“Large-Scale Vermicomposting of Dairy Manure”

Three Years in the Belly of the Worm -

A Case Study

By: Thomas Herlihy
Managing Director
Worm Power, LLC

Who

RT Solutions, LLC
DBA Worm Power

- Professional engineering firm created solely to promote large-scale vermicomposting projects.

- Serve private and municipal clients (variety of organic wastes).

- Leveraging USDA SBIR support and private investors we have permitted, designed, built, financed and now operate North America’s largest earthworm composting facility.
Background – Manure Issues

Economics of dairy manure management (the CRUCH)

- Larger farm operations (economy of scale and compensate for revenue/animal)
- More animals = more manure
- Regulations limit manure application rates (less manure/acre)
- Combined results in greater land needs for manure (more acreage)
- Costs increase significantly as distance from farm to field increases

Excess manure becomes a waste issue, as the value of manure can not offset handling costs
($/ac spreading costs > $/ac fertilizer value)

One Potential Solution

Large-Scale Vermicomposting of Animal Manures

- A publicly and environmentally acceptable solution for manure management.
- A reliable technology capable of producing a premium organic product with a competitive return rate.
- Animal operator’s benefits include: reduced land application costs (land required, time, labor, and equipment).
- Win–Win–Win Scenario for:
  - Animal operation
  - Vermicomposting company
  - Consumer of the worm castings
The Search

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

- A progressive owner, willing to sign a long term Operation Agreement
- Suitable piece of land for the project (economically developable)
- More manure than can be economically used
- Ability to secure an increasing supply of manure (future growth)
- Proximity to target marketing sectors (product support)
- Close proximity to major transportation routes

Why Vermicompost in New York

- New York State is third (3rd) in the nation in grape and apple production and 3rd largest dairy producing State - We all don’t live in Manhattan.
- 675,000 cows in active production, produced in excess of 2 billion lbs of milk (USDA 2003).
- Over 100,000 cows in a 70 mile radius.
- Manure produced: in excess of 5 billion lbs per year
Coyne Farms

• 1,000 Registered Holstein milkers & 600 heifers.

• 4th Generation family “Dairy of Distinction”

• Average Cow - 1,800 lbs

• 83 lbs/day of milk
  100 lbs/day of manure
Process Flow Diagram

Separator Facility

Construction of separator facility (June 2005)  Final separator facility (December 2005)
Separator Equipment

prototype manure separator (above).
Fan centrifugal model shown to the right.

Effluent Handling

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

Effluent is injected into crop fields behind chisel plow
Vermicomposting Facility

Overall facility (December 2005)

Facility Operation

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

Vermicompost Material

Screening

Worm Castings + Vermicompost Compost

Storage

Distribution

TARGET MARKETS

Hay Silage (carbon)
Manure Solids (nitrogen)
Manure Lagoon
Raw Manure
Liquid Manure

Pre-Vermicomposting Conditioning (composting active aeration)
Pathogen Reduction
Seed Destruction

Composted Dairy Manure
Raw Materials

Materials collected from Coyne Farm (approximately 3000’ from separator-vermicomposting facility)

- 12 Tons per day - manure solids and off-specification hay and/or corn silage

Mixing

- Raw materials analyzed quarterly

- Separated Dairy Manure and Off-Specification Silage are loaded and mixed with Agricultural Equipment

- Mix is made to specific standards and Accurately Measured.
  - Carbon to Nitrogen Ratio
  - Moisture Content
  - Porosity
  - Bulk Density
Composting

Mixed materials loaded into aeration bays

Thermophilic Composting
- 14 days with one turn
- Min of 3-days @ 55 degree C
- Weed seed destruction
- Pathogen reduction (PFRP)
- Reduces readily available energy
- Organic Certification - OMRI

Oxygen and temperature are measured, with feedback to air flow (rate & volume controls)

Vermicomposting

- Worms are fed the uncured (green) compost
  - Only when ready!!!
- Building was engineered with automatic ventilation, watering, heat and directed lighting systems - happy worms = a good night’s sleep.
- Fed, harvested, processed by multiple hydraulic/mechanical systems.

Odor Free – We serve lunch to Cornell visitors next to worm beds
Vermicomposting

**Feeding**

Material is spread in a uniform 1” layer across the surface of each digester.

**Harvest**

A 1” layer is cut from the bottom of each digester.
Husbandry

- Good animal husbandry of worms is most critical – Approximately 8 million
- Homogenous moisture content of material
- Monitor temperature continuously (tipping point)
- Look for cocoons and reproduction.

Finished Product

- Automatic systems move material from digesters to finished product Building.

- Finished product screening
  - Robust aggregate screener
  - 3 current product lines
  - Over(s) returned
  - Bulk packaging

- Finished product storage
  - All product kept in fully enclosed buildings
Transportation

- Finished product distribution
  - Nationwide shipping contracts
  - Local shipping

Marketing “Worm Power”

- Commercial - Wholesale
  - Vineyards
  - Vegetables
  - Greenhouse
Marketing “Worm Power”

- Retail Sales
  Home owner – Lawn & Gardens

Research and Future Development

- On-going projects with multiple departments at Cornell University to document the benefits of vermicompost in various applications.

- Outstanding preliminary data on disease suppression – Doctoral student’s primary focus.