



Integrated Waste Management Consulting, LLC

Matthew Cotton

Composting Systems



- 25 years in the composting industry
- Permitted and helped develop some of the major facilities in California
- Worked on numerous statewide projects for CalRecycle
- Over a decade on the US Composting Council Board, including three terms as president
- Main author of SWANA's newest training course on Organics Collection
- Main author of SWANA's compost training course
- Lead instructor for USCC's 40-hour Compost Operator Training Course (in CA)

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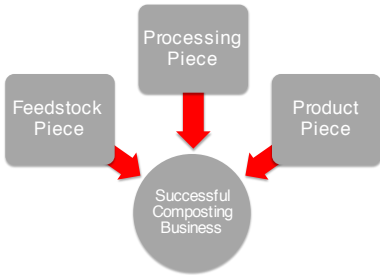
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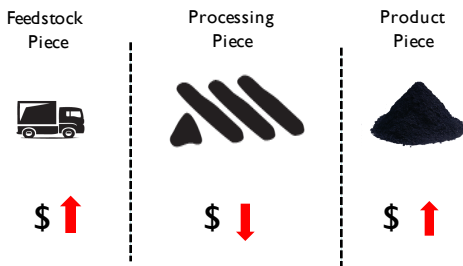
Sys·tem

/ˈsɪstəm/
noun

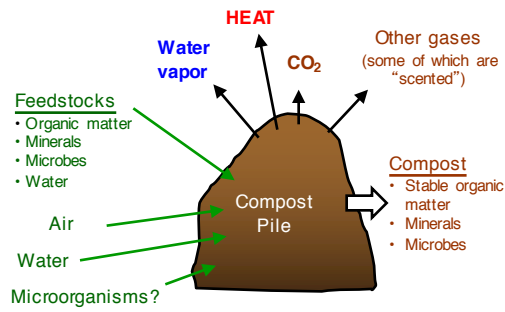
a set of connected things or parts forming a complex whole, in particular.



The Commercial Compost Equation



A Quick Review





Small



Medium



Large

How does Aeration happen?



How Do Materials Move?



Are Materials Contained?



Ways to Describe Composting Systems

- **Open/freestanding**
 - Covered
 - Bins
- **Enclosed**
 - Contained
 - In-vessel
- **Passive aeration**
- **Forced aeration**
- **Static**
- **Agitated or turned**
- **Batch**
- **Continuous**
- **Modular**

Our Categories Today

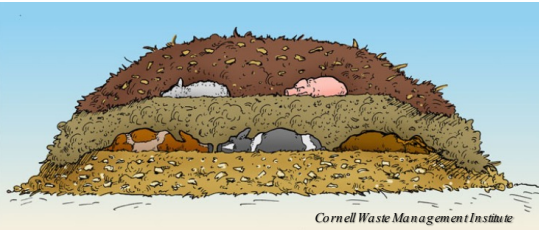
- Passively aerated – Static
- Passively aerated – Turned (Windrows)
- Forced aerated – Static
- Forced aerated – Turned (agitated)
- Contained or “In-vessel”

Passive/Static





Passively Aerated Static Pile



Cornell Waste Management Institute

The "standard" (most common) method for composting animal mortalities (1-2 turns)



Passively aerated static pile – but, in a bin

Dead chickens (1-2 turns)



Passively Aerated Windrow System

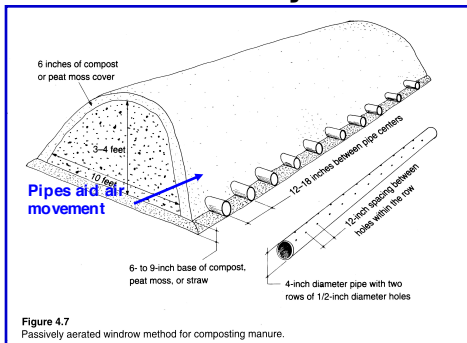


Figure 4.7 Passively aerated windrow method for composting manure.

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Passively Aerated Windrow System



Developed in Canada for fish processing waste + Peat

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Dairy Manure Solids
(to make bedding)

PAWS at
SUNY Cobleskill

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“MASSIVE PASSIVE”

MASSIVE passively aerated static pile



stumps, soil and large wood debris

Achilles heel → Fire

PS: Fred Michel

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Passive piles

- Incidental to infrequent turning
- **Low labor**
- Slow
- Little process control
- Odors – can be bad **but might be better (?)**
- Common for animal mortalities
- Watch out for fires w/ large piles



Passive/Turned (Windrows)



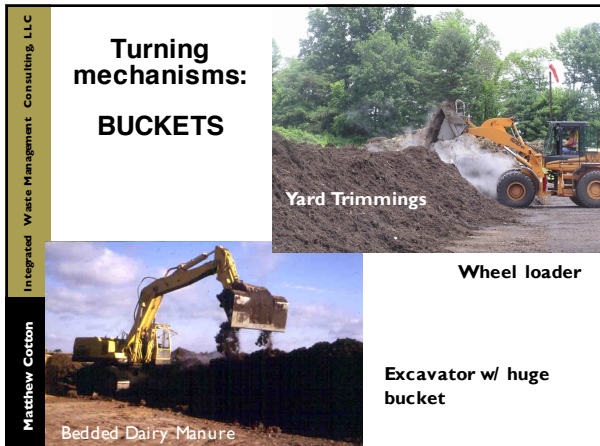
Turned windrows



Horse & Cattle Manure









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Tractor-powered turners



Straddle-style
Yard Trimmings



Biosolids
Side-discharge auger




Two-pass Turner
Bedded dairy manure


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Tractor-pulled turners



Straddle-style
Cattle feedlot manure





Elevating conveyor (2-pass)
Yard trimmings

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Self-contained straddle-type turners

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More self-contained turners

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Features

Self-trailing

Water handing (a good one)

Cab convenience & comforts

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Turned Windrows

- **Simple, easily started and managed**
- Little or no engineering
- Limited process control
- Moderate composting time
- Large area
- Labor and fuel costs
- Odors difficult to control, periodic intense emissions

Trapezoidal Piles or "Blocks"



Large extended piles (blocks)

Aerated/Static



Photo: Greg Golewski, OCRRA

Individual Aerated Static Piles (ASP)



Aeration pipe connections to blowers behind block wall



Dairy Manure Solids

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Aerated static piles, but in bins

Yard Trimmings + Food Scraps

Dairy Manure Solids

Biosolids + Wood Chips

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Some alternatives to perforated pipe

Slotted air channels in concrete floor

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Some more alternatives to perforated pipe

Trenches covered with board with drilled holes

Spaced boards over an air plenum

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Small-scale aerated & static in bins

Manure + Yard Trimmings + Food

Dead Chickens + Wood Shavings

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Aerated & static but "contained"

Aerated bags (e.g. "Ag-bag")

Plastic "tube" w/ outlet holes

Gore System

Semi-Permeable Cover

Photo source: David Riggle

Designed so that when hot air hits the fabric, it condenses and drips back in and helps control odors. No biofiltration.

Cedar Grove Composting Seattle, WA region

GORE covered systems Aerated static piles

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Aerated Piles

- More reliably aerobic
- Moderate to good process control
- Inconsistent conditions in pile
- **Low area requirement, easily covered**
- Relatively low labor
- Odor control – lower generation, can capture exhaust (negative mode) or building air

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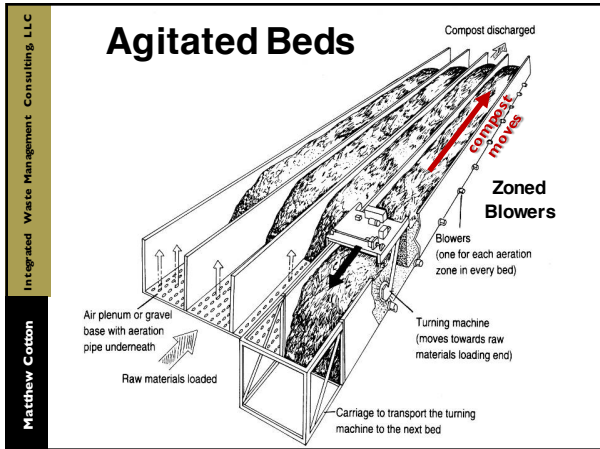
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Aerated/ Agitated





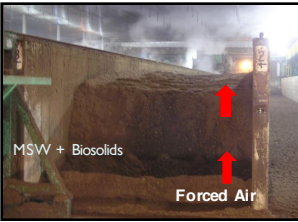
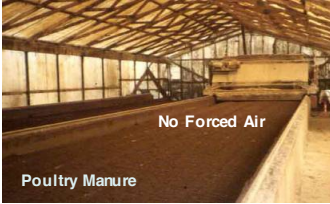
PS: Green Mountain Technology
PS: Lew Naylor



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Agitated Beds

PS: Karin Grobe

Agitated beds

- Good process control
- **Built-in materials handling**
- Short to moderate composting time
- **Overcomes air channeling, inconsistent conditions**
- Low area requirement, easily covered
- Requires engineering

Small-scale Aerated & Agitated



Earth Tub



Agitated with auger



Misc. Industry Waste

Contained or In-Vessel



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Tunnels

Bioreactor air is monitored, controlled and recycled

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Modular Containers

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Rotating Drum Reactors

3 - 5 days in the drum, then ?

MSW + biosolids





Contained/In-vessel

- *You buy it, they support it*
- Many systems, configurations and options
- Usually, very good process control
- Requires skilled/trained operator
- **Turnkey package - self-contained**
- Very good odor and emissions control

Possible Supporting Operations

- Receiving/staging
- Separation/sorting
- **Size reduction**
- Storage
- **Mixing**
- **Pile formation**
- Shipping
- Blending
- Bagging
- Storage
- **Screening**
- **Pile breakdown**



Composting = materials handling (not entirely, but close)







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Grinders



Auger Shredder



Tub Grinder



Slow Speed Shredder

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Mixers & Mixer-Shredders







From USCC Conference
Equipment Demonstrations

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Separation





- Screens
- Destoners
- Pneumatic
- Handpicking
- Magnets

- Disc
- Trommel
- Satellite
- Shaker & vibrating
- Finger



Compost Application

- Manure spreaders
- Dry chemical spreaders (e.g. lime)
- Compost spreaders, rear discharge (below)
- Side discharge spreaders
- Blower trucks (above)



Thank You

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