MANAGEMENT

Composting Horse Manure in Static Windrows: Passively Aerated Windrow Method

by A.B. Card and J.G. Davis[1]

(Note: This sheet is intended to follow fact sheet 1.225, Composting Horse Manure in Dynamic Windrows. *In order to complete the processes described herein you must have access to the information in that fact sheet.)*

Quick Facts...

The term static refers to a type of windrow composting that does not require mechanical turning.

Static windrow composting can be divided into two types: 1) passively aerated; and 2) actively aerated. This fact sheet describes the passively aerated windrow method.

Moisture is essential for the health of the compost organisms and to prevent spontaneous combustion of the windrow.

The term static refers to a type of windrow composting that does not require mechanical turning with a bucket loader or other equipment. That is, the windrow does not move. It remains static instead of dynamic (referring to turning the windrow). Static windrow composting can be divided into two types: 1) passively aerated; and 2) actively aerated. This fact sheet describes the passively aerated windrow method.

What is Passively Aerated Windrow Composting?

This technique involves the same process for setting up a windrow as described in fact sheet 1.225, *Composting Horse Manure in Dynamic Windrows* (i.e., mixing thoroughly, adding appropriate amounts of nitrogen if necessary, and watering). However, instead of building the windrow directly on the ground, a porous base material and perforated pipe aeration system must first be put in place. Heat from the windrow draws air into the pile by convection, just like heat from a fireplace flowing up a chimney pulls air from inside the house into the fireplace.

Is Passively Aerated Windrow Composting Right for My Operation?

This technique may be suitable for operations with fewer than 10 horses and no access to a bucket loader. For those operations with 10 or more horses it is recommended that you use a bucket loader to build the windrow.

Advantages

- No turning is necessary, so there are fewer ongoing labor requirements and equipment costs.
- Results in compost with higher nitrogen content than dynamic windrow compost.
- Supresses odors better than the dynamic windrow method.

Disadvantages

- Cost of the required materials (base material, pipe, and compost).
- Must build windrow to specific guidelines.
- Process can take longer than the dynamic windrow technique.
- Requires more space than dynamic windrow technique.
- Internal temperature of the windrow may not get high enough to kill parasites and weed seeds.

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• External layers will not reach temperatures that destroy parasites and weed seeds.

• Disadvantages listed in fact sheet 1.225, *Composting Horse Manure in Dynamic Windrows* also apply to passively aerated windrows.

Table 1: Length required for windrows with manure only or manure with bedding.

Number of Horses	Length – Manure Only	Length – Manure with Bedding[a]
10	183 feet	365 feet
20	365 feet	730 feet
30	548 feet	1095 feet
40	730 feet	1460 feet
50	913 feet	1825 feet
60	1095 feet	2190 feet
70	1277 feet	2555 feet

[a]50% manure and 50% bedding.
+ based on 1 horse producing 0.8 cubic foot of manure per day.

Materials Needed for the Passively Aerated Windrow Method

Follow the same guidelines outlined in fact sheet 1.225, *Composting Horse Manure in Dynamic Windrows* for determining the location. Because this technique requires smaller windrows – 4 feet tall by 8 feet wide – you will need more length for the windrows than is indicated in fact sheet 1.225. Determine how long your windrow will be based on the figures in Table 1. Assemble the materials needed to set up the passive aeration system underneath the windrow. You will need finished compost or woodchips to form a 9-inch base under the pile that extends a foot beyond the manure/bedding on either side of the windrow (i.e., this base should be 10 feet wide with manure/bedding 8 feet wide on top of it). Use Table 2 to determine how much of this material to use based on the length of your pile.

Table 2: Yards of base material required for manure only or manure with bedding.

Number of Horses	Yd^3 of Material for Manure Only Windrows	Yd^3 of Material for Manure with Bedding[a] Windrows
10	16.5 cubic yards	33 cubic yards
20	33 cubic yards	66 cubic yards
30	50 cubic yards	99 cubic yards
40	66 cubic yards	131.5 cubic yards
50	82 cubic yards	164 cubic yards
60	99 cubic yards	197 cubic yards
70	115 cubic yards	230 cubic yards

[a]50 percent manure and 50 percent bedding.
+Wood chips (2" long chips) cost approximately $10 per cubic yard.

Next determine the number of 10 feet long and 4-inch diameter perforated, rigid pipes necessary using Table 3. These same pipes are often used in leach fields and will have two rows of half inch diameter holes drilled at five and seven o'clock (i.e., on either side of the bottom of the pipe's circumference) along the length of the pipe with a maximum of one foot between holes. Holes are generally offset (not directly across from the hole in the other row).

How to Build the Passively Aerated Windrow

See Figure 1. Distribute the base material 10 feet wide and to the length you have determined, maintaining a 9-inch depth. Lay the pipes across the width of the base material every 18 inches with the holes in the pipe along the bottom. This orientation allows liquids to drain easily and prevents the holes from becoming plugged with decomposing material and obstructing airflow into the windrow. Pipes must extend beyond the material and compost layer on both sides so that ends of pipe do not get plugged and diminish airflow.

Table 3: Number of 10 feet x 4-inch pipes needed based on length of windrow[a].

Number of Horses	Number of Pipes for Manure only Windrows	Number of Pipes for Manure with Bedding[b] Windrows
10	122 pipes	243 pipes
20	243 pipes	487 pipes
30	365 pipes	730 pipes
40	487 pipes	973 pipes
50	609 pipes	1217 pipes
60	730 pipes	1460 pipes
70	851 pipes	1703 pipes

[a]Pipes are placed every 18 inches across width of windrow.
[b]50 percent manure and 50 percent bedding.
+10 feet long x 4-inch diameter pre-drilled PVC pipes are approximately $7.40 each.

Mix the manure/bedding so that it is uniform. Cover the pipes with a layer of this mixed material, being careful not to alter the 18-inch spacing. Each layer should be no more than 1 foot thick. If supplemental nitrogen is required, add this to the layers as specified in fact sheet 1.225, *Composting Horse Manure in Dynamic Windrows*.

Add moisture to each 1 foot thick layer as the windrow is built. Moisten the manure/bedding so that it feels moist to the touch, but no water comes out when you squeeze it (like a damp sponge, about 40 percent moisture). Moisture is essential for the health of the compost organisms and to prevent spontaneous combustion of the windrow. Warning: Manure and bedding are difficult to wet once they completely dry out!

While building the windrow be careful not to compress the layers. Creating a fluffy windrow is critical for providing adequate aeration.

Form the passively aerated windrow up to 4 feet tall and then add a 6-inch layer of finished compost to the outside. This holds in moisture and heat

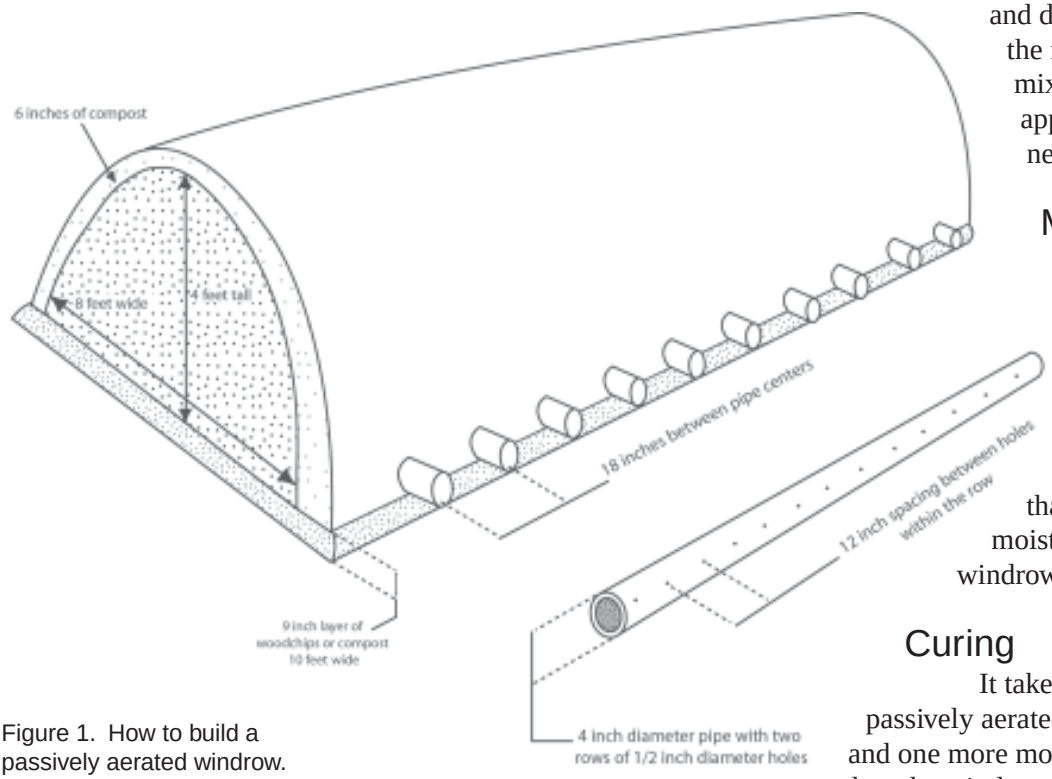

Figure 1. How to build a passively aerated windrow.

and doesn't diminish the quality of the finished compost once it is mixed together. See Table 4 for the approximate volume of compost needed to cover the windrow.

Monitoring Moisture

Every other week, check the moisture level in the windrow by opening a hole in the outer compost covering layer and feeling the internal layers of decomposing manure and bedding. If they feel dryer than a "wrung out sponge," apply moisture either to the top of the windrow or into a hole in the side.

Curing

It takes at least three months for a passively aerated windrow to finish composting and one more month to cure. Curing is complete when the windrow temperature falls to the outside air temperature. At that point your compost is ready for on-site use or for sale.

Re-using Materials

The external covering layer of compost will be mixed into your cured compost once it is moved. The pipes can be reused if they are not damaged. Remove them carefully by pulling them out horizontally prior to moving the compost on top of them. The base layer of material, if it is made of woodchips, can be reused if it is thoroughly separated from the compost. If compost is mixed into the woodchip base layer and it is reused it will not provide adequate airflow for the pile.

Table 4: Approximate cubic yards of compost for covering windrow.

Number of Horses	Approximate Compost for Manure Only	Approximate Compost for Manure with Bedding[a]
10	11 cubic yards	22 cubic yards
20	22 cubic yards	44 cubic yards
30	33 cubic yards	66 cubic yards
40	44 cubic yards	88 cubic yards
50	55 cubic yards	110 cubic yards
60	66 cubic yards	132 cubic yards
70	77 cubic yards	154 cubic yards

[a]50 percent manure and 50 percent bedding.
+Compost costs about $22 per cubic yard.
++Compost for external layers on subsequent passively aerated windrows can be taken from compost produced on site.

References:

Davis, J.G., and A.M. Swinker. 1996. 1.219, Horse Manure Management*. Colorado State University Cooperative Extension.*

Rynk, R., et al. 1992. NRAES-54, On-Farm Composting Handbook. *Northeast Regional Agricultural Engineering Service.*

Card, A.B. and J.G. Davis. 2002. 1.225, Composting Horse Manure in Dynamic Windrows. *Colorado State University Cooperative Extension.*

Card, A.B., J.V. Anderson and J.G. Davis. 2002. 1.224, Vermicomposting Horse Manure in Windrows. *Colorado State University Cooperative Extension.*

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