Compost Site Management



Compost Basics, BMPs, & Nuisance Mitigation

Composting Methods

"Despite all our achievements we owe our existence to a six-inch layer of topsoil"

Anonymous

Climate change isn't just hurting the planet - it's a public health emergency

The Guardian - October 30, 2017

Climate change fueling disasters, disease in 'potentially irreversible' ways, report warns

55% OF EDIBLE RESTAURANT LEFTOVERS END UP IN HERE.

SAVETHEFOOD.COM

Avoidable food waste contributes 2% of total GHG Emissions in US

CAUTIO

Campbell and Ingram, 2012.





- ~ 2 Million Tons Food Scraps Composted In US in 2014 (EPA, 2014)
- Massachusetts 5th highest number of composting facilities in US at 262 (BioCycle, October 2017)



Ecosystem Services

- Return Energy, nutrients, life
- Soil Health Organic matter, structure, soil food web
- Hydrological Cycles Infiltration, retention, drought resistance, runoff & pollution mitigation
- Plant Health root density, disease resistance & antagonism, reduction in agrochemicals
- Goal of <u>soil as sink</u> vs emitter of GHG

One 5 gal bucket of food scraps composted = 1 gal of gasoline mitigated

(Highfields Center to Composting)





Agricultural Soils have the potential to soak up 13% of the carbon that is in the atmosphere today (equivalent to Total Carbon **Dioxide released** since 1980) through regenerative agriculture practices such as the use of compost.

(Olson, 2011)

The stranger of the

33-66% reduction in fertilizer required for vegetable production (Hill, 1984)

Drought Resistance

Figure 7.4 Effect of composted mulch on soil moisture content of 0–15 cm layer.



Life Cycle Inventory & Life Cycle Assessment for Windrow Compost Systems, 2007.

Composting Creates Jobs

Jobs are sustained in each stage of the organics recovery cycle.

PER 10,000 TONS WASTE/YEAR

JOBS SUSTAINED



Green infrastructure uses compost in rain gardens, green roofs, bioswales, vegetated retaining walls, and on steep highway embankments to control soil erosion and storm water. Using compost in green infrastructure creates **even more jobs.**

SOURCES:

Manufacturing Compost

Brenda Platt, Bobby Bell, and Cameron Harsh, Pay Dirt: Composting in Maryland to Reduce Waste, Create Jobs & Protect the Bay, Institute for Local Self-Reliance (ILSR), May 2013.

Brenda Platt, Nora Goldstein, Craig Coker, and Sally Brown, The State of Composting in the U.S.: What, Why, Where, & How, Institute for Local Self-Reliance (ILSR), June 2015.

Brenda Platt and Neil Seldman, Wasting and Recycling in the United States 2000, Institute for Local Self-Reliance (ILSR), 2000.

To learn more, visit: ilsr.org/compost-impacts

INSTITUTE FOR

Local Self-Reliance





Compost Basics, Best Management Practices, & Nuisance Mitigation







Managed Compost

The presence of oxygen and oxygen loving organisms:

- Fast and complete decomposition
- Higher Temperatures needed to kill pathogens and weed seeds
 - All particles reach 131° or greater for at least 3 days
 - Achieved through effective aeration and turning
- Minimal odors which are primarily caused by anaerobic organisms





(McSweeney, Community-Scaled Composting Systems, 2019 forthcoming)

Why Sites Close

- #1 Odor (and odor complaints)
- #2 Over or under capacity
- Also: economic factors, vectors, nimby-ism

Good planning, training, and <u>best management</u> <u>practices</u> can help.

Compost BMPs: Compost Recipe

• Balance:

- Protein w/ Carbon (C:N Ratio)
- Moisture w/ dry matter (Moisture Content)
- Dense material w/ bulking agent (Bulk Density)
- Analytically developed
- Effective blending

1 Part High Nitrogen (Green)

1-2 Parts High Carbon (Brown)

1-2 Parts Neutral (Balanced C:N)

½-1 Part Bulking Agent (Porous) Compost BMPs: Temperature Treatment

TES TUN

Monitoring

Turning

0 Degrees outside!

180

REOTEN

Monitoring Pile Activity

Compost Monitoring Log											
Pile Identification: FW 28 Pile Location										Date Pile Built: _6/22/11	
Fe	edstock	s and Mix	Proport	tions:							
Date	Pile Temperature					Air Temp	MC	Odor	Visual	Notes (mgmt, weather, vectors):	
	1	2	3	4	5						
	1'/3'	1'/3'	1'/3'	1'/3'	1'/3'					6 11 11 1hrs	
1/28	142/130	117				80.	55	NHY		(half of pile)	
8/1	139/	154/				80	70	manuse		Turned 43 8/3	
8/4	154/	133/141				75	65	MAMIE			
8/8	150/	133/				70	65	NHY		ROLL IS	
8/11	144/120	152/130				75	60	NHY			
3/18	134	142/142		×.,	-19	77	55	-RIRY		ister Varily	
8/22	140/	125/	-			75	60	earry		turned Vs	
8/25	150/138	130/	,			70	60	2494			
8/29	117/12	2 12-8/12	3			70	65	musty	9/10	132/13 127/115.	

Pathogen Reduction Mechanisms

- Thermal destruction
- Production of toxic byproducts such as gaseous ammonia
- Competition between indigenous microorganisms and pathogens
- Antagonistic relationships between organisms
- Antibiotics produced by certain fungi and actinomycetes
- Natural die-off in the compost environment (which is non-ideal for enteric (gut) pathogens)
- Nutrient depletion

Kristine Wichuck and Dary Mccartney. A review of the effectiveness of current time-temperature regulations on pathogen inactivation during composting. (Journal of Environmental Engineering and Science · August 2007).



FIGURE 8.4. Heat inactivation of Salmonella enteritidis serotype Montivideo in composted biosolids. (Data from Ward and Brandon, 1977.)

Process to Further Reduce Pathogens (PFRP) & National Organic Program (NOP) Standards

Turned Windrows

• **PFRP standard** is to turn pile <u>at least five</u> times while maintaining ≥131 Degrees F for <u>at least 15 days</u>

Aerated Static Pile or In-Vessel

• **PFRP requirement** *is that the material reaches* 131 *Degrees F or greater for a minimum of* 3 *days*

Key Factors to Ensure Pathogen Inactivation

- Institutionalize BMPs
- Track batches
- Consistent temperature monitoring (1' and 3', multiple points)
- Adopt maturity standard
- Prevent reintroduction of pathogens (keep high and dry)
- Maintain aerobicity (small pile sizes)
- Periodic testing

Compost BMPs: Moisture Management

- Improved pad surfaces
- Graded
- Level
- **Clean water diversion**
- **Clean pad**
- Recipe

Compost BMPs: Compost Maturation

- Earthy smell
- Friable
- Temps below 100 F
- O₂ demand, CO₂ & N₂O production minimal (test)
- Alive!

Compost BMPs: Vector Controls

- Immediate incorporation of food sources Cover piles (w/ compost & covers)
- Avoid odors
 - Hit temps

Compost BMPs: Housekeeping

- Aesthetics matter! People smell w/ their eyes
- Remove trash
- Organized space
- Size properly

Methods of Aerobic Composting



Turned Windrows

Involves the formation of composting windrows and the periodic turning of the windrows with a **bucket loader**, **windrow turner**, or excavator



Aerated Static Pile (ASP)

Also known as **"forced aeration"**, this involves the formation of piles over perforated aerationchannels or ducts that push or pull air through the material in a controlled manner with blowers.

Aerated Static Pile (ASP)

Positive Aeration is when air is <u>pushed</u> through the composting material **Negative Aeration** is when air is <u>pulled</u> through the composting material



In-Vessel

Contained composting systems in which the composting materials are processed and aerated by a system of agitation or forced aeration and often a combination of the two

In-Vessel



Basic Styles of Aerobic Composting Bin Systems

Forming piles in large bins and turning them periodically, usually from one bin to the other.

Basic Styles of Aerobic Composting Vermicomposting

Worm composting is facilitated by specific species of earthworms that rapidly process organic wastes and produce worms castings.

- Pre-composted at thermophilic temperatures
- Cured

Basic Styles of Aerobic Composting Static Pile or "Passive" Composting

Used to describe composting in an unturned pile.

THIS IS NOT RECOMMENDED WHEN HANDLING FOOD SCRAPS FROM OFF SITE AS IT DOES NOT MEET THE INTENT OF THE PATHOGEN REDUCTION STANDARD

Animal Feeding

Not technically a "composting method", but is an important form of food scrap recycling. Effective composting of residuals or "refused feed" is an important Best Management Practice.

Animal Feeding

Feeding food residuals to swine is limited to non-meat and cooked products in Massachusetts.

COMPOST UTILIZATION in HORTICULTURAL CROPPING SYSTEMS



Edited by Peter J. Stoffella Brian A. Kahn

Special Indian Edition

THE SCIENCE OF COMPOSTING

Eliot Epstein



On-Farm Composting Handbook



Natural Resource, Agriculture, and Engineering Service (NRAES) Cooperative Extension FIELD GUIDE TO ON-FARM COMPOSTING



COMMUNITY-SCALE Composting systems

A Comprehensive Practical Guide for Closing the Food System Loop and Solving Our Waste Crisis

James McSweeney

Foreword by Marguerite Manela





Free Online Resources

- Leaf & Yard Waste Composting Guidance Document. MA DEP. <u>http://www.mass.gov/eea/docs/dep/recycle/reduce/06-thru-l/leafguid.pdf</u>
- Guide to Agricultural Composting. MDAR. 2010<u>http://www.mass.gov/eea/docs/agr/programs/compostguidet</u> <u>oagcomposting2011.pdf</u>
- Vermont Agency of Natural Resources Composter Resources Developed by CTS. Site Planning & Management, School Composting, School Curriculums http://www.anr.state.vt.us/dec/wastediv/compost/resources.htm
- Online Materials Management & Tracking Tool http://goo.gl/7dqsZh

Free Online Resources

- RecyclingWorks Source-Separation BMPs: <u>http://www.recyclingworksma.com/local-health-department-guidance-for-commercial-food-waste-separation/</u>
- MassDEP:

http://www.mass.gov/eea/agencies/massdep/recycle/reduce/com posting-and-organics.html

- Institute for Local Self-Reliance: <u>https://ilsr.org</u>
 - Yes! In My Backyard: A Home Composting Guide for Local Government
 - Growing Local Fertility: A Guide to Community Composting
 - Pay Dirt
- The Composting Collaborative:

https://www.compostingcollaborative.org

Free Webinars and How-To Videos

- Institute for Local Self-Reliance: <u>https://ilsr.org/tag/webinar/</u>
- The Composting Collaborative: <u>https://www.compostingcollaborative.org/resource-</u> <u>category/webinar/</u>
- Highfields Center for Composting Video Series Recipe Development, Pile Monitoring & Turning, School Training – <u>https://vimeo.com/highfieldscomposting</u>

