

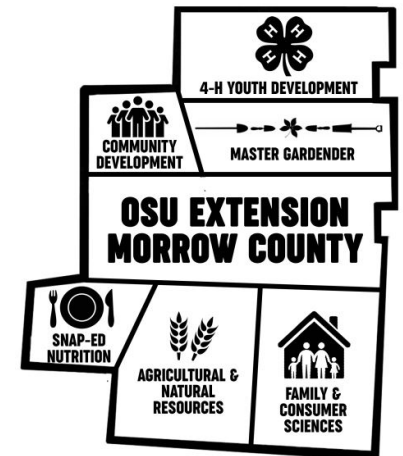
Manure Composting

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Meet Your Presenters



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Composting Manure

What kind can be composted?



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Why Compost Manure?

- To help with some of the challenges of managing manure and meeting environmental regulations
- Composting is a possible alternative to handling manure
- There are several benefits

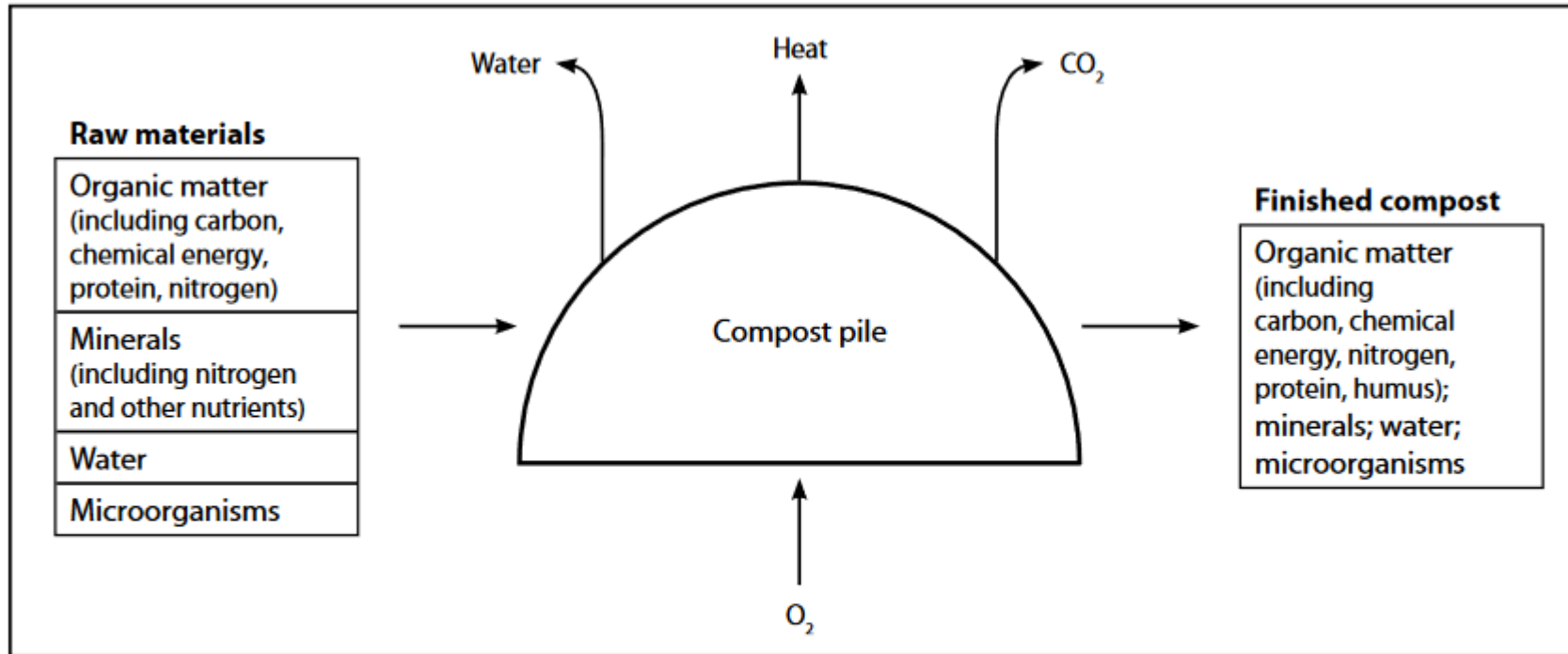


Figure 1. The composting process. The amounts of carbon, chemical energy, protein, and water in the finished compost are less than in the raw materials. The finished compost has more humus. The volume of the finished compost is 50% or less of the volume of raw material.

Adapted with permission from *On-Farm Composting Handbook* (NRAES-54). Natural Resource, Agriculture, and Engineering Service, Cooperative Extension, Cornell University, 1992.



Manure Compost Benefits

Reduced Volume = Composting reduces the volume and density of manure approximately 50 to 65 percent.

Adds Organic Matter

Reduces the need for fertilizer

Reduces potential for soil erosion

Nitrogen in compost is more stable than in manure = Less susceptible to leaching.

Properly prepared compost is free of viable weed seeds

Benefits Continued

Marketable Product:

- Gardeners, landscapers, vegetable farmers, turf growers, golf course operators, and ornament crop growers

Disease Causing Organisms can be destroyed

Has been proven to be a safe and effective bedding material for livestock, including milking cows

It is a more desirable product to most folks, where manure is not always.



Manure Compost Disadvantages

- Time
- Space
- Money
- Contains less Nitrogen than fresh manure
- Salt concentration
- Herbicide carryover



Composted VS. Un-composted Manure

Compost

- Slow – release form of nutrients
- Easier to spread
- Lower potential to degrade water quality
- Less likely to contain weed seeds
- Higher investment of time and money
- Reduced pathogen levels
- More expensive to purchase
- Fewer odors
- Improves soil tilth

Manure

- Usually higher nutrient content
- Sometimes difficult to spread
- Higher potential to degrade water quality
- More likely to contain weed seeds
- Lower investment of time or money
- Potential for higher pathogen levels
- Less expensive to purchase
- Odors sometimes a problem
- Improves soil tilth



The Process

Effective composting is affected by four major factors:

- Aeration
- Nutrient Balance
- Moisture Content
- Temperature

If these four factors are properly controlled, composting will take place at a very rapid pace.



Aeration

Key element in efficient composting



Aerated Bin Composting Demo Photo Gallery
Rutgers University

CFAES



Maintaining Airflow – Floorboards spaced with gaps for airflow.



Half-filled Bay – Front boards are placed as bin fills.



Exterior Grade Box – Houses electric service, motor, and fan.



Electric Motor – Electric motor and small industrial squirrel cage fan.



Typical farm / industrial grade
½ HP, continuous operating,
3,450 RPM motor.



Gate Airflow Regulators –
PVC gate flow regulators manually
control bay airflow.

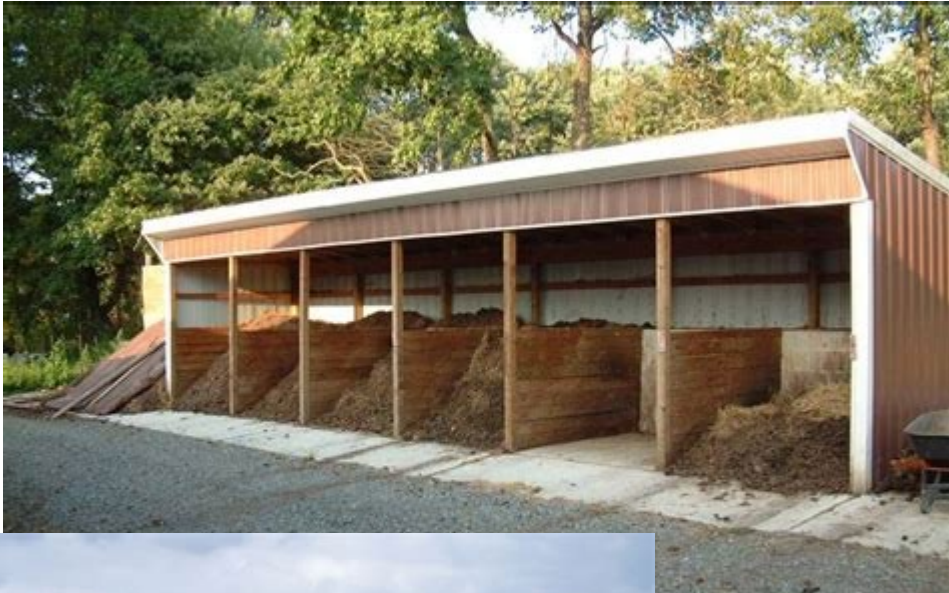


Manual Gate Valve –
Close-up of manual gate airflow
regulator.



Filled Bin –
Completed construction with filled
8' x 8' bins.

Aeration Continued





Nutrient Balance

Carbon to Nitrogen (C:N) Ratio in the compost pile

Composting is successful when the pile is 20-40 parts of carbon per part of nitrogen.

Ideal ratio is 25:1 to 30:1



Table 1. Carbon to Nitrogen Ratios for Selected Materials (by weight)

Materials with high N content	C:N Ratio
Vegetable wastes	10-12:1
Coffee grounds	20:1
Grass clippings	12-25:1
Cow manure	20:1
Horse manure	25:1
Poultry litter	13-18:1
Materials with high C content	
Leaves	30-80:1
Corn stalks	60:1
Straw	40-100:1
Bark	100-130:1
Paper	150-200:1
Wood chips and sawdust	100-500:1

Rabbit Manure is 2% N, 1%P, 1%K

Sheep 17:1

Swine 15:1

Waste Management and Composting
UMass Extension



Moisture Content

- Ideally 60% moisture after the original mixing
- Below 40% moisture the rate of decomposition decreases rapidly
- In general try to keep the moisture content between 40% and 65%.
- May need to add moisture if too dry or cover if too wet
- A mixture with 50% moisture will feel damp to the touch but not soggy

Temperature

- Pile will start out at the outside temperature when it is first mixed and can reach 150 degrees in 10 days
- The maximum compost rate occurs between 110 and 150 degrees F
- Research has shown that 131 degrees F kills most parasites, weed seeds, and disease –





Efficient Composting

Table 1. Recommended conditions for rapid composting

Condition	Reasonable range ¹	Preferred range
Carbon to nitrogen (C:N) ratio	20:1–40:1	25:1–30:1
Moisture content	40%–65% ²	50%–60%
Oxygen concentration	Greater than 5%	Much greater than 5%
Particle size (diameter in inches)	0.12–0.5	Varies ²
pH	5.5–9.0	6.5–8.0
Temperature (°F)	110–150	130–140

¹ These recommendations are for *rapid* composting. Conditions outside these ranges also can yield successful results.

² Depends on the specific materials, pile size, and weather conditions.

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Sciences, Oregon State University



Curing

- The final stage of composting
- Heating is very minimal to not at all
- Compost that is applied to fields as fertilizer doesn't need to be cured before application
- Compost that is used for livestock bedding, gardens, or packaged for sale should be cured for 4-6 weeks
(Should be stable and it is less likely to harm plants)

Management Strategies

Large Scale

- Turned Windrows
- Aerated Piles



Management Strategies Small Scale



How long does it take?

Table 2. Typical composting times for selected combinations of methods and materials

Method	Materials	Active composting time		Curing time
		Range	Typical	
Windrow— infrequent turning ¹	Leaves Manure + amendments	6 months–1 year	9 months	4 months
Windrow— frequent turning ²	Manure + amendments	1–4 months	2 months	1–2 months
Aerated static pile	Sludge + wood chips	3–5 weeks	4 weeks	1–2 months

¹ For example, with a bucket loader.

² For example, with a special windrow turner.

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Site Selection

- Well drained area but not near any water sources
- Compost pad should ideally drain into a containment pond
- Slopes of 2-4%
- Pad should be made from concrete, packed soil or gravel

Using Manure Compost

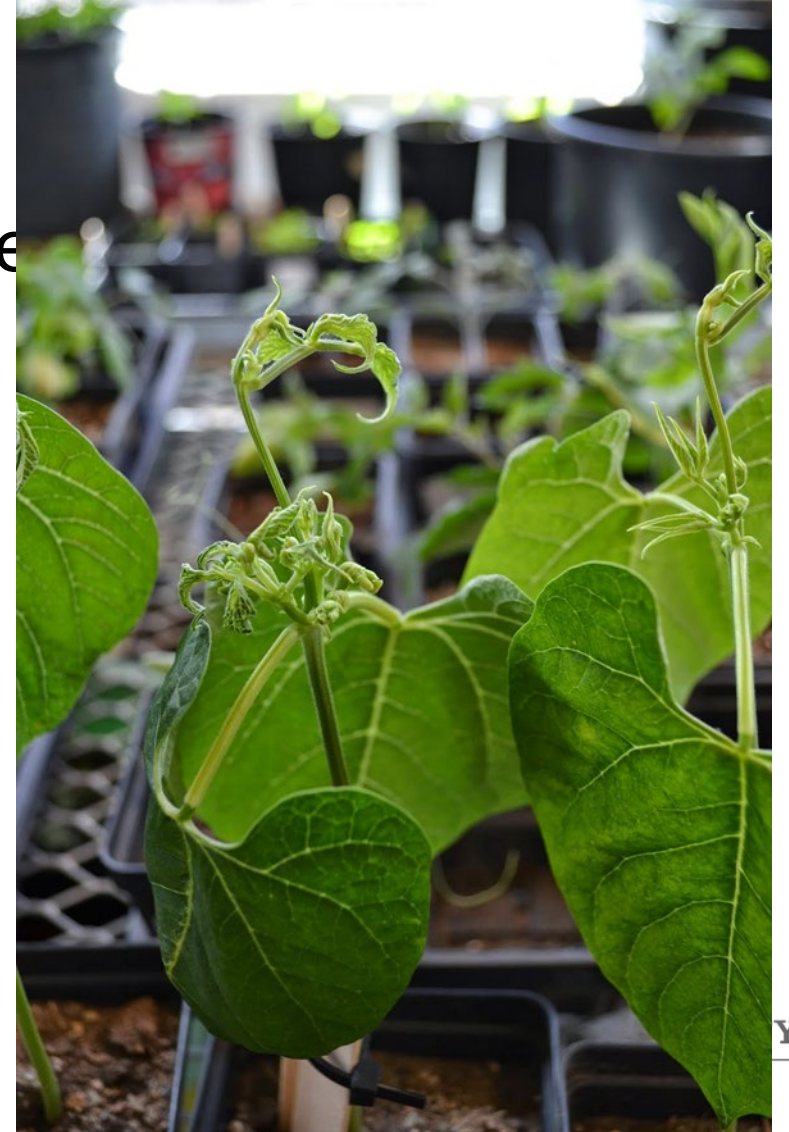
- Nutrient content can vary depending on the type of manure and the amount and type of bedding in it
- Have it analyzed

Table 1. Approximate amounts of manure needed to provide 1 lb of nitrogen.

Manure Type	Amount of manure needed to provide 1 lb Nitrogen (N):	Phosphorus (P) content*:	Potassium (K) content:
Horse	800 lbs	2.4 lbs	4.5 lbs
Cow	650 lbs	2 lbs	2.5 lbs
Poultry (layers)	170-300 lbs	4 - 7 lbs	0.6 - 1.0 lbs
Composted Dairy Manure	1300 lbs	7 lbs	16 lbs

* Note that manures provide phosphorus and potassium as well as nitrogen. The quantities listed are the amounts of P and K provided by the amounts of manure shown.

Know where it came from



Safety

- Don't use fresh manure on actively growing fruits and vegetables
- Apply fresh manure to the edible gardens in the fall and incorporate
- Never use cat, dog or swine manure in your compost pile for your vegetable garden — These manures are more likely to contain parasites that infect humans than other manures
- Always wash vegetables before using
- Always wash hands after working with compost



MORTALITY MANAGEMENT PLAN

OVERVIEW – Under Ohio law the disposal methods for dead livestock are as follows: burning, burial, composting, rendering, and landfill. See rule 901:10-2-15 of the Administrative Code and Sections 941.14, 953.26, 1511.022, and 3734.02 of the Ohio Revised Code. Mortality disposal must be performed using best management practices that are consistent with these sections. NPDES requirements prohibit the holder of a permit from disposing of any mortality in manure storage and treatment facilities, storm water management facilities, or any other treatment system that is not specifically designed and approved for mortality.

Burning – Burning mortalities is a biologically safe disposal method. The incinerator should be sited in a convenient location that will avoid potential problems and be downwind of livestock housing, farm residences, and neighbors. Owners or operators are encouraged to contact the Ohio EPA for information regarding incineration.

Burial – Burial involves excavating a grave or pit, filling the bulk of the excavation with dead animals, and then covering them with soil until the grave or pit is filled. Where burial is allowed, it must be in accordance with Ohio Revised Code Section 941.14.

Composting – Composting is similar to the process of natural decomposition except that it is enhanced and accelerated by mixing organic waste with other ingredients in a manner that optimizes microbial growth. Owners or operators who use composting are required to be certified by Ohio State University Extension or a local Soil and Water Conservation District.

Rendering – The use of rendering services recycles the nutrients contained in dead animals. Proper biosecurity measures must be utilized to minimize the spread of disease from the farm to farm by transport vehicles and personnel. If animals are rendered, they should be transported to the rendering service within twenty-four hours of their death. The owner or operator is encouraged to contact the Ohio Department of Agriculture's Division of Animal Industry for additional information.

Sanitary Landfill – Sanitary landfills are engineered burial facilities for disposal of solid waste. Disposal of dead poultry and/or animals in a sanitary landfill is permitted in some cases. A CAFF or MCAFF is encouraged to contact the landfill operator to determine if the landfill accepts dead animals, the fees associated with the animals, and the proper disposal methods.

Composting – Composting is similar to the process of natural decomposition except that it is enhanced and accelerated by mixing organic waste with other ingredients in a manner that optimizes microbial growth. Owners or operators who use composting are required to be certified by Ohio State University Extension or a local Soil and Water Conservation District.

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MORTALITY MANAGEMENT PLAN

Name of Facility:

	Name	Phone
Local Veterinarian:		
Ohio Department of Agriculture:	Animal Industry	(614) 728-6220
Ohio Department of Agriculture:	Livestock Environmental Permitting	(614) 387-0470

DISPOSAL METHODS

(Check all that apply)	LOCATION/COMPANY	EQUIPMENT NEEDED
<input type="checkbox"/> Burning		
<input type="checkbox"/> Burial		
<input type="checkbox"/> Composting*		
<input type="checkbox"/> Rendering		
<input type="checkbox"/> Sanitary Landfill		

*Check for moisture, carbon source, turning and leachate containment weekly.

BEST MANAGEMENT PRACTICES: Describe the best management practices that will be used to dispose of dead livestock:

CATASTROPHIC MORTALITY EVENT: Provide a short description of procedures to be used in the event of a catastrophic loss if normal mortality management methods cannot handle such losses. If burial is chosen, identify on a site map the most logical location for burial, taking into consideration the siting criteria for manure storage or treatment facilities established in Rule 901:10-2-02:

Mortality Management Class

Online Course

<https://campus.extension.org/enrol/index.php?id=608>



Mortality Composting Rules and Regulations

- **Ohio Department of Agriculture**
- **Ohio Department of Natural Resources**
- **Ohio Environmental Protection Agency**
- **Ohio State University Extension**
- **Ohio Agriculture Research and Development Center**
- **USDA – Natural Resources Conservation Service**

Summary

- Manage manure and compost properly
- Place your compost pile in a good location away from ground water to avoid runoff and water contamination
- Follow the rules if they apply to you
- Follow safety protocol when using it in your gardens

Resources Used

https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/WasteManagementAndComposting09-57_0.pdf

<https://wimastergardener.org/article/using-manure-in-the-home-garden/>

<https://extension.unh.edu/resource/guidelines-using-animal-manures-and-manure-based-composts-garden-fact-sheet>

<https://extension.oregonstate.edu/news/turn-manure-compost-your-garden>

<https://www.ag.ndsu.edu/publications/livestock/composting-animal-manures-a-guide-to-the-process-and-management-of-animal-manure-compost/nm1478.pdf>

https://www.canr.msu.edu/news/bunny_honey_using_rabbit_manure_as_a_fertilizer

<https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em8825.pdf>

OHIO LIVESTOCK MANURE MANAGEMENT GUIDE



https://agcrops.osu.edu/sites/agcrops/files/imce/fertility/bulletin_604.pdf

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