

Composting with Manure

Target Audience: Experienced composters interested in amending their soil or their compost with animal or human waste and/or reducing their impact on landfills, sewers and septic systems by redirecting animal and human waste.

Teaching Aids / Props: None, except slides.

Time required: 1 hour, including Q&A.

Presentation outline

1. Objectives

- a. To highlight the uses, advantages, and disadvantages of different types of manure.
- b. To share best practices for composting and gardening with manure.
- c. To demystify sanitation and safety concerns regarding composting with manure.

2. 5 minute refresher: Composting 101

- a. Cold composting:
 - i. add as you go
 - ii. takes several seasons or years to decompose
- b. Hot composting
 - i. batch method
 - ii. 3'x3'x3' to 5'x5'x5' size
 - iii. requires turning
 - iv. finished in a single season or less
 - v. preferred method for composting with manure, as the high temperatures will help eliminate unwanted pathogens (bacteria, viruses, fungus), and will also decompose any seeds in the manure
- c. Carbon/Nitrogen Ratio
 - i. 30:1 ratio is ideal
 - ii. Too much carbon will slow decomposition
 - iii. Too much nitrogen will lead to ammonia gas release
- d. Browns/Greens Ratio
 - i. 2:1 or 1:1 ratio of Browns to Greens will usually result in a mix close to the required 30:1 Carbon/Nitrogen ratio.
 - ii. Consult a chart for greater precision.
 - iii. Don't confuse the Carbon/Nitrogen ratio with the Browns/Greens ratio. All organic material, green or brown, is mostly carbon. By tweaking our brown/green ratio we're just trying to approximate the right amount of nitrogen.

3. Is Manure Safe?

- a. Reality check: Bacteria are everywhere
 - i. We live in a fecal-phobic society obsessed with eliminating germs, but...
 - ii. Bacteria and other microorganisms are everywhere and are vital to our ecosystem, and manure has been used in agriculture for millennia, usually safely.
 - iii. There are extreme views both for and against the use of livestock, pet, and human manure in compost, and whether it is safe to use on food gardens. It is very difficult to separate fact from opinion.
 - iv. Store-bought compost and fertilizers were almost certainly made in part from animal manure and, unless certified organic, may have also been made from biosolids from a municipal sewage treatment plant, meaning human manure (humanure).
 - v. Do your own research and make your own choices about the health risks associated with various manures, based on your personal circumstances and comfort level.
- b. Concerns & Countermeasures
 - i. *Concern #1: Contamination of water sources*
 - Know where your water comes from and where it drains to, and place manure accordingly.
 - a. Don't pile or bury fresh manure within 150 feet of water sources.
 - b. Be particularly cautious when placing manure from carnivores (including housepets) and omnivores (including pigs and human).
 - Never gamble with your personal water supply or your community's water supply.
 - ii. *Concern #2: Contamination of garden edibles*
 - Always wash your garden edibles thoroughly, even if you aren't using manure!
 - A properly managed hot pile should sanitize your compost, but this is difficult to guarantee in a backyard pile.
 - Aging your finished compost will further reduce pathogens, particularly exposure to freeze/thaw cycles.
 - Exercise particular caution if you sell your produce, or if anyone in your family is at high risk of contracting food-borne illnesses (ie pregnant women, very young children, and persons with cancer, kidney failure, liver disease, diabetes or AIDS).
 - iii. *Concern #3: Safe handling of manure / personal sanitation*
 - Always wear gloves and wash your hands after handling manure.
 - It's also best to place dirty clothes directly into the washing machine and then take a shower before dressing again.

4. Using Manure: Fresh, aged, or composted?

- a. Using fresh manure
 - i. Fresh manure may be added directly to a garden, as a soil amendment, but only if it is fallow (ie after the fall harvest if there will not be a fall planting). Adding fresh manure to a planted garden will likely kill seeds and plants by overwhelming them with nitrogen, and may also introduce pathogens to any plants that survive.
 - ii. Fresh manure will decompose in place over the winter, and freeze/thaw cycles will kill most pathogens, so the soil will be ready for spring planting.
 - iii. Undigested seeds in fresh manure may sprout in the spring. Consider the animals' food sources to evaluate this risk.
 - iv. If fresh manure is acquired while the garden is planted, it should either be allowed to age on its own or added to a compost pile.
- b. Using aged or composted manure
 - i. "Aged manure" and "composted manure" are both imprecise terms, often used interchangeably, indicating the manure has been at least partially decomposed, either on its own or in a compost pile.
 - ii. Aged manure may also be added to a compost pile for further decomposition, and a hot pile will help reduce pathogens and undigested seeds.
 - iii. Aged/composted manures can typically be safely added to planted gardens without endangering the plants themselves. But...
 - If the manure was not aged over-winter or hot composted, it's best to wait some time before harvesting, to allow any lingering pathogens to die or move on. Allow 120 days before harvesting leafy greens, root vegetables or strawberries, and allow 90 days for everything else.
 - iv. As with fresh manure, undigested seeds in aged manure may sprout. Consider the animals' food sources to evaluate this risk, and consider hot composting to eliminate seeds.

5. Detour: Urine!

- a. Urine is generally safe to use in a hot compost pile, and can be very useful for quickly boost the nitrogen level while also adding moisture.

6. Composting livestock manures

- a. Chicken manure
 - i. C/N ratio between 6:1 and 15:1, usually closer to 6:1 for laying hens.
 - ii. Mixing it with used bedding (straw, woodchips, etc) will often result in a mix near the ideal 30:1 C/N ratio.
 - iii. Often considered the "hottest" manure due to consistently high nitrogen, particularly from laying hens.
- b. Pig manure
 - i. 6:1 - 16:1 C/N ratio

- ii. Pig manure can be used effectively in compost, but comes with some additional risk because pigs are omnivores and their waste may contain roundworms (nematodes) that could also infect a human. A hot pile *should* kill them, but that's tough to guarantee.
 - iii. Pig owners may choose to take the calculated risk, but non-pig owners should look for a safer source than pig manure.
 - c. Horse manure
 - i. 30:1 C/N ratio means it will compost perfectly on its own, without adding external greens or browns.
 - ii. Horse manure may contain undigested seeds, but is otherwise an excellent manure. Hot composting will help eliminate seeds.
 - d. Cow manure
 - i. 15:1 C/N ratio (dairy cattle)
 - ii. 19:1 C/N ratio (beef cattle)
 - iii. C/N ratios may vary wildly depending on cattle living conditions and diet.
 - iv. Excess salts?
 - Commercial cattle are often given salts to stimulate growth, resulting in very salty manure.
 - Conflicting data on whether beef or dairy cattle are saltier, due to varying practices among ranchers and dairy farmers.
 - Know your source or test the manure, or monitor your soil for salt accumulation.
 - Particularly a concern in New Mexico, where limited rainfall means salts accumulate in the soil more rapidly.
 - e. Goat/Sheep manure
 - i. 12:1 - 18:1 C/N ratio (goats)
 - ii. 16:1 C/N ratio (sheep)
 - iii. Since sheep and goat manure is typically collected by cleaning out straw stable bedding, the straw content will push the total C/N ratio closer to the ideal ratio.
 - iv. Both can be used effectively, but may be more difficult to acquire for composters who don't keep goats or sheep of their own.
 - f. Rabbit manure
 - i. 6:1 - 12:1 C/N ratio
 - Key variable: whether urine is collected or drained off
 - ii. There are many claims that rabbit manure is a "cold" manure that can be added directly to planted gardens without damaging the plants, but this is likely based on anecdotal reports from pet owners using small volumes of manure that has partially aged in place. Rabbit manure is very high in nitrogen and does not magically decompose differently from other manures -- it should be composted or aged just like other manures, before spreading it on a planted garden.

- iii. Rabbit manure can provide an excellent environment for worm farming, particularly vermicomposting worms, as long as urine isn't allowed to pool. Urine can be drained off or absorbed with straw or other materials.

7. Composting Pet Manure

- a. Safety concerns
 - i. Pregnant women should never handle cat feces, because of the risk of contracting toxoplasmosis.
 - ii. Because they are carnivores, dog and cat feces, like pig manure, is more likely to contain roundworms that could be harmful to humans. As a result, there is near consensus that dog and cat waste should not be added to compost piles intended for garden edibles, even though the risk could be eliminated with proper compost management.
- b. Alternative 1: Burial method
 - i. Cut the bottom off a bucket or barrel & bury it to just below the lid. Drop pet waste in the top and allow it to decompose underground. Move the bucket as needed, leaving the waste in the ground.
 - ii. Pet waste should be buried at least 150 feet from all water sources and drainage ditches, to avoid contamination.
- c. Alternative 2: Flush it
 - i. Depending on local infrastructure, it may be better to flush cat waste, and some dog waste, down the toilet, rather than sending it to the landfill.

8. "Humanure"

- a. Septic Systems 101
 - i. Waste water ("black water") is collected in the septic tank and gravity separates it into three layers: scum, gray water, and sludge.
 - ii. Gray water is released into a drain field -- it is often rich in nutrients, but may also be contaminated with bacteria or chemicals.
 - iii. Sludge & scum layers decompose anaerobically, releasing foul smelling gas. These layers must be pumped out from time to time.
 - iv. Where does septic waste go?
 - Added to municipal sewage, or occasionally to approved landfills
 - Used as agricultural fertilizer, either immediately or after further decomposition in a cesspool.
 - Can be used as source for very efficient methane-based energy (but with terrible greenhouse emissions).
- b. Sewage Treatment 101
 - i. Similar to septic systems, but on a larger scale
 - ii. Black water runs through multiple screening filters, then rests and is separated into scum (skimmed off), water and sludge.
 - iii. The waste is put through both aerobic and anaerobic decomposition cycles.
 - iv. Additional filtering and "polishing" steps vary by facility.

- v. Polished water is released into the environment.
 - vi. Collected “biomass” is used for fertilization, soil reclamation, fuel, and other uses.
- c. Another Reality Check: Humanure is everywhere
- i. Whether human waste goes into a septic tank, a sewage system, or a home composting toilet or pile, it’s ultimate fate is bacterial decomposition followed, more often than not, by a return to the soil as a fertilizer.
 - ii. Instead of asking “Is it safe to compost humanure?”, we should be asking “How can humanure be composted safely?”
 - As with other manures, the answer is to maintain a healthy hot pile and to allow finished manure to age over winter before spreading it on an edible garden.
- d. Composting Toilets
- i. Legality varies by municipality. Typically, composting toilets are legal but building codes will also require a traditional toilet on the site.
 - ii. There are many types of composting toilets (too many to review in depth here). Some of the choices composters must make:
 - Commercial vs. DIY
 - Flush vs. Waterless
 - Electric vs. Non-electric
 - Self-contained vs. Centralized
 - Automatic (Compost-in-place) vs Manual (Compost-in-pile)
 - iii. Humanure has a C/N ratio between 5:1 and 10:1, but many composting toilets use sawdust or other absorbent materials, which push the carbon ratio back up a bit.

9. Notes on Sustainability

- a. NPK Impact
 - i. Long term use of manures may alter your soil’s NPK values, so additional soil amendments may be needed.
 - ii. Excess phosphorous is a common outcome. While most garden plants can accommodate this, it can be harmful to your local environment because phosphorus in runoff water will feed algae blooms. If your phosphorous level is spiking, take a break from manure until it settles down.
- b. Climate impact
 - i. Tough to calculate / varies by locality
 - ii. Manure can be sourced locally or even hyperlocally, reducing the carbon cost of transplanting chemical fertilizers.
 - iii. Humanure composting is more carbon energy efficient than municipal sewage treatment, but net climate impact depends on whether methane gas is captured.
- c. Overall impact

- i. As with compost in general, manure and other natural soil amendments are healthier for the soil, the crops, consumers of the crops, and the environment at large than chemical fertilizers.

10. Questions?