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Vermiculture: Reduce Your Manure through Worm Composting

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What is vermiculture? "Vermi" is the Latin for worm. Vermiculture is the use of worms to break down the organic wastes in compost and decaying matter. The worms break down the organic matter via their digestive processes. These earthworms are a specific type known as red worms, tiger worms or red wigglers (*Eisenia spp*.). In this article we will also discuss the use of other beneficial insects such as nematodes and preying mantises.

Advantages of vermiculture?

Vermiculture composting has several advantages:

 It can reduce labor and equipment costs of regular composting in windrows since there is less need for aeration.

 There are no nitrogen costs since supplemental nitrogen is not needed

 There is no unpleasant odor since it is an aerobic process.

 Worm castings (worm feces) improve plant growth even more than regular compost.

 Worms will double their population every 4 months under ideal conditions.

 Dramatically speeds up the decomposition process, resulting in quicker time to a useful product.

Disadvantages of vermiculture?

There are some disadvantages of vermiculture:

 Initial cost of red worms may be cost prohibitive (up to $22/lb for bulk orders plus shipping**).**

 Need to care for and monitor worms year round.

 Decomposition depends upon the number of worms in the pile.

 The market is less developed for worm castings than for regular compost.

 Weed seeds or parasites may not be killed using this method.

How do you use and manage vermiculture?

One horse produces about 350 lbs of manure per week. One pound of *Eisenia* (approximately 1,000 worms) will eat approximately 3.5 lbs of material per week. So you will need 100 pounds of *Eisenia* per horse to digest each week's manure. If the manure is mixed half and half with worm bedding, 200 lb of *Eisenia* will be needed per horse (Card et al 2007). You can also start with as many as you can afford and slowly double the population, but you do not want to overwhelm the worms with too much compost. Start small and increase when you have more worms.

Most vermiculture users employ either a worm bin or a windrow method. A worm bin would be for a smaller operation and will be more management intense than a windrow method. It may be possible to add worms to a manure pile as well but there is no literature on this method.

The directions that follow on worm bins come from Earth911. Worm bins are usually 8-16 inches deep with one square foot of surface area per pound of compost or worm bedding per week. Adding at least some worm bedding on a regular basis is important to keep the worms productive. Good bedding must be free from sharp or abrasive material that may harm the worms' sensitive exterior, retain moisture, allow oxygen flow, and be of neutral pH. You can use a mixture of materials to create a balance, or stay with the same material, you don't necessarily have to add things from the list below. Worms may eat up to 50% of their bedding. Most vermicomposters should be adding bedding more often. There's no particular ratio, it's more of an art than a science.

Other worm bedding additives include:

- black and white newspaper torn into one-inch-wide strips and moistened to the dampness of a wrung out sponge
- leaves that are broken up as much as possible and kept from matting together so that air can circulate through the pile
- sawdust used in a method similar to the leaves
- a handful or two of soil, ground limestone, or crushed eggshells for grit and calcium
- peat moss
- coconut husks (coir)
- torn up cardboard
- shredded paper (added every few months, process it like the newspaper above)

Besides manure, worm food you can add includes:

- stale bread
- fruit and vegetable scraps
- coffee grounds and filters
- non-greasy leftovers
- grains
- tea bags

Do not feed the worms:

- meat
- cheese
- yogurt
- fish
- butter, oily foods
- plastic bags
- other plastic or metal
- pet waste (dogs, cats, hamsters, etc.)

Cover the food with worm bedding after you have added it. Place the bin in a shady location where it will not freeze or overheat such as a garage, patio, or outside the back door of the barn. Keep bins out of hot sun or heavy rain. If temperatures drop below 40° F, move bins indoors or keep well-insulated outdoors. Begin feeding the worms only a little at a time. As they increase in number, add larger quantities of manure and food. That is all that is needed for maintenance. After 3 to 6 months, the bedding or manure will have been eaten and you can begin to harvest the

brown, crumbly worm compost. It is necessary to do this at least twice a year to keep the worms healthy.

There are four possible methods for harvesting when using worm bins:

- Move the contents of the worm bin to one side, place fresh manure and bedding materials in the newly created space. Harvest the other side once the worms have migrated to the new food and bedding.
- Add the worm compost to your garden soil by removing 1/3 to ½ of the contents of the bin, including the worms. Add fresh bedding and manure to the bin.
- Spread a sheet of plastic out in the sun or under a bright light. Dump the contents of the bin into a number of piles on the plastic. The worms will crawl away from the light into the center of each pile and you can brush away the other material on the outside by hand.
- Place a decomposing melon on one side of the bin. The worms will go to the melon (they love it!).
- Place food scraps in an onion bag and the worms will enter the bag to reach the food and then remove the bag.

According to the fact sheet by Colorado State University (Card et al. 2002), with the windrow method you can use one of two options, Option 1:

- Create an initial manure base 6 feet wide, 18 inches tall, and 6 feet long oriented east/west so it receives sunlight on the south side all day and wet it so that the moisture content is wetter than a wrung out sponge. Divide the worms and spread them evenly over the top of the moistened base material; they will migrate into the material. Then add a 3 inch layer of worm bedding and manure weekly to the start up pile and moisten as before. After the pile reaches a height of 3 feet, add new worm bedding and manure to the end of the pile in the direction that the windrow will be built, matching the height of the startup pile and with a height of 3 feet and turn or water it to facilitate a maximum temperature of 145° F. The worms will move into it once it has cooled to 90° F and has ideal moisture levels. Continue lengthening the windrow until out of space, then you can U-turn back parallel to the first windrow.

The advantages of this option are that it involves less hand labor, the worm population grows more rapidly, and there is pathogen and weed seed reduction. The disadvantages are that there is a higher chance of the windrow becoming dangerously hot and digestion is not as complete.

Option 2 is to:

- Create an initial manure base 6 feet wide, 18 inches tall, and 6 feet long oriented east/west so it receives sunlight on the south side all day and wet it so that the moisture content is wetter than a wrung out sponge. Make it as long as six weekly volumes of material will allow. Divide the worms and spread them evenly over the top of the moistened base material; they will migrate into the material. Allow the worms to colonize the windrow and digest most of the base material (time required depends on number of worms). Add water as needed to the

proper moisture content and monitor for digestion. Then add a 3 inch layer of material on top of the base layer down the length of the windrow and moisten as before. Make additional 3 inch layers at a frequency determined by how quickly the worms digest the material. After the first windrow reaches 3 feet in height, build the second base layer parallel to and touching the first windrow. Then add a 3 inch layer of material on top of the base layer down the length of the windrow and moisten as before. Add more layers as the worms digest the material.

The advantages of this method are that there is less of a chance of the windrow becoming dangerously hot and there are more castings with more thorough digestion. The disadvantages of this method are that more hand labor is involved and the worm population does not grow as rapidly.

To harvest the castings from the windrow method, check to be sure that worms have migrated into the new material and till the castings directly into the soil or screen it to add it to pastures, soil mixes, potted plants, lawns, and gardens.

Where do I get the worms?

There are many online sources for *Eisenia*. Do an internet search for red wiggler worms, red worms, or tiger worms. You may already have them in your manure pile or compost bin.

Are worms temperature sensitive?

Eisenia prefer temperatures of 65° to 75° F, but can tolerate temperatures from 39° F to 90° F. *Eisenia fetida and Eisenia andrei* were proven in Colorado to withstand near freezing conditions, making them the best choice for outdoor vermicomposting. At higher temperatures, make sure the worms do not dry out. In freezing temperatures, leave the worms alone. They will migrate to the most comfortable areas for them in extreme temperature conditions, hot or cold. Cover the pile with insulating materials such as old blankets, vacuum cleaner bags, sheep's wool etc. for the worms. Feed them at reduced levels in the winter but do continue to feed them.

Will deworming products negatively affect the worms?

No, dewormers are deactivated up to 95% after passing through the horse's digestive tract and are further deactivated by sunlight so dewormers should cause minimal to no harm to the worms.

What are the warning signs that worm composting is not going well?

These are some warning signs that worm composting is not going well:


Worms are dying


Bin/windrow smells rotten and/or attracts flies

Causes of dying worms may include (solutions in parentheses):


Worms may not be getting enough food (bury more food into the bedding).

 Worms are too dry (moisten pile to wrung out sponge level (40% moisture).

 Worms are too wet (add bedding, gently mix the bedding).

 Worms are too hot (put bin in the shade).

Causes of bin/windrow smelling rotten and/or attracting flies may include (solutions in parentheses):

 There is not enough air circulation (add dry bedding under and over the worms and do not feed them for 2 weeks).

 Pile contains non-compostables such as meat, pet feces or greasy food (remove them).

 Exposed food is in the bin (secure the lid, cover food scraps with bedding, and cover worms and bedding with a sheet of plastic).

What do you do with the worm compost?

Worm compost can be used as a fertilizer and soil amendment. Add it to soil mixes, pastures, potted plants, lawns, and gardens. !

What about the use of beneficial nematodes?

On a horse farm, the most likely application of beneficial nematodes would be to kill fly larvae and ticks. You apply them early in the morning or at night. Wet the soil first, then apply them by mixing them with water and using a watering can, irrigation or mist system, hose end sprayer, backpack or pump sprayer. Once they find the pest, they will enter it through a body opening or directly through the body wall. The nematode will then release a toxic bacterium which will kill the host within 24-28 hours. This bacteria will provide a food source for the nematodes, allowing them to reproduce until the food resources are depleted, at which time they will exit the dead host and immediately look for a new one. A common nematode variety used to kill fly larvae is *Steinernema carpocapsae* and *Steinernema feltiae* to kill ticks.

What about the use of preying mantises?

On a horse farm, the most likely application of preying mantises would be to kill mosquitoes, along with mites (which can be an intermediate host for internal parasites). When you order them, you will receive egg cases that you attach to the branches of shrubs, trees, or other plants at a notch between the stem or trunk and a branch in a warm location, out of sunlight. Or you can hatch them in a paper bag kept in a warm place. The preying mantises will consume the mosquitoes and mites once hatched. However, they will consume each other as well as other beneficial insects if enough pests are not available. They do not consume ladybugs since those are bigger than most other beneficial insects.

Use of biological methods to manage manure and insects can be very effective. Worms can help reduce waste on the farm. Beneficial nematodes and insects can be an effective means of insect control. Use of these environmentally friendly tools can make your farm more enjoyable for you and your horse(s).

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