

On-Farm Composting

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Compost:

- ❑ The **controlled and managed** breakdown of organic materials into a stable humus like substance that resembles soil.
- ❑ Wikipedia - **Compost** (pronounced /kɒmpɒst/ or US /kɒmpoʊst/) also known as brown manure, is the **aerobically** decomposed remnants of organic matter.
- ❑ Provides a balanced diet and comfy environment for beneficial microbes.

Compost, it's a beautiful thing!

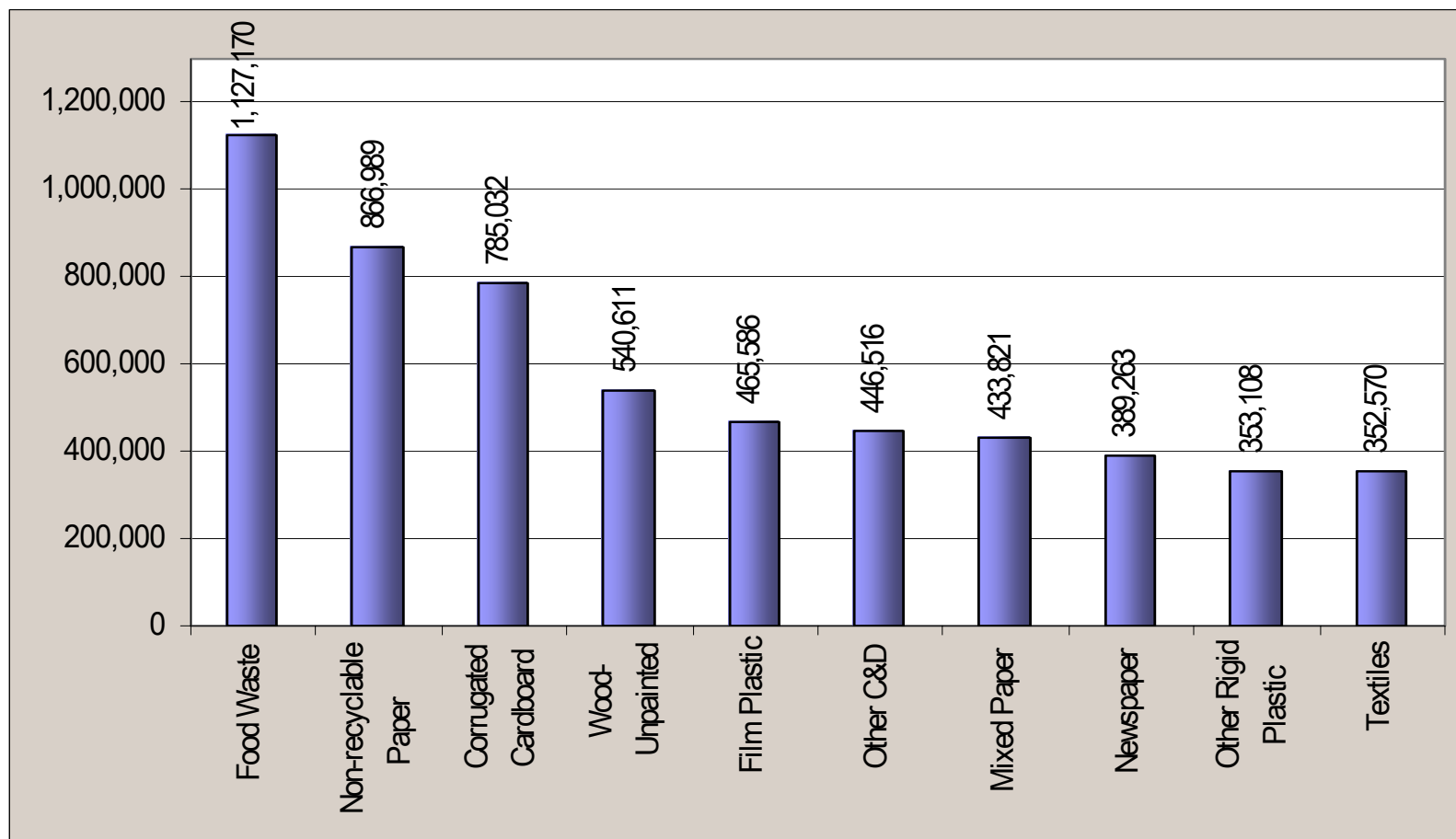
- ❑ Adds beneficial microorganisms to the soil and promotes a dynamic and diverse soil food web
 - Increases soil health
 - Increases plant disease resistance
- ❑ Increases soil water holding capacity and reduces soil erosion
- ❑ Improves soil compaction and increases aeration
- ❑ Buffers the soil pH
- ❑ Adds nutrients to the soil that are slowly available to plants
- ❑ Provides a manure management program



Is on-farm composting for Me?

- ❑ How do you manage organics wastes?
- ❑ Composting recycles organic wastes into a valuable **RESOURCE!**
- ❑ It stabilizes organic materials
 - Compost is easier to handle than manure
 - Compost can be stored safely, transported easily and applied at a convenient time
- ❑ A process to manage animal mortalities
- ❑ On farm composting can provide potential income through feedstock receipts and sale of compost

Top 10 materials disposed in PA 2001(tons)





Basic Compost 101

- ❑ A blended mix of “browns” and “greens”
- ❑ Water
- ❑ Air
- ❑ A “Welcome mat” for microorganisms
- ❑ Decomposition occurs naturally or can be enhanced



Ideal compost conditions

- ❑ Carbon:nitrogen ratio (C:N) 20:1 to 30:1
- ❑ Moisture content: 40% to 60%
- ❑ Bulk density
 - Sufficient to allow for aeration to promote aerobic conditions
 - 800 to 1,000 lbs./cubic yard
- ❑ Oxygen $> 5\%$
- ❑ Temperature 150F within 2 weeks

What to expect

- ❑ Microbial activity will begin immediately after pile construction
- ❑ Compost pile temperature will rise to 105 to 160 Fahrenheit
- ❑ Steam may become visible
- ❑ Pile will lose dimension (shrink) 30 – 50 % in volume



What do I need to get started?

- ❑ Feed stocks
- ❑ Land
- ❑ Equipment
 - Existing farm equipment
 - Specialty equipment as needed
- ❑ DEP permits
 - Based on feed stocks



Feed stocks

- Determine what organic feed stocks are available on the farm
 - Manure is nutrient dense but may require bulking materials for composting
 - Animal bedding
 - Crop residues and spent silage
 - Non-marketable produce
- Check local sources for additional feed stocks



Additional feedstock sources

- Yard waste
 - Leaves
 - Brush and branches
 - Wood chips
- Food waste
 - Grocery stores
 - Restaurants
 - Schools and other institutional cafeterias
 - Farm and produce markets

Caution: Transportation can be cost prohibitive

Additional feed stocks: Produce scraps

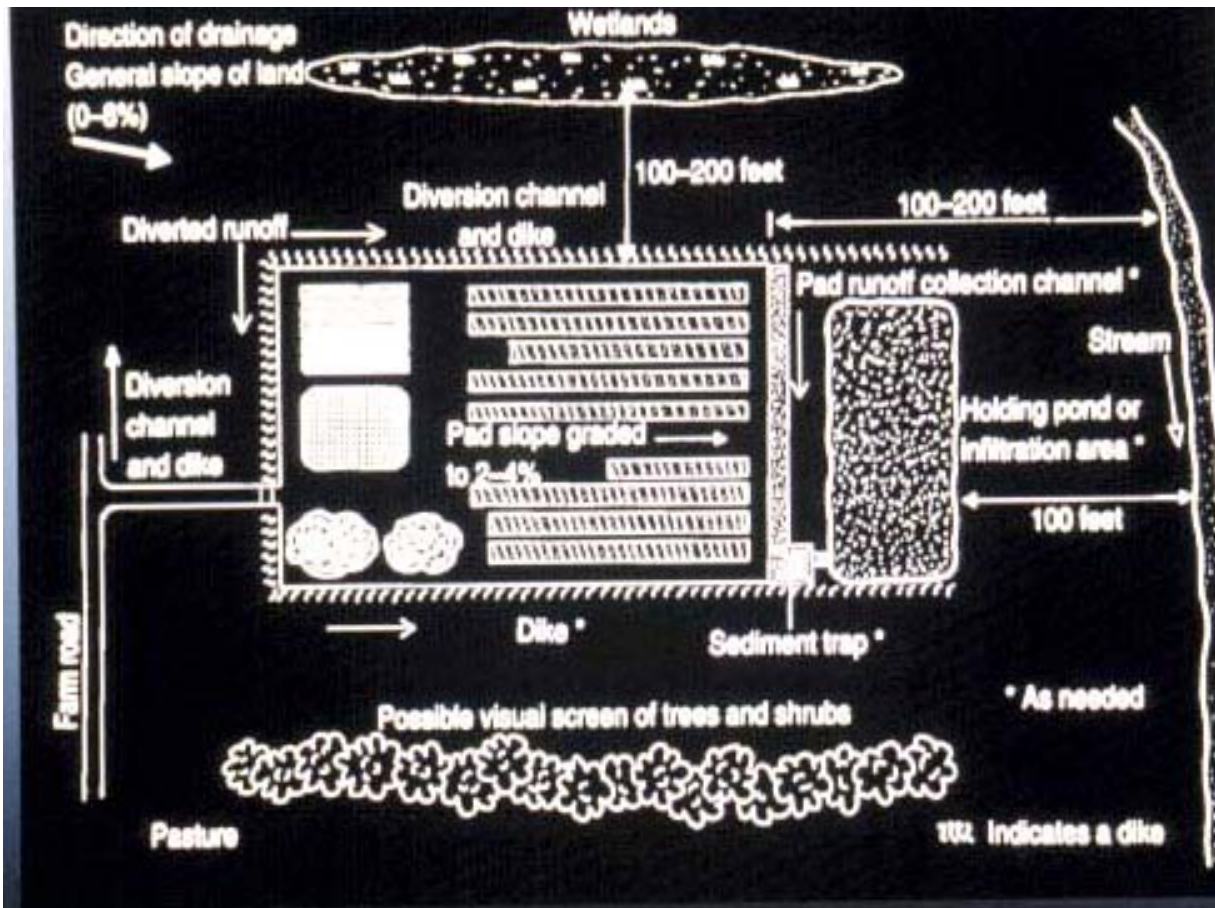




Land

- ❑ Fields for direct application of leaf waste
- ❑ Sufficient space for windrow or static pile composting methods
 - Receiving/tipping area
 - Compost pad
 - Curing/storage
 - Product/customer access area

Typical compost site layout



Site Layout and Drainage Diagram (Example)

Location considerations

Is the location convenient?

- ❑ Does the site meet the setback restrictions?
- ❑ What upgrades will be required? i.e. grading, paving, fencing
- ❑ Does the site allow for future growth?
- ❑ Is the site centrally located?
- ❑ Neighbor considerations
- ❑ Will it meet DEP siting criteria?



PaDEP minimum setback distances

A compost facility cannot be located:

- ❑ Within 3.3 feet of regional water table
- ❑ Within 50 feet of a property line
- ❑ Within 100 feet of a perennial stream, sinkhole, or wetland
- ❑ Within 300 feet of an occupied dwelling, a water source or an exceptional wetland
- ❑ Within a 100 year floodplain

PaDEP permits based on feed stocks

□ **Yard waste composting Permit-by-Rule**

Leaves, yard trimmings, brush and branches, garden residues, grass clippings

□ **On-farm composting General Permit 17**

Yard waste, manure, source separated food scraps from food markets, grocery stores, food banks, food distribution centers, school cafeterias and institutions, source-separated newspaper, and source-separated corrugated paper (cardboard)



PaDEP permits based on feed stocks

□ **Residual and Municipal Waste Composting General Permit 25**

Yard waste and source-separated wastes including agricultural waste other than mortalities, butcher waste other than whole carcass, food processing waste, pre-consumer and post-consumer food residuals, land clearing and grubbing material, untreated wood waste, gypsum wallboard, paper, cardboard, waxed cardboard, virgin paper mill sludge and spent mushroom substrate.



Composting equipment

- ❑ Front-end loader or farm tractor with bucket
- ❑ Windrow turner/manure spreader
- ❑ Feed grinder
- ❑ Wood chipper or grinder
- ❑ Screening equipment
- ❑ Monitoring equipment (temperature, CO₂, moisture probes)
- ❑ Truck





Composting methods

- ❑ Passive windrow
- ❑ **Turned windrow**
- ❑ **Aerated static pile**
- ❑ **In-vessel**
- ❑ Vermicomposting
- ❑ PHD method – Piled High and Deep



Windrow composting

- ❑ Organic materials placed into elongated piles
- ❑ 4-8 feet high by 8-16 feet wide
- ❑ Equipment dictates size of windrows
- ❑ Should be turned periodically to promote decomposition
 - Front end loader – adequate for farm use
 - Compost turner – PTO or self propelled
 - Manure spreader – for mixing or spreading

Kenny Gehringer

Four Springs Farm, Lehigh County



- ❑ Beef farm
- ❑ Receives food waste from Wegmans Allentown Store
- ❑ Approved to accept up to 500 tons/year of organics

Organics from Wegmans Allentown



Wegmans' produce and flower Depts.



Wegmans' surplus organics mgmt.



What's behind door #1, 2 and #3



Four Springs Farm receiving area



Four Springs Farm composting windrow





Four Springs Farm finished compost





Four Springs Farm composting

- ❑ 6 to 8 weeks to construct a full windrow
- ❑ 5 feet high by 10 feet wide
- ❑ Tractor pulled windrow turner
- ❑ Pile turned every two to four weeks
- ❑ Temperature reaches 160 F
- ❑ Product used on farm fields

Wegmans' contributions

- Feed stock
 - Bakery, Produce, Floral Departments' organics, other prepared foods, coffee grounds and filters, obsolete frozen foods
- Volumes
 - 6-8 tons per week in summer
 - 5 tons per week in winter
- Costs
 - \$75 month for custom roll-off container
 - \$200 a pull for transportation to the farm
 - \$20 per ton to the farmer

Columbia Borough Yard Waste Facility

Lancaster County



- ❑ Began operating in 2004
- ❑ Accepts yard waste from 12 Townships and Boroughs
- ❑ Collects 1,000 lbs. of food waste/week
 - School, market and restaurant
 - Uses 42-gallon totes
- ❑ 45-day composting time
- ❑ 2,000 tons composted in 2008

Food scraps from Musser's Market



Food is composted with wood chips



Steam emitted during windrow turning



Columbia composting equipment



Columbia Borough trommel screen



Rodale Institute composting



AgRecycle, Allegheny County



AgRecycle Equipment



Dickinson College Farm, S. Middleton Twp., Cumberland Co.





Dickinson College Farm

- ❑ Composting program began at Dickinson College in 2001
- ❑ Spring 2008: “Hobart” pulper installed cafeteria
 - Shreds food and biodegradables and removes moisture
 - 750 lbs. pre- and post-consumer food/day are composted as a result of Hobart pulping



Dickinson College Farm

- Savings from composting food waste
 - \$10,800/yr. disposal costs
 - \$1,200/yr. trash bags
- Finished compost is used on the Farm, soon to become “Certified Organic”
- Farm raises vegetables for the cafeteria menu
- Access road and compost pad were constructed of crushed slate in 2008

Dickinson College Farm, S. Middleton Twp., Cumberland County



Shenk's Berry Farm, Lancaster Co.



Be sure to visit the farm in early June!



Tractor mounted compost turner





Side discharge compost spreader



Mulching raspberries with compost





Aerated Static Pile Composting

- An active system that uses forced air
 - Either positive or negative air pressure
- Offers faster decomposition rates
- Greater process control
- Creates greater oxygen availability
- Able to control excess heat buildup
- Requires less area than windrow method

Two Particular Acres, Montgomery Co.

Aerated Static Pile Composting

- Feed stocks:
 - Yard waste
 - Food waste
 - Manure
- 10,000 cu.yds. received 2008
produced 6,000 cu.yds. compost



Two Particular Acres Aerated Static Pile air system



Two Particular Acres feed stocks





Two Particular Acres feed stocks

- ❑ Food waste: Four Seasons Hotel, Philadelphia
 - 35-gallon totes for collection & transport
 - Hauled in biodiesel-fueled Ford F350 pick-up
 - 37 miles one way
 - \$80/T vs. \$118/T traditional hauling/disposal
- ❑ Food waste: Villanova University
 - Delivers 30 containers 3x/week
- ❑ Yard waste: Limerick Township
- ❑ Leaves and brush from landscapers and homeowners

Two Particular Acres Hauling equipment



Two Particular Acres Processing equipment



Two Particular Acres windrow covers



Two Particular Acres finished products



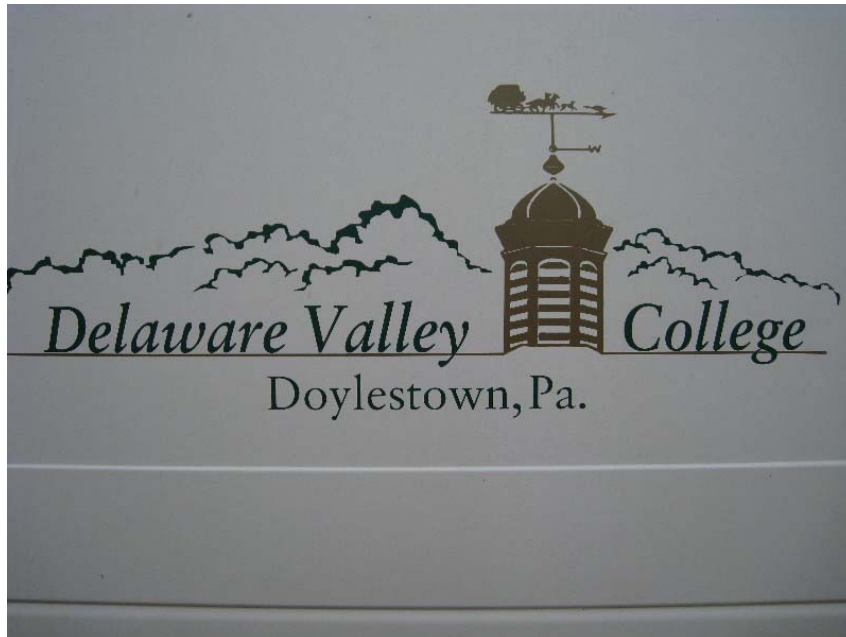
- ❑ Blended mulch
- ❑ Manufactured topsoil
- ❑ Compost for improving farm fields

In-Vessel composting

- ❑ Greatest process control
- ❑ Faster decomposition
- ❑ Weatherproof
- ❑ High capital investment and continual maintenance
- ❑ Requires a source of energy



Delaware Valley College, Bucks Co.





Delaware Valley College

- ❑ Compost feed stocks:
 - Doylestown Borough's yard waste
 - College yard waste and farm manure
 - Cafeteria food waste, pre- and post-consumer
- ❑ The food service has switched to all biodegradable service ware
- ❑ Uses windrow composting and has installed a wind-powered in-vessel digester

Food service post-consumer waste



Del Val compost windrows & turner



Del Val organics Bio-Digester



Wind-powered digester motor





PASA Beef Cook-off, Glasbern Inn

- ❑ PASA's first “zero waste” event
- ❑ Promotion of grass-fed beef via chef competition
- ❑ 170 people attended
- ❑ Featured biodegradable service ware



Separate collection of compostables



Compostables = 7:1 waste reduction



Ken Gehringer's
Four Springs Farm



When is compost, compost?

- ❑ Compost temperature remains constant at approximately 100F
- ❑ There is no visible evidence of the original feedstocks
- ❑ The material has a rich, earthy aroma

Pathogen reduction - PFRP

- ❑ **EPA 503 Regulations** require:
 - Compost temperature maintained at least 151F for 3 consecutive days using aerated static pile method and a minimum 30-day compost time
 - 155F for 15 consecutive days and 5 turnings using windrow composting and 45-day compost time
 - 30-day curing time prior to distribution
- ❑ Most effective means of pathogen & seed destruction



Monitoring and recordkeeping

- ❑ Good records can help you improve your compost process and final product
- ❑ Track all feed stocks
- ❑ Record:
 - Weather conditions
 - Compost pile temperatures
 - Turning frequencies
 - Volumes of finished products
- ❑ Note issues, i.e., odors, runoff



Composting is not for Me!

- ❑ Requires work, time, money, equipment and land
- ❑ Feed stocks can be odorous
- ❑ Compost can be odorous
- ❑ Compost may not provide the required Nitrogen expected
 - Generally 15% of N is released the first year



The “Take Home” message

- ❑ Become knowledgeable
- ❑ Network with other composters
- ❑ Start small
- ❑ Use existing equipment
- ❑ Know your customers
- ❑ Consider PROP compost certification classes

References

- ❑ BioCycle, **www.biocycle.org**
- ❑ Natural Resource, Agriculture and Engineering Resource Service - On-farm Composting, **www.nraes.org**
- ❑ PaDEP, **www.depweb.state.pa.us**
- ❑ Professional Recyclers of Pa. (PROP) **www.proprecycles.org**
- ❑ Rodale Institute, **www.rodaleinstitute.org**

Discussion





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