Standard Operating Procedures
Example Equestrian Compost Program
Marin County, CA

Jeffrey A. Creque, Ph.D. 2017
<jacreque@sonic.net>

Introduction

Visually, there is not much difference between a compost windrow and a plain old pile of manure. The difference lies in the processes going on within the two types of piles. Composting directs and enhances natural processes of decomposition. The result is the more rapid breakdown of materials to a biologically stable form- finished compost- that has more value as a soil amendment, and has less polluting potential, than the bedding manure it was made from. Understanding and observing a few simple concepts helps make composting more effective. Check with local regulatory agencies, including your County Health Department, before initiating your compost program.

Proper C/N Ratio

Composting is a biological process in which a large number of microorganisms use compost raw materials as food. Just as horses require a correct balance of carbohydrates and protein for a healthy diet, so compost microbes require access to the correct amount of carbon for each unit of nitrogen they consume. The ideal carbon to nitrogen, or C/N, ratio for composting is about 35/1. Fresh horse bedding manure usually has a C/N ratio that is adequate for effective composting to occur without the addition of other materials. Materials should be moved directly from the stable to the active compost windrow to minimize losses of nitrogen as ammonia via volatilization. Excessive use of high C bedding can lead to excessively high C/N ratios, necessitating high N additives, such as cottonseed meal or green wastes. Alternatively, consider reducing your use of bedding, or more careful separation of manure and bedding when cleaning stalls, retaining separated bedding for reuse.

Proper Aeration

Although composting can take place with or without air, high temperature composting requires aerobic (with air) conditions. High temperatures associated with aerobic composting help kill weed seeds in manure and favor beneficial compost organisms and rapid decomposition. Ideal temperatures range from 131 to 155^{o} F. Odors associated with aerobic composting tend to be pleasant, while anaerobic (without air) conditions often produce unpleasant odors. Bedding materials usually provide good initial aeration. Turning the compost windrow helps maintain aeration as materials decompose, and

exposes all compost materials to the high temperatures inside the actively composting windrow.

Proper Moisture

All living processes require water, and composting is no exception. Composting processes will slow or stop if materials are too dry, or too wet. Proper compost moisture is around 50-60%. This is about the moisture of a wrung-out sponge. Squeezing a handful of compost material in your hand is an easy way to check moisture conditions; if the material feels moist but no water can be squeezed from it, the moisture is about right. In dry weather, compost moisture should be maintained by irrigating. In wet weather, windrows should be covered if necessary. If left uncovered during rain, windrows may become so wet as to become anaerobic. This is often aggravated by wet conditions on the composting pad, which may interfere with the windrow turning schedule by preventing access by turning equipment. This is temporarily acceptable, but turning and aerating of windrows should resume as soon as soil and weather conditions permit. Managing compost leachate will become an issue if compost becomes saturated. Providing for the proper disposition of leachate and runoff is an important element in the siting and design of a compost operation.

Monitoring

The job of the compost manager is to make sure composting proceeds quickly and with a minimum of effort and problems. Good record keeping is an essential part of the compost operation. Monitoring of compost temperatures and moisture is a simple and efficient way to evaluate the progress of the composting process, anticipate problems, and identify the need for management intervention.

Operating Procedures
Daily

Collection of Materials
Collect materials from stables and add to the compost windrow currently under construction. The windrow should measure approximately 12-16 feet wide at the base and may be as high as convenient but not higher than about 8’. Loads of material should be arranged neatly, allowing 12' between windrows. Check and record temperatures of active windrows (see below).

Weekly

Assemble and Turn Windrows
As weather permits, consolidate the active windrow using a front-end loader. Maintain windrow width and build the pile as high as convenient. Turn windrows if necessary. Remember, the idea is to get as much air into the windrows as possible; try not to compact windrows with the loader bucket and avoid running over compost material with the loader. Because of decomposition, windrow volume will decline over time. If width and height are maintained at each turning, windrow length will gradually decrease. Other organic materials generated on site, such as landscaping debris, lawn clippings, spoiled hay, woodchips, etc. may be added to the active windrow. No brush, wood, stones, or trash should be introduced to the compost area. Brush may be chipped and the chips added to other compost materials. Be sure to keep the compost area neat at all times.

Monitor Temperature and Moisture

Pathogen Reduction Phase
US Environmental Protection Agency (EPA) and National Organic Program (NOP) standards for composting of animal manures require a minimum *pathogen reduction period* of 15 days for turned windrow composting systems and 3 days for forced air static and passive static systems. Temperatures must be maintained at or above 131 degrees F for this period, and, for turned windrow systems, the pile must be turned a minimum of 5 times, at a minimum of 3 day intervals. Static systems require a blanket of finished compost at least 2" thick over the top of the windrow for the 3 day pathogen reduction period. The idea is to expose all parts of the pile to 131 degrees F for at least 3 days to insure adequate reduction of pathogens in the manure. Once the pathogen reduction period is achieved, the pile can be managed as described below. Sometimes, due to weather conditions, for example, it may be necessary to delay the pathogen reduction phase. Typically however, it will be easier to achieve and maintain the necessary temperatures early in the process, rather than later.

Before turning the pile, check the temperature and moisture of each completed windrow. Measure temperature at a depth of 24" at three to five points equal distances apart along the top of each windrow. Record temperatures on the Compost Data Sheets. At the same time, dig into the windrow to check moisture. Ideal moisture should resemble that of a wrung-out sponge. Record moisture characteristics (Too Dry, Moist, Too Wet) on the data sheet. Note the odor of the compost (e.g., Nice, Bad, Sulphur, Ammonia). Whether or not to add water to the windrow will depend on degree of dryness and whether or not rain is expected. Withholding irrigation to maintain windrows on the dry side going into winter is recommended. Excessive moisture slows the composting process and can result in valuable nutrients being leached from the windrow. During the dry-season, water as necessary to maintain damp sponge moisture. Excessive dryness also slows the

composting process, and can also result in losses of valuable nutrients to the air. Covering windrows with tarps can reduce moisture loss in the dry season and protect windrows from becoming too wet in winter.

Monthly

Assemble New Windrow
Repeat the weekly procedure as needed until maximum windrow length has been achieved. At this point, turn the completed windrow to the next windrow position. Start a new pile in the assembly area, repeating Steps 1 to 3, above. Start a new Compost Data Sheet for each new windrow.

Finished Compost

By about the third or fourth month of operations, and monthly thereafter, the oldest windrow on the pad should be "finished." This condition can be recognized using the following indicators:

-Following roughly 3 months of temperature fluctuations, including temperatures ranging from 131 to 160 degrees or more, temperatures stabilize at about 100 degrees F.
-Compost is dark in color and uniform in texture.
-Odor is pleasant, similar to moist soil, without any trace of ammonia or other off odors.

Once compost is finished, it should be removed from the pad to the maturation/storage area. Ideally, finished compost should be allowed to mature for about a month before being spread on pastures or being used in garden or landscape applications.

Trouble Shooting

Horse stable manure is unlikely to cause significant problems as a compost material. The following are some problems that may arise, with management responses:

Pile fails to heat up.
-too dry, add water to sponge moisture.
-too wet, turn weekly, if soil conditions allow, until temperatures begin to rise.
-excessively high C/N ratio. Add high N materials, reduce bedding /manure ratio.

Pile too hot.
Spontaneous combustion is a potential compost hazard, especially with large windrows when temperatures are high and moisture levels are low. If windrow temperatures rise above 165^{o} F, temperatures and moisture should be monitored daily. If temperatures rise

to 180^{o} F, the windrow should be turned, watered if needed and monitored until temperatures drop. If temperatures remain high, the windrow can be divided into two or more piles to facilitate cooling. Combustion is unlikely if the pile is well mixed and uniform sponge moisture is maintained at all times.

Pile cools off.
Cooling of the pile may occur due to conditions that are too dry or too wet, or due to lack of oxygen. Cooling can also indicate completion of the composting process. If the pile is not finished, check moisture, add water if needed, and/or turn the pile.

Off odors.
Saturated, anaerobic compost conditions can cause unpleasant odors. Avoid watering in wet weather; maintain pile moisture below optimum when rain is expected; do not over-water piles. Turn wet piles if soil conditions allow, but keep heavy equipment off the pad when conditions are wet to avoid damaging the composting pad.
Ammonia is readily lost from stable manure, particularly when materials are too dry or not well mixed. The odor of ammonia does tend to draw flies, and ammonia loss to the air represents a loss of nitrogen from the compost. This is undesirable because it slows decomposition and means a lower quality finished product. To prevent or halt ammonia losses, stimulate biological activity by watering if necessary and turning as appropriate. In some cases, adding additional carbon materials may be necessary.

Leachate
Minimizing the leaching of nutrient rich liquid, "leachate," from compost windrows is important. Avoid over watering. Maintain high temperatures and aerobic conditions to accelerate evaporative and respiration losses of water in the wet season. Tarp windrows if possible in wet weather. Maintain a minimum 100 foot vegetated buffer strip between surface water and compost windrows to help filter any runoff. Avoid or minimize equipment traffic on the compost pad when the pad surface is soft.

Flies
Flies are a nuisance, commonly associated with unmanaged manure piles. Flies may be a problem in composting if off odors, including ammonia, are allowed to persist. By observing recommended turning schedules, eggs and larvae of manure breeding flies can be killed by the high temperatures of the windrow interior. Maintaining proper windrow moisture and active composting conditions will prevent off odors and minimize flies on the compost site.