

Conducted a six month search across the Eastern U.S. to find the **RIGHT Opportunity**:

- A progressive animal agriculture operation (supermarket effect),
- Willing to sign a long term Operation & Supply Agreement
- Suitable piece of ground for the project (developable)
- Operation with more manure than can be economically used
- Ability to secure an increasing supply of feedstock (future growth)
- Compatible on a business and human level
Site Selection

✈️ New York State is a Major Agricultural State – A leading state in grape, apple production and dairy production - We all don’t live in Manhattan.

✈️ 675,000 cows in active production, (3rd in nation) produced in excess of 10 billion lbs of milk (USDA 2003)

✈️ Dairy manure produced: in excess of 16 billion lbs/year
Secure Consistent Feedstock

- Location: Avon, NY - (State’s largest dairy concentration)

- Located on 1,600 head dairy, adjacent to another 1,700 head operation

- Less then 5-miles from the two primary shipping modes

- Great people to work with!
Coyne Farm

- 1,000 Registered Holstein milkers & 600 heifers.
- 4th Generation family owned and operated “Dairy of Distinction” – Not organic certified
- Average Cow weighs 1,800 lbs
- Daily Husbandry
  - Consumes 300 lbs/day of feed and water
    - Yields 85 lbs/day of milk
    - Yields 120 lbs/day of manure
Interstate 390
Proosed Vermicomposting Facility
Coyne Farm Main Facility

Legend
- Main Facility
- Mobile Home Park
- Interstate 390
- Roads

Interstate 390
Jenks Road
Route 5 & 20
Proposed Vermicomposting Facility
Coyne Farm Main Facility
Separator Facility Construction

Construction of separator facility (June 2005)

Final separator facility (December 2005)
Manure Separator
Feedstock Preparation

prototype manure separator (above).

Fan centrifugal model shown to the right.
Manure Management
Integrating Plant and Animal Agriculture

1,000,000 & 7,000,00 gallon manure effluent lagoons

Effluent is injected into crop fields behind chisel plow
Manure Management
Integrating Animal and Plant Agriculture

Separated manure effluent is pumped from lagoons through 5,000’ of drag hose to subsurface injector

- Conserves nutrients
- Reduces
  - Odors
  - Road traffic
  - Soil compaction
  - Application costs
Site Development

Site clearing and pad construction for processing and conditioning buildings (Feb. 2005)
Facility Construction

Construction of composting aeration system
(May 2005)
Facility Construction

Installation of flow-through digesters
(June 2005)
Vermicomposting Facility

RT Solutions, LLC Vermicomposting Facility
(Left to Right)

(1) Finished Product Processing Building
(2) Vermicomposting Building
(3) Office Trailer
(4) Composting Building
(5) Raw Feedstock Storage

Completed December 2005
Process Flow

Raw manure → Manure Separator → Manure Lagoon

Manure Solids (nitrogen) → Hay/corn Silage (carbon) → Mixing (C/N Ratio) → Mixed Material

Liquid Manure → Water

VERMICOMPOSTING Flow-Through Digesters (Worms Worms and more Worms)

Vermicompost Material → Composted Dairy Manure

Worm Castings + Worm Compost → Storage → Distribution

TARGET MARKETS

Pathogen Reduction
Weed Seed Destruction
Process Controls

Raw materials stored in covered facility

Materials are mixed with large agricultural equipment to specific parameters

- Porosity, MC, C:N ratio, bulk density
- Reproducible recipes (weighted within 10 lbs)
Process Controls

Mixed materials loaded into aeration bays

Thermophillic Composting

- 14 days with one turn
- Min of 3-days @ 55 degree C
- Weed seed destruction
- Pathogen reduction (PFRP)
- Acts to stabilize the material

Oxygen and temperature are measured, with feedback to air flow - rate & volume controls
Feeding

Material is spread in a uniform 1” layer across the surface of each digester.
Worms are fed the uncured compost
  • Only when ready!!!

Building was engineered with automatic ventilation, watering, heat and directed lighting systems - happy worms = a good night’s sleep.

Harvested by multiple hydraulic systems -
Process Controls

- Good animal husbandry of worms is **MOST** critical

- **Uniform moisture content of material**

- Monitor temperature continuously (tipping point)

- Look for cocoons and reproduction.
Animal Husbandry

- Good vermicomposting requires basic animal husbandry
  - If you treat your worms like a garbage disposal don’t be surprised by the results
  - Careful feeding, watering and environmental controls lead to healthier and larger worm populations – surprise!
  - Keep a log book and record observations, feedings and harvests.
  - Use your nose as part of your monitoring program.
The importance of earthworms in breaking down organic matter was first emphasized by Charles Darwin in 1881.

- While feeding the worm's rudimentary crop & gizzard act to physically breakdown ingested material
- Material passes through the worm's GI tract and becomes “biologically inoculated”
- Physical, chemical and biological process accelerates decomposition & stabilization
Animal Husbandry

Other Considerations

• Worms do not have large mouths. Yes they will breakdown big pieces of organic matter, but do you want to wait.

• Economical vermicomposting means maximizing production in the shortest time.

• Use your log book to correlate processing rates to feed and environmental conditions.

• Seasonality plays a factor

• Don’t worry about pure cultures (species)
Harvest

Worm worked material is removed from bottom of each digester

Continuous-Process, Flow-Through Earthworm Vermicomposting Digester
Product Quality Control

- Finished product screening
  - Robust screener
  - 3 current product lines
  - Bulk packaging
  - Retail packaging

- Finished product storage
  - All product kept in fully enclosed buildings and containers (seasonality of sales)
Facility Operations

- Finished product distribution
  - Nationwide shipping contracts
  - Local shipping
Vermicompost Products

- Solid vermicompost products and liquid extract product can be sold in bulk and small retail packaging
  - **Solids**
    - Bulk in 1 cu-yd containers (commercial growers)
    - Retail in a variety of small packages
  - **Liquid vermicompost extracts**
    - Bulk 275 gal carboy
    - Smaller retail
Research and Development

- Worm Power has been awarded nine research grants from Federal and State Agriculture Agencies over the past five years to develop vermicomposting systems and vermicompost products.

- Funded Research includes*
  - Large Scale Vermicomposting
  - Vermicomposting and dairy manure management
  - Vermicompost use in vegetable production
  - Vermicompost use in potting mixtures
  - Vermicompost in diseases suppression
  - Development of liquid vermicompost extracts
  - Mechanisms for disease suppression from vermicompost

*Worm Power enjoys a long-term research collaboration with multiple departments at Cornell University
Worm Power is designed to be the nation’s largest supplier of organic plant growth and protection products based on our patented earthworm composting technology.