The Evolution of Composting at Ohio State University: The Practical Aspects of Compost Management

Gerald Reid
Harold Keener
Mary Wicks

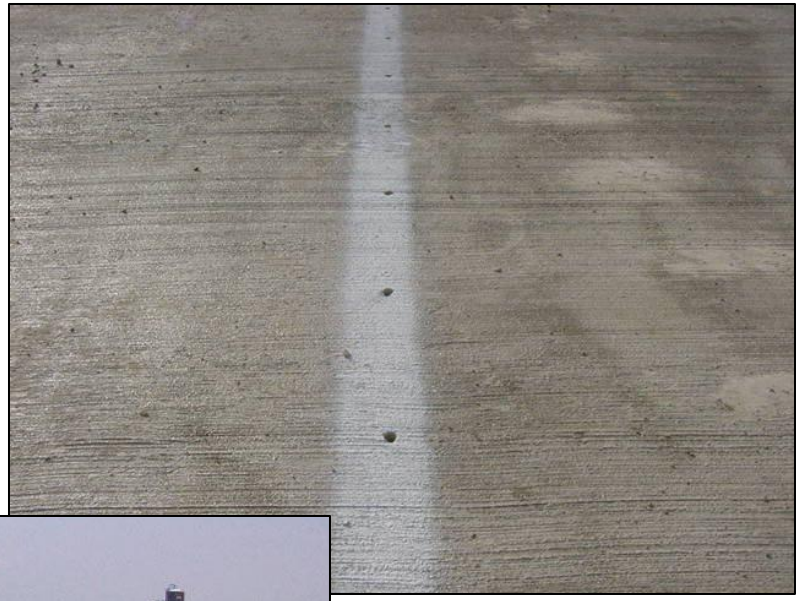
THE OHIO STATE UNIVERSITY
OARDC

Compost Pad

Aerial view of concrete and clay pads, curing area and constructed wetland treatment cells at the Ohio StateUniversity's Ohio Agricultural Research and Development Center in Wooster, OH.

Aeration System

Aeration pipe . . .



holes . . .

and fans.

Material Delivery

Building a windrow with dairy manure and bedding.

Runoff Filter Strip

Wood chip berm used to filter runoff from the pad.

Wetland Treatment Cells

Constructed wetland treatment cells were designed to remove N and P from runoff.

Amendments

- Moisture content of dairy manure is 83%.
- Amend with straw or sawdust to meet target of 65%.
- Ratio of manure to amendment is 3:1.

Turning mixes materials and reduces particle size.

Research: Straw vs. Sawdust

Volume Reduction	
Straw	79%
Sawdust	56%
Weight Reduction	
Straw	50-80% of original manure
Sawdust	50-80% of original manure
Rate of Decomposition	
Straw	Slow to start, shorter process
Sawdust	Consistent throughout, longer process

Source: Michel, et al, 2004

Research: Windrow Covers

Effects of Covers	Covered	Uncovered
Reduce nitrogen loss	4%	18%
Slow down process (DM loss)	56%	67%

Management of covers: Most effective as temperature of compost declines.

Research: Rainfall Simulation

- Simulated 5-, 25-, and 100-year storm events.
- Findings:
  - Higher moisture content of compost = higher concentration of chemicals in runoff.
  - Major losses – TDS, ammonia, potassium.
  - Key is to maintain optimal moisture to minimize amount and toxicity of runoff.

Source: Skalak, et al, 2004

Research: Forced Aeration

- Aeration of windrow (dairy manure + sawdust) to maintain 10% oxygen (fan on 2 min/hr).

Effects of Aeration	Aerated	Non-aerated
Dry matter loss	38%	50%
Nitrogen loss	25%	10%
Weight loss	48%	38%

- Cost of aeration at 2 min/hr for 70 days:
  $6.00 per 90-ft windrow

Source: Keener, et al, 2002

Research: Odors

- Measured volatile fatty acids (VFA) and other odors during composting.
- Findings:
  - Formation of odors in manure occurs during storage under anaerobic conditions.
  - Composting decreases VFAs and other odors with most gone in 7 days and all gone in 16 days.
  - On/off aeration decreased VFA emissions (O_2 > 5% maintained at all times).

Odors

- Findings (continued):
  - Biofilters used early in composting process can reduce odors.
  - Oxygen is key to keeping microbial population, which feeds on odor compounds, alive.

Source: Elwell, et al, 2004

Research: Turning Frequency

- No effect on compost properties, temperatures, oxygen concentration.
- More uniform particle size.
- Increased mass reduction and greater N loss.

Effects of Turning	Turning Frequency		
	3 days, windrow	10 days, windrow	10 days, pile
DM loss	70%	65%	53%
N loss	41%	35%	15%

Source: Tirado, 2008

Research: Organic Transition

- During transition of soils to organic production, compost can:
  - Boost fertility and improve soil quality.
  - Suppress diseases, but depends on the compost composition and soil type.

Source: Baysal, et al, 2008

Research: Compost as Mulch

THE OHIO STATE UNIVERSITY OARDC

Low C:N (<30:1)

- N release increases
- Degraded soils
- Increased plant growth
- New landscapes
- Root rot suppression

High C:N (>30:1)

- N tied up by microbes
- N unavailable for plants
- Slow to moderate growth
- Established plantings
- Walkways

Prescription mulching with compost depends on C:N ratio.

Source: Herms, 2009

Education

Ohio Compost Operator Education Course

March 30-31, 2010
Wooster, Ohio

Contact:
Mary Wicks
330.202.3533
wicks.14@osu.edu
www.oardc.ohio-state.edu/ocamm

Thank you!

Gerald Reid

OSU/OARDC

1680 Madison Ave.

Wooster, OH 44691

330.263.3764

reid.5@osu.edu

References

- Baysal, F., M.S. Benitez, M.D. Kleinhenz, S.A. Miller, B.B. McSpadden Gardener. 2008. Effects of farm organic transition on soilborn disease suppression. *Phtyopathology* 98: 562-570.
- Elwell, D.L., D.C. Borger, D.V. Blaho, J.K. Fahrni, H.M. Keener, L.B. Willett. 2004. Changes in Concentrations of Malodorous Compounds During Controlled Aeration of Composting. Compost Science and Utilization, 12(2): 102-107.
- Herms, D.A. 2009. Mulching the Landscape: Effects on Soil Ecology and Plant Health. Presented at the Ohio Compost Operator Education Course, Wooster, OH, April 1-2, 2009.
- Keener, H.M., J.A. Pecchia, G.L. Reid, F.C. Michel, D.L. Elwell. 2002. Effects of Aeration and Covers on NH_3 , Water and Dry Matter Loss During Windrow Composting of Dairy Manure. Presented at the ASAE Annual International Meeting, Chicago, IL, July 28-31, 2002. Paper # 024139.
- Michel, F.M., J.A. Pecchia, J. Rigot, H.M. Keener. 2004. Mass and Nutrient Losses During the Composting of Dairy Manure Amended with Sawdust or Straw. Compost Science & Utilization, 12(4): 323-334.
- Skalak, K.M., T.F. Wilkinson, D.L. Elwell, H.M. Keener, F.C. Michel, L.C. Brown. 2004. Using a Rain Simulator to Evaluate Leaching from Compost Windrows – Preliminary Results. Presented at NABEC 2004, University Park, PA, June 27-30, 2004. Paper # NABEC 04-0040.
- Tirado, S.M., 2008. Effects of turning frequency, pile size and season on physical, chemical and biological properties during composting of dairy manure/sawdust (Dm+S). Master's Thesis. Ohio State University.

Market Value of Compost

- Suppresses disease
- Slow release of nutrients
- Added organic matter
- Reduces erosion
- Increases water holding capacity