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While this guide is “free”, it is not yet intended for widespread distribution (it is for my RWC email list subscribers or any others I give it directly to). If you would like to recommend it to others please simply direct them to the Red Worm Composting e-mail list sign-up page:
http://www.redwormcomposting.com/vermicomposting-newsletter/

Thanks!
Introduction

I decided to put together this guide for a number of reasons. Making some sort of free vermicomposting “how-to” guide available via my website is definitely long overdue.

The Red Worm Composting website itself has been very well received over the years, and while it certainly contains loads of info pertaining to the set up and operation of a successful worm composting system etc, it’s not really organized in such a way that readers can find everything they are looking for all in one place. I feel that the “Getting Started” section does a good job of helping people to get off on the right foot, but doesn’t cover all the important “fundamentals”, or help much with ongoing troubleshooting etc – so my hope is that this resource will be a bit more useful in that department.

UPDATE: I also now have a more substantial training course, called “Easy Vermicomposting” - great for those who really want to dive in a learn as much as they can about this topic. But, rest assured, this guide on its own is a pretty solid resource!

About Me

I’m sure a fair number of people will already be familiar with me (Bentley “Compost Guy” Christie) and my vermi-shenanigans, thanks to my blogging on the Red Worm Composting website these past few years, but it never hurts to provide a brief overview.

As I write this (in September/October 2010), I have been vermicomposting for about ten and a half years. I was first introduced to a worm bin while working for an environmental consulting firm...uhhh...ten and a half years ago – and needless to say, I was instantly hooked! Thankfully, the owner of the bin saw how excited I was, and insisted that I take some of the worms home with me.

The rest, as they say, is history!
Over the years I’ve set up countless worm composting systems, and have spent a great deal of time immersed in the academic and trade literature relating to the topic. I even went back to university to pursue a Masters degree that was (potentially) somehow, maybe related to the field, but...well...we won’t be talking about that here! 😊

Ok – I think that just about covers it for a “quick ‘n’ dirty” introduction. Actually, one last thing I should mention is the fact that, regardless of the “good sense I was born with” I have a really bad habit of making lame jokes and laughing to myself when I write. Let me apologize in advance to all those who do not share my love of goofiness. I can assure all of you that my interest in vermicomposting is very serious, as is my desire to help as many would-be vermicomposters as I can, so please take it with a grain of salt. It’s the “message” that’s the key, not the (goofball) “messenger” who delivers it. 😊

**How The Guide Is Structured**

I have included a summary of the main sections and subsections of the guide below, with links so you can actually go directly to any of them if there is something specific you want to learn about. Obviously my recommendation, then, is to view this document on your computer (or some other device that allows you to follow links) for maximum benefit.

**The Basics**
- What is Vermicomposting?
- Why Vermicompost?
- A Few Definitions and Distinctions
- Key Requirements of Composting Worms
- Things That Can Harm or Kill Your Worms
- Bentley’s “Golden Rules” of Vermicomposting

**Vermicomposting Systems**
- Overview
- Structure – Bins, Beds, Bags, Pits, Trenches, Heaps and More!
- Habitat & Food
- The Worm Composting Ecosystem
- Setting Up Worm Composting Systems

**Vermicomposting Q&A**
- Getting Started
The Basics

What is Vermicomposting?

My “duh!” definition would be something like “composting with worms”, but of course that’s pretty much a given.

Here’s what I refer to as my “geeky” definition (with some assistance from Dominguez et. al, 1998) for worm composting (aka “vermicomposting”):

“Worm composting is the bio-oxidation of organic wastes via the joint-action of earthworms and microorganisms, resulting in a stabilized, humus-rich material known as vermicompost”

Apart from the involvement of both earthworms and microbes, the other really key “take away” is the fact that it is an aerobic (oxygen-requiring) process. I should mention also that we’re not just talking about any sort of worm here. Don’t be fooled by the term “earthworm” - it’s very important that we employ one of the species of “composting worms”, the most common variety being the Red Worm (Eisenia fetida/andrei). (we’ll talk more about worms a bit later on).

WHY Vermicompost?

Here are just some of the great reasons for getting into vermicomposting:

1) Flexibility of scale – there is no critical size requirement for worm composting, as long as we have the key components in place. Systems can be small or large, which is very important since it means people can compost indoors during winter and in smaller spaces (apartments etc)
2) Worms can speed up the composting process and reduce the amount of labor required (no turning, forced aeration etc)
3) It is generally a “continuous” process – no need to save up lots of material for a typical hot composting heap (a “batch” process) – well suited for the typical homeowner.
4) Results in a phenomenal soil amendment with unique plant growth-promoting properties.
5) Educational and FUN!

A Few Definitions and Distinctions

**Vermiculture / Worm Farming** – often used as synonyms for “worm composting” and “vermicomposting”, these are more accurately used to label the practice of breeding/growing worms (often as a business).

**Vermicompost / Worm Castings** – these terms tend to be used interchangeably (which is fine), but technically they are somewhat different. Worm castings are quite literally the poop pellets (purely scientific lingo here, I can assure you) deposited from the rear end of worms. Vermicompost simply refers to the overall “compost” mix produced in a worm composting system. This is actually a more accurate term, since there will almost certainly be some materials other than castings (although there should be a high percentage of them in a “quality” vermicompost) left in the finished product.

**Worm Compost Tea / Leachate** – there is a common misconception that the liquid draining from a worm bin/bed is worm compost tea (often referred to as “worm tea”), when in fact, this liquid is more accurately referred to as “leachate”. Leachate can be used as a form of liquid fertilizer (we’ll talk about this later), but it should not be confused with high quality vermicompost tea, which is created using finished (stabilized), high quality vermicompost.

Key Requirements of Composting Worms

1) **Moisture** – worms are largely made up of water and they need to stay moist in order to facilitate gas exchange (respiration) with their surrounding environment. Moisture is also vitally important for microbes.
2) **Oxygen** – composting worms (and earthworms in general) are fairly tolerant of low oxygen, but it is still vitally important for their survival, and for the speed/quality of the vermicomposting process. Oxygen and moisture tend to be somewhat inversely proportional so you need to be careful about providing “too much” of either (too much aeration dries out the system – too much moisture reduces oxygen levels).

3) **Warmth** – generally speaking, the “ideal” temperature range for most composting worms is 15-30°C (59-86°F), with 25°C (77°F) often cited as an “ideal” temperature in the academic literature.

4) **Darkness** – light can stress worms (best case scenario) or even kill them (in the case of sunlight), so make sure you keep your system dark. As we’ll discuss later, light can be useful when attempting to keep our worms from roaming.

5) **Habitat/Food** – worms need a place to live – habitat “structure” along with sustenance. I’ve grouped these together since they are often one and the same (although “bedding” types of materials - discussed later - tend to provide more habitat value than the materials we often think of as “food”).

6) **“Peace and Quiet”** – yes, I realize that sounds a bit silly! Basically what I’m getting at is the fact that composting worms work best when they aren’t constantly being disturbed. Locate their system away from vibration sources (don’t put your bin on your washing machine, for example), and try to resist the temptation to constantly be digging around in the bin. That being said, don’t panic about this too much – composting worms tend to be a very tolerant bunch, so don’t be shy about checking on them and even digging around with your trusty garden hand fork (you *DO* have one or two of these, right?? Haha! Quite likely my favorite vermicomposting tool!)

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**Things That Can Harm or Kill Your Worms**

1) **Excessive drying** – hot/dry conditions and lack of moisture in a well ventilated system can create problems, but worms are surprisingly well adapted to cope with this
(producing cocoons, shrinking in size etc) so this will likely only kill off your worms if you are completely neglectful.

2) **Overheating** – particularly in outdoor summer systems with poor ventilation (dark plastic bins in direct sunlight are a definite NO NO!!). You can also overheat by adding too much material at once (especially when using larger systems).

3) **Cold Temps** – some tropical species (such as Blue Worms and African Nightcrawlers) will start to die off as temps drop below ~10 C (50 F) or so. Red Worms and European Nightcrawlers are quite cold-hardy but should not be allowed to reach the freezing mark. Even if your worms are able to survive the cold, you should realize that the process itself can slow down a LOT once temps start to dip.

4) **Ammonia gas production** – low C:N ratio of waste materials (~ 20:1 and below) can lead to off-gassing of ammonia, which can kill worms in a hurry. Careful with fresh grass clippings, manure, and protein-rich wastes. Air flow is very important.

5) **Anaerobic fermentation** – various anaerobic processes can potentially create harmful compounds, but fermentation seems to be fairly common with large concentrations of sugary/starchy wastes and poor air flow (overfeeders beware). Maybe the worms will die happy (hic!), but our aim of course is to keep them sober and processing our wastes in an effective manner!

6) **Inorganic salts and harsh chemicals** – a worm’s skin is a highly sensitive (and vitally important) organ. Avoid use of bagged “potting soils” (since often come with starter fertilizer), urine soaked manure/bedding (leave it exposed to elements for awhile), and any materials containing pesticide residues or other harsh chemicals in general. Even wood ash from your fireplace can potentially cause trouble since it forms potassium hydroxide (“lye”) when mixed with water.

7) **Sunlight** – careful with excessive handling of worms (outdoors) on hot, sunny, summer days.
8) **Predators** – typically only a potential issue with outdoor systems – primarily those with direct contact with the soil, or at least those offering “easy access” options. Some examples include: moles, shrews, robins, and predatory flatworms (not all of these will be present in all locations). I myself have had to deal with Robins and shrews – while they can both be a bit frustrating, they certainly haven’t really had a significant impact on my outdoor worm population.

There *are* other things that can harm/kill our worms – but these are some of the main ones to keep in mind.

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**Bentley’s “Golden Rules” of Vermicomposting**

1) **There are NO “rules” of vermicomposting! 😊** - This is somewhat “tongue-in-cheek” as you might guess, but my recommendation here is to never treat any one person’s advice (or even the advice of many) as “gospel” (yes, that includes my own). There are countless variables at work in vermicomposting so every system tends to be different. Aside from that, many people simply take what they read and pass it along as advice to others (without necessarily testing it out for themselves). Draw from a wide range of sources, and MOST IMPORTANTLY, test things out for yourself! But don’t take my word for it! Haha

2) **Fundamentals are the KEY** – the closest thing to actual “rules” would be the fundamentals (such as the basic requirements of composting worms listed a minute ago). Master the basics of vermicomposting first, and the rest will become easy! Trying to “wing it” based on various tidbits of info/advice and the power of your enthusiasm alone can result in things getting ugly. I LOVE enthusiasm, don’t get me wrong – but let’s aim for *educated* enthusiasm, mmkay? 😊

3) **Bedding is your friend** – this should be your vermicomposting mantra! As we’ll discuss a bit later, you can never add “too
much” bedding, and it tends to be something of a “cure all” – especially for smaller enclosed systems. Based on all the newbie bins I’ve had the opportunity to look at, I’ve reached the conclusions that a LOT of people just don’t add enough bedding right off the bat.

4) It is FAR easier to kill your worms via overfeeding than via starvation. The sooner you get over the idea that these worms are your pets and need to be “fed” like your cats and dogs and/or the notion that your system “should” be processing exactly 1.6453 lb of food waste every day (based on some “rule” you read somewhere), the BETTER! It would literally take months to kill off all your worms if you left them unfed, yet you could likely accomplish this in a matter of days if you added far too much waste at once.

5) Let the Worms Guide You – as a follow up to the last recommendation, my suggestion here is to base your feeding regimen on the speed with which the worms are processing the materials (NOT based on “rules” and potentially-misguided expectations)

6) Not All “Food” Materials Are Created Equal – Newcomers to vermicomposting often assume that ALL their waste materials will be processed at a similar rate, and will have similar properties while decomposting etc. This is definitely not the case, and we’ll look at this in more detail in the “Food” section.

7) A vermicomposting system contains a complex ECOSYSTEM – many people (naturally) think “WORMS!!!! YEAH!!”, and assume all other creatures are invaders, potentially harmful etc. There are SOME “bad” critters (such as predatory flatworms), but most are harmless – perhaps annoying at worst. Other organisms can be important indicators of a shift in balance in your system, which helps to explain why they are often associated with vermicomposting systems going downhill (worms dying etc). We’ll talk more about critters later.
The Vermicomposting System

Overview

The term “system” is often associated with the container being used for worm composting, yet it is more accurately a label for the “whole shebang”– container (if there even is one), habitat/food, and ecosystem. Here is a basic formula you can keep in mind:

Structure + Habitat/Food + Ecosystem (worms, microbes, critters) = “The System” (dude!)

I should point out as well, that human involvement is a key requirement here. I wouldn’t really classify a naturally-occurring heap of organic matter (that happens to have composting worms living in it) a “worm composting system” – a “composting worm ecosystem” perhaps, but really when it comes down to it, composting in general is a human-mediated process.

Structure – This is most often some sort of physical container (bins, beds – or even trenches/pits etc), or it can simply be the structure created via heaping up habitat/food materials.

Habitat/Food – The materials that provide protection and sustenance for the worms. Terms many people are familiar with are “bedding” and “food”, but there is of course plenty of overlap here.

Ecosystem – Again, it’s very important to remember that there is an entire functioning ecosystem within a worm composting system – not just a bunch of worms.

OK - let’s talk about each of these in more detail...
Structure – Bins, Beds, Bags, Pits, Trenches, Heaps and More!

The “structure” of a worm composting system offers protection, and often (but not always) containment of some sort. Your typical run-of-the-mill plastic “worm bin” is a prime example – and will likely be the sort of structure that most people are familiar with. In the case of open heaps, windrows etc, where there is no physical container holding everything in, the “structure” is simply the sum total of habitat/food, plus any protective materials that might be placed over top (straw, leaves, tarps etc).

Ideally, our worm composting structures should help us to facilitate the establishment of the composting worm “requirements” listed earlier. In other words, they will hopefully help to retain moisture, provide oxygenation, feed/protect worms, keep them warm/cool, provide darkness, and buffer against disturbances. Obviously, there are very few examples of structures that can provide ALL of these. Ironically, it is probably the lowest-tech example of all - the humble, aged manure heap - that comes the closest! Again, some might argue that this is not a “worm composting system” – but let’s not split hairs for now, OK? 😊

Containers

There are certainly advantages to using some type of physical container for worm composting. Some of these include:

- **Protection** – having some sort of “wall” around the habitat/food zone obviously helps to provide the worms with an extra level of protection from the elements and predators/pests.
- **Portability** – this may not be the case with larger containers (or those dug in the ground etc), but many worm bins/beds/bags can be moved around, thus helping us to provide the worms with conditions as close to “ideal” as we can
- **Optimization** – many containers are designed specifically with the intention of optimizing the vermicomposting
process, potentially resulting in faster processing times and/or higher quality results
- **Reduced Footprint** – by containing everything it is far easier to optimize for space as well (loose heaps etc tend to spread out and take up more room)

When selecting a good container, we always need to keep the worm “requirements” in mind. In the case of bins that don’t offer much in the way of “breathability”, the depth of the container will be a very important consideration. For example, a big plastic garbage can (assuming you don’t drill countless holes in the sides) will more than likely be an inferior container to some sort of bin/bed that has a lot more surface area (and less depth). I’ve talked at various times (on RWC site) about “surface area to volume ratio” (or “surface area to depth ratio”) – this is an important concept, but I recommend you don’t get too hung up on specific values. Simply focus on using a container that offers a decent amount of surface area and/or provides the system with good air flow in some other manner (eg something like a plastic garbage can likely **could** be a great worm bin if you added lots of plastic air vents in the walls). Ease of use, and quality/speed of output will also be important considerations. In the case of a really deep bin with limited surface area, it will likely be much more of a challenge to feed effectively and remove vermicompost etc.

**Basic DIY Plastic Worm Bins** – The first container we’ll talk about is likely the one most commonly used for new worm composting systems. Generally, this is some form of plastic tub (eg “Rubbermaid Roughneck Tote”) that is modified and set up for worm composting. These types of bins represent a decent option for those who are new to worm composting, but they are not without their limitations. Let’s look at some of the Pros and Cons

**PROS**
- inexpensive
- lightweight
- durable
- retains moisture well (so, somewhat “neglect-proof”)
- easy to set up (no real DIY skills required)

**CONS**
- easily become “too wet” (forces out oxygen, creating anaerobic conditions)
- limited air flow (when enclosed)
due to excess moisture and poor air flow they can be slow and produce lower quality compost.
- can overheat (not ideal for outdoor summer conditions)

Most often, people use the lid that comes with these bins, but as I’ve discovered, simply leaving the lid off can make a world of difference in terms of helping to optimize the process and maintaining worm health. The increased air flow helps to reduce moisture and increase oxygenation, and also allows harmful gases to dissipate more easily. On the flip side, though, you do need to pay a bit more attention to your system (make sure it doesn’t dry out etc), and there can be an increase chance of having worms escape (especially early on, when they tend to be more restless). We’ll talk more about all of this a bit later on.

**Wooden Worm Bins** – These types of containers are an excellent option for worm composters, especially those with a bit more DIY flair. That being said, don’t let this intimidate you if you are “all thumbs” like me – I somehow managed to build a pretty nice (but fairly basic) slatted wood worm bin for myself several years ago, and it is still going strong today. Wooden bins are a really great choice for outdoor locations since they offer far more “breathability” (for lack of a better term) than plastic bins. Not only does this generally result in a more optimized process, but this can be vitally important during hot summer conditions since it can help with evaporative cooling (assuming you keep the contents moist enough).

Ok – let’s quickly look at some of the Pros and Cons of wooden bins:

**PROS**
- reasonably inexpensive (compared to manufactured bins)
- fairly easy to create something basic (but still functional)
- wood bins tend to “breathe” a lot more
- potential for faster processing and higher quality end product (due to breathability)
- flexible in terms of design (you get to decide – assuming it is a DIY project)
- natural material so more eco-friendly

**CONS**
- more expensive than plastic
- heavier than plastic
- biodegradable, so limited life
can require a bit more technical know-how
- tend to dry out much more quickly (so they can require more attention at times)
- potentially messy (since liquids may drain out etc)

**Flow-Through ("Continuous-Flow") Containers** - While flow-through systems can (and usually do) employ various types of plastic and wooden containers, the designs (and ultimately the principles involved) are a fair bit different than your run-of-the-mill bin/bed - so they certainly deserve their own section here. The main idea with this approach is that composting worms will tend to move away from their own wastes and towards food sources if provided with the opportunity to do so. We’ll talk in a minute about why/how this can be used to our advantage.

There are three main types of flow-through system in widespread use:
1) Stacking worm bins, 2) Worm composting bags, and 3) Single compartment flow-through beds.

Stacking systems are almost certainly the most popular among them, although the bag systems seem to be gaining some ground thanks to the success of the Worm Inn. Single compartment flow-through beds tend to be mid-to-large-scale systems employed for larger waste streams (commercial use etc). Once upon a time there was a smaller (single compartment) system called the “Eliminator”, designed for typical home/school use, but it is no longer available (in North America anyway). Perhaps some enterprising worm composter will eventually create a comparable system! (hint, hint 😊)

Before we talk about each of these main varieties in more detail, I should point out that it’s certainly possible to create your own DIY flow-through bin/bed (definitely don’t mean to imply that you have to use something manufactured), but I would consider this a bit more advanced – likely requiring at least some building skills.

**Stacking Bins** - Other than your typical “plastic tub” type of container, I’m sure that stacking bins must (collectively) be the most common “worm bins” in use these days. If I’m not mistaken, the very first stacking system was the Can-O-Worms, created by an Australian company called Reln Plastics (this bin appeared on the worm composting scene sometime in the 90’s). This is still one of the best stacking bins (in my humble opinion) given its sturdy construction and respectable size. Various other types of stacking bins have appeared
since then – all of them basically looking and functioning in the same way.

The idea here is that you start by setting up your first tray like a typical “worm bin” (something we’ll talk more about a bit later) and then gradually work your way upwards, adding additional trays as the lower ones become full. In a perfect world, the worms will migrate in an upward direction over time, and when you are finished with the last tray the lowermost tray “should” be ready for harvesting. Unfortunately, we don’t live in a perfect world, and these systems often fall short of the expectations.

As you may be able to tell already, I’m not a huge fan of stacking systems. Let me quickly point out, though, that I’ve only actually used one model, so I’m certainly not trying to label them all as “bad” or anything like that. I am a K.I.S.S. kind of guy, so one issue I have simply stems from the fact that I find the multiple trays to be a bit of a hassle – especially when the worms don’t cooperate. Nevertheless, they are definitely a step up from your typical tub system. I am particularly impressed with newer models (such as the Worm Factory 360), which seems to be the first model to actually use air vents (no clue why it took so long for this feature to be added). I have not tested this bin out myself, but I suspect that the increased air flow will help to speed up the process and produce a higher quality end product.

Wooden stacking systems (like wooden bins in general) have the “breathability” advantage without the need for fancy vents, but they definitely require a bit more attention (especially if you keep them outside during hot dry weather) since they can dry out very easily. The particular wooden stacking bin I own also falls short on tray depth, which only increases the chances of the worm habitat drying out. As such, my recommendation for anyone making their own stacking wooden bin is to make sure each tray is at least 5-6” deep.

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**Worm Composting Bags** – Those familiar with my website will also know that I’ve become a real fan of a particular type of worm composting “bag” - namely the Worm Inn. I’ll be the first to admit that my opinion is biased here, but when it comes down to it, the only reason I recommend it so much (and the reason it’s been the only bin I’ve sold on the RWC website) is because I love it! Like I said, I am a K.I.S.S. kinda guy, and my “perfect” continuous-flow worm system is one that uses a single-compartment design. The added beauty of the
The fabric bag approach is that it makes these containers ultra-lightweight, so they can be moved around easily (and shipped easily).

The original worm composting bag was the “Swag” – yet another cool vermi-invention from Australia. This is a larger (and heavier) system than the “Inn” but it relies on the same basic principles. Food is added from the top, while vermicompost is removed from the bottom (once the system has been up and running for awhile).

One of the great things about bag containers is that they provide the worm zone with a LOT more air flow than most “regular” bins. As indicated by the success of my Worm Inn “Overfeeding Challenge” (don’t try this at home! Haha), this substantial increase in air flow effectively decreases the chances of dangerous conditions developing. Not to be a broken record here, but increased air flow also speeds up the process and improves the quality of the output! Another small perk of the Worm Inn in particular is that it encourages your worms to settle in quite quickly (not very common to encounter roaming worms), and does a great job keeping everything in (worms + critters) while still providing the habitat with lots of oxygen.

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**Single-Compartment Flow-Through Beds** – Worm bags technically fall into this category, but I wanted to keep them separate based on the unique features they offer. As such, what I am referring to here are all rigid bins/beds that use some sort of screen/grate as a floor so that vermicompost can be harvested from the bottom on an ongoing basis (generally once the system has been up and running for at least a month or two). As mentioned, these are often larger systems, ranging in size from the “OSCR” and the “Wigwam” all the way up to some of the huge flow-through beds built and used by worm composting pros (eg. Worm Power, Sonoma Valley Worms).

The commercially-available beds tend to be very expensive, but for those who are really serious about vermicomposting (eg. those wanting to develop a worm composting business), this can represent a sound investment. For those people who don’t want to shell out big bucks for a pre-made bin, making your own is certainly a viable option, as demonstrated by RWC’s “Mark from Kansas” (well-known for his OSCR worm composting system) the folks at Silver Lake Mennonite Camp, and Larry Duke. These sorts of project will definitely require solid building skills, but in the opinion of this “all thumbs” handyman, with a little help and a solid design plan, I think a lot of people could do it (I hope to attempt this myself before too long).
Like the worm bags, these other single-compartment flow-through beds provide excellent aeration, which helps to speed up…OK OK, you know the drill! 😊

While you can certainly raise loads of worms in these beds, they are generally designed more for waste processing and quality vermicompost production. For those who are more interested in raising lots of big fat worms (and don’t really care about the output), there are likely plenty of cheaper low-tech approaches that would work just as well (or better).

**UPDATE**: If you are interested in potentially building your own single-compartment flow-through bed, and are looking for a great design, you may want to consider the “VermBin” Series.

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**OTHER Containers** – I just want to touch on this subject briefly before we move on. It’s important to mention that there are countless container options available for setting up our worm composting systems. For those who don’t like to build anything, there are plenty of bins, boxes, bathtubs – pretty well anything including the kitchen sink (an old sink buried in the ground would likely work very well in fact) – available in junkyards and curbside on garbage pick-up days. As you become more and more immersed in the worm composting hobby (and inevitable obsession! Haha), you will quickly develop your “eye” for potential worm bins – they are literally everywhere! Feeding troughs, old freezers/fridges (just make sure the refrigeration apparatus is safely removed), barrels, milk crates etc etc etc.

Just be sure to keep those worm requirements in mind at all times when selecting your containers!

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**Open Worm Beds – Trenches, Pits, Windrows, Heaps**

These are the worm composting systems that are not enclosed within some sort of solid structure – they are often what I refer to as “low-tech” approaches, but that’s not to say they can’t be highly effective! Generally, you would set up an open bed outside, but there certainly isn’t anything stopping you from doing so inside a greenhouse, shed etc (in the case of trenches and pits you will of course need access to
the soil). Again, likely due to my love of all things “K.I.S.S.”, I have come to LOVE these sorts of systems over the years. They are inexpensive, easy to set-up (although some labor is typically involved), and pretty darn effective when set up properly.

**Vermicomposting Trenches & Pits** – I happened to stumble on this worm bed approach while trying to figure out what to do with all the restaurant food waste I had piling up (the result of a somewhat naively-attempted partnership with a very popular local eatery). I had reached the point of basically digging holes and burying the material, but then it occurred to me that I should actually be creating full-fledged worm composting systems.

Vermicomposting trenches and pits are basically the same thing – the trench is simply an elongated pit that is set up like a typical worm composting system (something we’ll talk about a bit later). Here are some of the Pros and Cons of this approach

**PROS**
- surrounding earth offers excellent protection from hot/cold extremes
- with some sort of cover (straw etc) can retain moisture quite well
- potential for vermicomposting large quantities of waste materials
- easy to set up and maintain (not counting the back-breaking labor, of course! Haha)
- great for naturally fertilizing nearby plants
- less of an “eyesore” than other large systems (can basically be hidden from view altogether
- can be used for years (may eventually become windrows though)

**CONS**
- not ideal for those wanting to harvest worm compost
- increased potential for pest/predator invasion (since open and in contact with soil)
- not great idea when water table is high (especially if you are using manures)
- can get washed out during very severe (high rainfall) storms if soil is slow to drain
- surrounding soil can impede oxygenation
- not ideal for extremely cold locations (with deep frostline)
- obviously won’t work well in shallow soil areas (with bedrock underneath)

As I’ve discovered (and listed with the “PROS”), these sorts of systems can provide you with a really easy (and effective) all-natural approach for fertilizing your plants. Rather than dealing with the hassles of harvesting worm compost, you can simply continue adding food materials, letting the composting and garden ecosystem do the rest.

When we moved to our current property, the soil was absolutely awful – thick, hard clay – and not too surprisingly, there were very few gardens. Over the years, thanks to my outdoor “vermigardening” efforts (primarily the trenches), my yard has become much more fertile. I am NOT a lawn person, and as such, refuse to do ANYTHING to make it look better (other than tear it up and install new gardens!). What’s funny, though, is that my grass (in backyard especially) has become increasingly thick and healthy over the years simply due to the huge abundance of creatures that have made my property their home (with creatures comes poop, and with poop comes fertility). I recently happened to find an old picture of our backyard and could not believe the way it used to look (yikes!)

One other thing to mention before we move on here...

In some ways I think I feel like I’ve “lucked out” in terms of geographical location, and local conditions in general, since I haven’t had to deal with too many “problems”. I concede that this approach won’t necessarily be a good choice for those who live in areas with lots of pesky animals (bears, raccoons, rats etc) or predators like flatworms and moles. Extreme-weather locations may also create issues.

If you’d like to learn more about my worm composting trench adventures, I recommend you check out the [Vermicomposting Trench section](#) on the HOT TOPICS page. My [Vermicomposting Trench Video](#), in particular, should provide you with a good overview.

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**Heaps & Windrows** – As is the case with pits and trenches, the only difference between these “open” systems is size. Extend a heap and you end up with a windrow. The difference between these beds
and their subterranean cousins is of course the simple fact that they are built up above ground.

As I alluded to earlier, basic “heaps” – especially those made up of aged manure – can be pretty phenomenal composting worm habitats just on their own. My very first face-to-face encounter with Red Worms actually took place when I happened to dig into big old manure heap sitting out behind a horse stable. I’ve seen some other incredibly productive manure heaps (and worm beds of my own) since then, but I’m quite confident that I still have yet to see Red Worm densities like that! It was literally disconcerting to see so many (albeit odd looking) worms in one location! (although, I suspect that I would be pretty darn excited these days if I found a pile like that again) 😊

I’ve become quite a bit more familiar with “windrows” over the past couple of years (at time of writing) since that’s basically what my trenches have turned into as the humus-rich deposits have accumulated down below. I also decided to try out a windrow as a winter vermicomposting bed during the winter of ’09/10 (I’d used a couple of other systems during previous winters), and was very impressed with the results.

Here are some Pros and Cons of heaps and windrows:

**PROS**
- very easy, fast and inexpensive to set up
- can provide worms with a near-optimal habitat (so, can be a great way to breed lots of worms)
- well suited for winter worm composting (just make them bigger and better insulated)
- like trenches and pits, can be used to help fertilize nearby plants
- if you have the space, they can work well indoors

**CONS**
- easily invaded by pests and predators (unless set up indoors)
- generally more exposed to elements
- may require more attention than some other systems
- not best choice for vermicompost production (but not bad if optimized for this and protected from rain)
- can take up a lot of space
“Wedge” Windrow – While you might not typically think of heaps and windrows as “continuous-flow” beds, there is an approach, known as the “wedge method”, that essentially allows you to create a continuous-flow windrow. I’m fairly sure that it was Dr. Clive Edwards and his vermicomposting research team at the Rothamstead research facility during the early 80’s who came up with this method, but Jim Jensen provides a great set of instructions for setting up wedge windrows in a Worm Digest article called “The Kiss Plan” (Worm Digest, Iss#18, 1998). The basic idea here is that you start with a heap or a small windrow (stocked with composting worms), and then simply start extending it on one side with your feedstock. The worms should move in the direction of the newest food deposits, eventually leaving behind lots of rich vermicompost. This approach is ideally suited for those with access to manure and a fair amount of outdoor (or shed/warehouse) space to spread out in. Again, if your intention is to produce high-quality vermicompost, my recommendation is to make sure your windrow is protected from rain.

Habitat & Food

As mentioned earlier, there is a fair amount of grey area between the components of a worm composting system that serve as “habitat” and those that serve as “food”. Very often they are one and the same. Anything that is biodegradable will eventually become a food for something over the long-haul (although, that’s certainly not to say that there won’t be resistant materials like wood etc left in your vermicompost when it is essentially ready for use). That being said, I think that it will be very helpful if we make the distinction between those materials referred to as “bedding” and those more commonly thought of as “food”. Generally speaking (and as you might imagine), it’s the bedding materials that are going to offer the best habitat value, and of course the food materials that will provide most of the nutrition.
**Bedding**

These materials tend to be high in carbon (i.e. they have a high carbon-to-nitrogen ratio), are more resistant (than foods) to breakdown, and again, should help to provide our worms with a lot more habitat value. In my mind, the best bedding materials are absorbent (soak up and hold moisture), and somewhat bulky (allowing air flow). As such, I tend to think in terms of “primary” and “secondary” bedding materials – the primary materials working great on their own, while the secondary materials tend to be better suited for a bedding mixture (with other secondary and/or primary materials).

Examples of **Primary Bedding**:
- Shredded cardboard (non-glossy, corrugated, drink tray. Egg carton, toilet roll)
- Shredded brown paper
- Shredded newsprint (black and white ideally)
- Dryer lint? (I’ve had good success with this, but I don’t recommend if you are using dryer sheets)
- **Decayed** leaf litter (“leaf mold”)
- **Rotten** straw/hay
- Various coarse composts and aged manure mixes

Again, as long as the material is relatively stable (breaks down slowly), absorbs and holds water well, and encourages air flow it should work well.

**NOTE**: Apart from glossy papers, I’m also not a big fan of bleached white paper. In moderation it can be fine, but using it as your sole bedding material may not be the best idea since it contains various chemicals (apparently including dioxins, according to the EPA).

Examples of **Secondary Bedding**:
- Fall leaves (not to be confused with “leaf mold”)
- Straw/hay
- Peat moss (not super “eco-friendly though)
- Coco coir
- Pet/Human hair?* (not recommended if lots of hair care products used)
- Wood chips/shavings/sawdust (as long as the wood doesn’t have chemicals or toxic oils)
- Any number of other dry, bulky plant wastes.
*Hair is actually a slow-release N source as well. On a related note, while I haven’t tried it myself, I wouldn’t be surprised if something like sheep wool waste (and similar materials) would actually be a great primary bedding material due to water-holding potential.

Keep in mind that anything fresh and green will tend to be an N-rich material, and as such will not be a great choice as a bedding (may cause heating and/or ammonia volatilization). If you want to use green plant materials as bedding components, be sure to let them age and dry out a lot before use.

Some people might wonder about peat and coir, since these are often touted as excellent worm bedding materials (and do have phenomenal moisture holding properties). While it certainly depends on the system being used, the potential issue with both of these materials is that they can end up compacted, thus impeding air flow (due to small particle size) – as such, you’ll be better off to mix these with something a bit bulkier, in my humble opinion.

Let me remind everyone once again that bedding is our “friend” (haha), so please don’t be shy about adding LOTS of it to your worm composting system (more than “food” for sure) – and in fact, assuming there are no harsh chemicals/salts etc IN your bedding materials, it’s safe to say that you can never really add “too much” of it. Now is probably the ideal time to point out that SOIL is NOT an ideal worm composting bedding material! I’m not sure if it’s because people just naturally assume that all worms live in soil, or due to the fact that I’ve sometimes recommended adding a “pinch” of garden soil (to help inoculate with microbes etc), but I can’t tell you how often I receive emails from people who have added soil to their worm bins.

Let me start by pointing out that in theory, this isn’t a horrible thing. After all, “soil”, for many, is something that comes out of a plastic bag purchased at the local landscaping depot, and these bagged potting soils mostly consist of peat moss. The problem, though, is that a fair number of these potting soils also come ready-for-use with inorganic fertilizers to help give plants a boost right off the bat. As mentioned earlier, worms are very sensitive to salts (including fertilizer salts), so this can create problems.

Actual garden soil, while perhaps less likely to have fertilizers in it, is just generally NOT the type of material you will want to have in a worm bin (especially our nice little indoor systems). It’s generally very
heavy, and if it has clay in it there will be the tendency for it to get really mucky and impervious to air flow. Garden soils may also have some critters we don’t want to introduce to our bins as well.

Ok – with that little lecture out of the way, let’s now move on to the topic of food...😊

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**Food**

Grey areas side, the “foods” are typically going to be the materials that are higher in nitrogen, and those offering greater nutrition in general. In the case of actual “food wastes” (primarily fruit and vegetable matter), they also have the tendency to have a high water content, which is definitely something important to keep in mind - especially with our enclose plastic bins (those poor bins just can’t catch a break can they? LoL).

Being something of a rebel when it comes to the accepted “rules” of worm composting, I tend to feel a wee bit leery about making recommendations in this department. On one hand, I certainly don’t want to lead some poor newbie down a potentially unpleasant (or even dangerous) path, while at the same time I also don’t want to discourage the more experienced vermicomposters from trying certain materials typically thought of as “bad” etc.

Waffling aside, let’s try to get to the heart of the matter here. The long and the short of it is that ANY biodegradable material (assuming it’s not laced with nasty toxins) CAN basically be processed in some form of worm composting system. That being said, for all those who are using smaller systems – especially enclosed plastic indoor bins – my recommendation is to always err on the side of caution. Stick to the typical compostable food wastes, and remember the importance of moderation.

Here is a list of waste materials I recommend for smaller bins (be sure to read the “caution” section though):

- fruit and vegetable waste
- coffee grounds and tea bags
- egg shells
- bread/pasta
AND of course, any of those primary and secondary bedding materials I listed earlier.

**CAUTION**

**Acidic foods** – citrus and other highly acidic waste materials (pineapple, tomatoes etc) should treated with a bit more caution than other fruits/veggies. Coffee grounds can also create trouble if you go overboard with them (especially the fine grind, darker roast blends). If you find yourself with large quantities of acidic wastes I recommend putting them in your backyard composter.

**Spicy Foods** – wastes like hot peppers and fresh onions contain potent volatile oils that may cause issues for worms in smaller enclosed spaces.

**Starchy Wastes** – these are totally fine for worm bins, as long as they are added in moderation. It’s when you add a lot all at once that you can run into trouble. Concentrations of starchy waste, particularly when buried, can turn into a gooey anaerobic mess – often fermenting and creating trouble for the worms. Breads left on or near the surface can also develop dense growths of mold, resulting in clouds of spores being released into the air when the bin is disturbed.

Here are some wastes I definitely do **NOT** recommend adding to a typical worm bin:

- meats
- dairy
- oils and excessively oily foods
- excessively salty foods (eg potato chips, salted nuts etc)
- Human and dog/cat feces

There’s no need to throw out the baby with the bath water though. You can still add materials like: salad with some dressing on it, stir fry with one or two pieces of meat in it (and oils), corn with some butter and salt etc. Just use a bit more caution than you might with some of the ideal wastes.

Also, let me once again point out that some of these materials (such as meat, human/pet feces) **can** be vermicomposted – **BUT** this should only be attempted by those with more experience, and specialized
systems (larger outdoor beds, composting toilets etc) should be set up for the task.

**A Word or Two About Manure** – Various types of livestock manures are among the “best” food materials for composting worms. I’ve been extremely impressed with bedded, aged horse manure in particular as a total all-in-one food/habitat medium and use it as often as I can get my grubby hands on it (as you may recall, my very first experience with Red Worms involved digging in a big ol’ pile of this stuff, and finding unbelievable densities of worms). The problem, however, is that “manure” can refer to countless different materials – and not all of them are necessarily going to be ideal for our worm composting systems. We’ve already touched on the fact that human/dog/cat wastes need to dealt with very carefully, but even among the various farmyard manures (which tend to be seen as less “risky” for use as composting substrates) there are plenty of issues to consider.

Worms are highly sensitive to ammonia, salts, and a wide range of other chemicals. Given the fact that manures can contain all of these (not necessarily in the same mix though), it can be a bit of a challenge to determine if a given “manure” is suitable to be used as a worm food. As such, I definitely recommend exercising a great deal of caution when using manures, especially if you are new to worm composting and extra especially (lol) if you are using some sort of small, enclosed plastic bin (sorry to keep raining on the plastic bin parade, but these are not the most forgiving systems in the world).

Here are some additional recommendations:

- Use really well-aged manures (earthy – like a compost) when setting up a system, and somewhat newer (but still aged) manure mixes as “food”. If you layer this newer manure on top of your safe habitat zone (assuming a well-ventilated system), the worms can simply come up to feed on it when it suits their fancy without being forced into the situation.

- Manures that have been allowed to sit outside for awhile and those actively “pre-composted” tend to be more worm-friendly. All the best material I’ve used myself has come from outdoor heaps that have been rained on countless times, and more than likely gone through some sort of semi-hot-composting stage as well.
- Poultry manure and all urine-soaked manures are going to have high salt content and will be very likely to off-gas ammonia. Be sure to soak them well and allow them to sit for a period of time before use (assuming you don’t simply let them sit out in the elements for awhile).
- Test any manure you are unsure about on a small scale first – use a small test bin (best if you start with lid off, and then with lid on if the worms seem content to stay in the material)
- I generally only recommend manures for larger, very well-ventilated systems (not small plastic worm bins). Those with experience should be fine to make an educated decision about this, but for newcomers I just don’t think it’s worth the risk to add the material to your bins.

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**Optimizing Food for Vermicomposting** – It is very important to realize that not all food materials are created equal (as stated in my “Golden Rules”). In fact, it is safe to say that there is an incredibly wide spectrum of foods in terms of their resistance to decomposition, and just generally how they decompose. A fairly new carrot, for example, is going to take much, MUCH longer to break down in a worm bin than some rotten spinach. Pasta will obviously break down differently than cantaloupe. The list goes on!

“Optimizing” our foods simply means making them more “worm-friendly”, which results in a faster, more efficient worm composting process. Of course, in order for the materials to become “worm friendly” they first need to become more “microbe friendly” – something we can accomplish by increasing the surface area, and just generally breaking down their structural integrity. Here are some of the key ways we can help the process along:

1) **Aging** – This simply involves letting food materials sit for a period of time before adding them to our worm composting systems. This provides microbes with the opportunity to become established (partially decomposing the food materials while they are at it) before adding worms into the mix.

2) **Chopping/Grinding/Blending** – All of these effectively increase the surface area of the food materials (especially grinding and
blending), and greatly reduce structural defenses, thus allowing a LOT more microbes to colonize – and much more quickly.

3) **Freezing** – Tossing your food wastes in the freezer can be a nice “lazy” approach to scrap handling, since it not only provides you with a potential long-term storage spot for your worm food (assuming you have the freezer space), but it actually does a pretty good job of starting the structural breakdown of the materials (water expands when it freezes, causing cells in fruit/veggie wastes to rupture). It’s also a good way to help ensure that you are not inadvertently introducing any unwanted critters (namely fruit flies) to your bin/bed when you add the materials. One last bonus is that frozen wastes can be great for well ventilated outdoor systems during the heat of the summer.

4) **Cooking** – similar to freezing, cooking tends to result in structural breakdown via rupture of cell walls, and it helps to kill off fruit flies as well. I generally don’t cook foods on purpose (for the sake of feeding my worms), but certainly add a fair quantity of cooked materials to my systems as a result of having dinner leftovers etc.

Something important to mention here is the fact that it’s not just “microbes” we are trying to help out here, but *aerobic microbes*, so “optimization” can very often involve mixing the foods with absorbent (and often bulky) bedding materials, which helps to soak up excess moisture and generally keep things more oxygenated. If we simply tossed our waste materials in a blender and then dumped the slurry into our worm composting system, we could very easily end up with a disastrous situation (almost certainly if we were using an enclosed plastic bin). Similarly, it is important to remember that the methods outlined above will often result in what appears to be a smaller amount of waste, so we can end up being fooled into thinking we should add more to our system. Definitely something to keep in mind!

In thinking a lot about this food-bedding balancing act over the years, and as a result of my ongoing fascination with bedded horse manure as a composting worm food/habitat, I came up with a concept I’ve referred to as “Homemade Manure”. The basic idea here is that we are creating a food/habitat material using typical residential compostables (fruit/veggie wastes, fall leaves, egg shells, coffee grounds etc) combined with various types of bedding (whatever we happen to have available), with the intention of creating something the worms will appreciate as much as (or even more than) a nice aged manure mix. If
you are not familiar with my blog posts on the topic, I recommend you check out the “Homemade Manure” section on the HOT TOPICS page: http://www.redwormcomposting.com/popular-vermicomposting-topics/

For a good overview, I recommend specifically having a look at the “Homemade Manure” video I made.

One KEY thing to mention here – the term “Homemade Manure”, is just that – A TERM – a couple of words I slapped together (haha). Please don’t take it too literally! Just as there is no standardization for materials labeled as “vermicompost” or “worm castings”, there also is no specific set-in-stone recipe for material called “Homemade Manure”. Really, it’s whatever you want it to be. As per usual, my recommendation is to focus more on the principles involved rather than getting caught up in exact methodology.

Again – our aim is to create a nice balance between nutrition and habitat value – moisture and oxygenation – and just generally to create a material that will end up being an aerobic microbial playground! ☺

If you want to set up a new system using Homemade Manure, my recommendation is definitely to focus more on the bedding components (shredded cardboard etc) than on the food wastes. If being used for feeding, then obviously add more food waste to the mix. If I might offer one caveat before we move on - definitely be careful with food materials that have started to stink really badly (i.e. don’t just mix these up with bedding and assume you have the ultimate Homemade Manure). Just because you take the time to create a nice HMM mix, it does NOT necessarily mean you shouldn’t still be aging the materials before introducing it to the worms. With my own HMM mixes I’ve actually found that it can take a bit of time before the worms move into it – so I suggest you don’t force them to live in it (unless it’s been made in a very conservative, careful manner). But once they DO decide to move in – LOOK OUT!!! I think you will be very pleased with the results! ☺
The Worm Composting Ecosystem

This is a topic that could easily fill an entire book on its own, and at some point I hope to write more about it. For now, though, I just want to cover the bare bones basics. There are three main groups I want to talk about: the “microbes”, the “composting worms” and the “critters” (which refers to as all the other little organisms that share the bin with the worms).

Microbes

Microbes (or “microorganisms”) are of course the countless invisible organisms in our worm bins that we don’t really give all that much thought to (although, I should mention that I’ve also lumped in some organisms that DO get noticed from time to time). Ironically, they are actually the ones doing the vast majority of the “work”! The main groups of microorganisms are the bacteria, fungi and protozoans. A couple of other potential members would be the algae and slime molds, but they are pretty far down the totem pole in comparison to the other groups so I’ll leave them out of this discussion for now.

Bacteria

This is a huge group of very small, single-celled organisms, present in pretty well every terrestrial and aquatic habitat imaginable. According to Wikipedia (see “Bacteria”), you might expect to find some 40 million of these little guys in a gram of soil (likely even more in rich materials like compost), while Lowenfels and Lewis (2006) suggest that 250,000-500,000 of them would fit inside a period (if you could find some way to squeeze 'em all in there! Haha).

Bacteria have countless vital roles in the biosphere, but one of key “jobs” of relevance to us worm composters is that of “primary decomposer”. Apart from fungi, bacteria are the most important organisms responsible for breaking down organic matter. Without them we would literally be “smothered in our own wastes in a matter of months” (yet another fun fact from Lowenfels and Lewis, 2006).

Apart from helping to break down organic materials, bacteria also just generally serve an extremely important role in the nutrient cycling
(and retention) within natural ecosystems (eg. the nitrogen cycle would not be possible without bacteria), helping to free up various nutrients for plants (and other organisms), and holding nutrient reserves in the form of “microbial biomass”.

As I’ve alluded to a number of times already, it is primarily the populations of aerobic bacteria we want to thrive in our worm composting systems, but it is almost inevitable that every single one of us will be made aware of the presence of some pockets of anaerobic bacteria at one time or another (likely many many times!). Most of the “stinks” that we encounter in our systems are created by various anaerobic processes.

On a related (smelly) note – that wonderful rich, earthy smell we come to associate with a properly functioning worm bed, or with finished compost and high quality organic soil, is also the result of bacterial activity. The actinomycetes are a unique group of soil bacteria that actually share some features with the fungi. Unlike some of the more typical bacterial body forms (eg. rods, spheres etc), actinomycetes have a filamentous morphology, allowing them to spread out through the soil (or whatever habitat they happen to be living in). Earthy smells aside, the actinomycetes also play an extremely important “decomposer” role as well.

**Fungi**

While there are certainly countless microscopic fungi, most worm composters will be well aware of the fact that fungi can become very visible in a worm bin/bed. Of course, it is probably a bit of a stretch to refer to all worm bin fungi as “microorganisms”, but hopefully my readers will forgive me for wanting to keep things simple (haha). This group, like the bacteria, plays an extremely important role in the decomposition of organic matter on the planet (especially vital for the decomposition of highly resistant materials such as wood and other tough plant materials).

The main reason fungi can indeed be a lot more “visible” than bacteria and other microbes, stems from the fact that many of them are able to form complex structures via the grouping together of “hyphae” (small, thread-like structures which are made up of a single cell or groups of cells). Hyphae themselves are invisible, but once you have huge masses of them together you end up with visible “mycelia” (hair-like fungal growth we see in our bins) or even various fruiting bodies, such
as mushrooms. This organized network structure allows fungi to transport nutrients over great distances, and to reach massive proportions. I actually read somewhere that the largest (recorded) organism on earth is a particular patch of *Armillaria sp.* (“Honey Mushrooms”) – **NOTE:** Just confirmed this on good ol’ Wikipedia (don’t ya just love it! Haha) – check it out: “Honey fungus”.

In our worm composting systems, apart from helping to break down all those resistant “bedding” materials, fungi can also serve as an important food source for the worms – which probably helps to explain why you don’t see the same sort of fungal growths in bins once the worms have been added. On a related note, aside from direct consumption, fungal growth can also be impeded by disturbing the substrate in which they are growing. As such, I always recommend that people periodically mix up the materials in their worm bins during the “aging” process since this helps to break up the mycelial growth (too bad I forgot to mention this in my YouTube videos! DOH!).

One other quick thing to mention (for now) – fungi tend to prefer a more acidic environment than bacteria, so a sudden, obvious growth of fungal mycelium in your bin could be an indication that the pH has dropped. Not too surprisingly, it isn’t uncommon to see lots of mycelium when we “overfeed” (something we’ll talk more about later).

**Protozoans**

These are definitely the “big boys” of the microscopic world – at least as far as single-celled organisms go! For this very reason – and of course, because they are just so darn interesting (ok, maybe it’s just me) – this group has been a science lab favorite for many years. I’m sure most of us can recall looking at pond water (or something similar) under a microscope and seeing all the paramecia, amoebae etc whizzing by and jiggling around. 🤣 Well, believe it or not, there are similar creatures (likely many of the same ones in fact) living in the watery micro-habitats of the compost ecosystem zone (and in our garden soil).

This group serves various important functions in natural ecosystems, but in our (dirty) “world” they represent important bacterial “predators” (helping to keep populations of bacteria in check, and returning valuable nutrients to the environment while they are at it), and important “food” organisms for the worms. In fact, according to
Edwards and Fletcher (1988) they are second only to fungi in terms of importance as a source of nutrients for earthworms.

FYI - if you would like to learn more about microbes (and soil/compost biology in general) I highly recommend “Teaming with Microbes” by Jeff Lowenfels and Wayne Lewis. It has lots of great info about composting and compost teas as well.

**Composting Worms**

Not surprisingly, these are the “stars of the show” in the minds of most vermicomposters, and there is little doubt that they do indeed play a very significant role (even if the microbes are doing most of the actual waste processing). Their movements and fragmentation of waste materials are incredibly valuable as a means of increasing surface area for microbes and encouraging more air flow. This is why the addition of composting worms to a regular backyard composter can be so beneficial (we’ll talk more about this in the system set-up section).

Something that needs to be said right off the bat is that **regular soil worms are NOT ideally suited for worm composting systems**. You can certainly find them in outdoor beds (in contact with soil), but if you try to add them to any sort of worm bin/bed they generally won’t thrive at all (unless of course you’ve happened to collect some sort of composting species).

There are three main classifications of worms based on where they tend to live in the soil profile.

**Anecic Worms** – These are the deep burrowers. They live a very solitary existence, but do come up to the surface fairly often (especially during wet weather) to feed and mate. A common example is the ”Canadian Nightcrawler“ (*Lumbricus terrestris*).

**Endogeic Worms** – These worms tend to be closer to the soil surface, living in networks of horizontal burrows. Unlike the anecic worms, they tend not to come up to the surface nearly as much (if at all), and they feed on materials/organisms found in the soil. A lot of the paler, small-to-medium sized “garden worms” tend to be in this group.
**Epigeic Worms** – These worms live in habitats near the soil surface, or even above the soil in rich organic matter. As you can probably guess, these are the worms we are interested in! Unlike the other two groups, epigeic worms are well-adapted for life in transitional habitats – they are tolerant of a wide range of conditions, they can quickly take advantage of food resources while they are available, and can also quickly expand their population numbers (not to mention producing lots of resistant cocoons for future generations). These characteristics, combined with their voracious appetite for a variety of materials we tend to think of as “waste”, makes them ideally suited for use in our worm composting systems.

**Common Varieties of Composting Worms**

**Red Worms (aka Red Wigglers, Manure Worms, Brandling Worms, Tiger Worms) – Eisenia fetida/andrei**

These are almost certainly the most widely used composting worm species, and undoubtedly the most well-known. Technically speaking, *Eisenia fetida* (formerly “foetida”) is a different species from *E. andrei*, as determined in a study by Dominguez et al. (2005), but can only be reliably distinguished from one another via molecular analysis. Since they very commonly occur in mixed populations, and are very similar in general, the best approach is simply to lump them together.

Some may wonder about the species, *Lumbricus rubellus* – another variety commonly referred to as a “Red Worm”. Many have claimed that these are the composting worms they are using, but I’m really not sure what to think. In Edwards and Bohlen (1996), the authors share these interesting tidbits:

“In surveys of commercial earthworm farms in the US and Europe by Edwards, and Australia by Buckerfield and Baker, the earthworms sold under the name *L. rubellus* were all *E. fetida* or *E. Andrei.*” (p. 251)

“It is believed to be suitable for organic waste breakdown, but this has yet to be substantiated.” (p. 253)

Interestingly enough, in an email exchange I had with Dr. Edwards in December 2009, he had this to say:
“The advantage of *L. rubellus* is that it can be bred in organic wastes and is useful for transfer to soil sites where it survives and improves fertility. There is a major USDA project on this in Illinois.”

Hmmmm...needless to say, I’d love to get to the bottom of this issue (and to learn more about that USDA study!!) – hopefully I’ll be able to add an update here before too long!

All in all, Red Worms are likely the most versatile of the composting worms - highly effective at processing organic wastes, and tolerant of a wide range of conditions. Some of the tropical species may be more tolerant of extremely hot conditions than Reds, but they don’t perform well at cooler temps (and in fact will start dying well above the freezing mark), and seem to be somewhat more temperamental.

Here is a run-down of Red Worm requirements, according to Edwards (1998):

Temperature – 15-20°C (limits: 4-30°C)*  
Moisture Content – 80-90% (limits: 60-90%)  
Oxygen Requirements – Aerobicity  
Ammonia Tolerance – Low < 0.5 mg/g  
Salt Tolerance – Low < 0.5%  
pH - >5 and < 9

*I think this temperature range is somewhat conservative to be honest. High temps closer to 35°C (95°F) and low temps closer to 0°C (32°F) are more like it (these are not ambient temps by the way – basically this would be the temperature in their immediate surroundings). Glenn Munroe (2005) comments on the hardiness of Red Worms, claiming that cocoons can remain viable even after being frozen for several weeks. He also reports having found living adults encased in frozen material, something I have also observed in my own outdoor systems.
European Nightcrawlers (aka Euros, ENCs, Belgian Nightcrawlers, Dendros, Giant Red Worms) – *Eisenia hortensis* (formerly *Dendrobaena veneta*)

European Nightcrawlers (not to be confused with “Canadian Nightcrawlers – *Lumbricus terrestris*”) are a larger-bodied relative of the Red Worm. They are effective composting worms but tend to grow and reproduce more slowly than Reds, based on my own observations and those reported in the academic literature.

Here are some academic findings highlighting some of the potential differences between Reds and Euros:

**From Dominguez (2004):**

*Eisenia fetida*
- # of viable hatchlings per cocoon – 2.5-3.8
- Time to Maturity – 28-30 days
- Life cycle – 45-51 days
- Hatching viability – 73-80%

*Eisenia hortensis*
- # of viable hatchlings per cocoon – 1.1
- Time to Maturity – 65 days
- Life cycle – 100-150 days
- Hatching viability – 20%

My recommendation is to consider this info in relative terms (how the two species compare to one another), rather focusing too much on the numbers themselves. I’ve seen a wide range of values for these various parameters – but the one thing that seems to be consistent is the fact that Reds appear to do things more quickly than Euros.

Euros tend to be a favorite for those who are interested in raising bait worms since, on average, they are quite a bit larger than Red Worms. I’ve read that they are also quite “tough” – being able to stay lively on a hook for long periods of time, even in very cold and/or brackish water.

As my good friend Jeff “The Friendly Worm Guy” (an avid Euro breeder in Northern Ontario) has discovered, European Nightcrawlers appear to be better adapted (than Reds) for life in more typical soil habitats. Since starting up larger outdoor beds, Jeff has been finding Euros all over his property!
In my experience, Euros seem to prefer a system with a bit more depth (and perhaps more moisture) than Reds. Any time I happen to find them in my outdoor beds they always seem to be way down below. I have also noticed that they really don’t seem to thrive in shallow and/or open systems the same way that Reds do. On a related note, if you are keen to grow a thriving population of Euros, I recommend setting up a system dedicated solely to this species. While they can certainly co-exist just fine with Red Worms, they will tend to have more success on their own.

Blue Worms (aka “Malaysian Blue”, “Indian Blue”, “Spike Tails”) – *Perionyx excavatus*

I have limited experience working with these worms – but *enough* to know that I don’t like them as much as Red Worms (to say the least)! Personal bias aside, the good news is that these worms can be pretty phenomenal waste-processors, and can expand in numbers very quickly if you can provide them with the right conditions – primarily in the form of 1) WARMTH and 2) a system that’s not too wet.

It’s not uncommon to end up with Blue Worms in cultures of Red Worms since they tend to be a fairly common “pest worm” in the worm farming industry. Here are some distinguishing features to watch for:

- thin body with pointy anterior and posterior ends
- purple/blue sheen
- very fast (somewhat unusual) movement
- under-developed clitellum (doesn’t really stick out) closer to anterior (mouth) end.
- distress and death once temps dip below 10 C (50 F) or so
- crazy roaming behavior (especially during high humidity)
- weird worm balls (groups of them balled together)

If you would like to see some of these worms up close and personal, be sure to check out these pictures that RWC “worm friend” Larry Duke recently shared with me: [http://www.redwormcomposting.com/reader-photos/blue-worms-perionyx-excavatus/](http://www.redwormcomposting.com/reader-photos/blue-worms-perionyx-excavatus/)

I’ve *NEVER* seen Red Worms take chunks out of relatively-intact squash like that! Crazy stuff!
African Nightcrawler – *Eudrilus eugeniae*

This is another tropical species that tends to die off as temperatures drop (again, somewhere in the 10C/50F zone seems to be lower threshold). Similar to the Blue Worms, though, they can be really effective vermicomposters in warmer (or even “hot”) systems! They are a much larger worm than Red Worms, although based on what I’ve read, this doesn’t necessarily make them ideal bait worms (I suspect they would be great as a live food for various creatures though).

Alabama Jumper (*Amythas sp*)

Yet another warmth-requiring worm (although perhaps a bit more tolerant than Africans and Blues), “Jumpers” can be considered something of a “hybrid” worm – not in a genetic sense (something that is a myth by the way) – but in terms of the sort of habitat they do well in. Like the main “composting worms”, these worms do well on a diet consisting of lots of organic matter, but they are also much better suited for life in soil than the others. As such, they are often purchased for the purpose of improving garden soil etc.

As a bit of an aside here, let me just pull out my soap box for a minute or two, so as comment on this practice in general. Unfortunately, many people seem to assume that worms have some magic ability to turn horrible soil into gorgeous loamy goodness, if they are simply introduced into their gardens. Sadly, the insanity goes even a step further when they assume that “composting worms” can be used in this manner (and shady worm dealers don’t seem inclined to turn away potential customers either). The bottom-line here is that you NEED to start with a solid foundation of organic matter before you can expect the worms to thrive. Heavily fertilized, pesticide-sprayed, lifeless lawns and gardens will never be a good habitat for worms and cannot be rescued (solely) by worms. If, on the other hand, you start adding lots of grass clippings, fall leaves, aged manure etc, and THEN perhaps add some worms (although, in a lot of cases it can be an “if you build it, they will come” sort of scenario) at some point it might be a different story!

Anyway...😊
If you ARE going to buy worms for your garden (and you don’t live in an area with really cold winters), you might think about getting some Jumpers! Give them a nice habitat with lots of leaf mulch, grass clippings etc and watch as they help to turn your beds into a fertile plant paradise!

The “Critters”

We will be talking about the various allies, pests and predators in the “Vermicomposting Process” section, so this will just be a quick overview – primarily focused on the taxonomy of these organisms.

Most creatures associated with our worm composting systems (including the worms of course) are part of the group known as “invertebrates” (animals without backbones, essentially). There are certainly some “vertebrates” that can be involved as well, such as birds, moles, shrews, frogs etc – but proportionally there will be very few (and ideally, we won’t allow them to become actual members of the ecosystem, since they tend to be worm predators!).

The two primary phyla of importance in most worm composting systems would be: Arthropoda, and Annelida (and well talk about each a bit more in a minute), but other groups - such as the phyla Nematoda (nematode worms – rarely seen with naked eye), Mollusca (eg slugs and snails – typically in outdoor systems), and Platyhelminthes (which includes the dreaded predatory flatworms) – can make their presence known as well.

**Phylum Arthropoda** – This is the huge group of invertebrates that have a segmented “exoskeleton” – an outer protective covering (or at least partial covering) made out of “chitin”, which is a strong/flexible polysaccharide. Apart from the worms, pretty well ALL the small “critters” we find in our worm composting systems are part of this group. Some of the important Classes of arthropod include:

- Insecta (the insects – eg. fruit flies, fungus gnats, soldier flies, ants, various types of beetles)
- Entognatha (eg. the “springtails”)
- Chilopoda (centipedes)
- Diplopoda (millipedes)
- Malacostraca (which includes Order Isopoda – “sow bugs”)
- Arachnida (spiders and mites)

Many of the arthropods found in a worm composting system have a similar function to the worms (they help to breakdown decomposing organic matter), but some are predators (eg. centipedes, rove beetles, some mites, and spiders), and occasionally they can be parasites (eg. parasitic mites).

**Phylum Annelida** – This is the group that includes Order (or “Subclass”, depending on who you ask) Oligochaeta, which in turn includes the “earthworms” (already discussed) and the enchytraeid worms (aka “pot worms”, “white worms”).

As I’ve emphasized in my “Golden Rules”, it is very helpful if we develop a certain “respect” for the inner workings of the worm composting ecosystem, rather than blindly assuming most of the creatures, apart from the worms, are “bad”. What we should be aiming for is achieving “balance” not eradication in most cases. We’ll talk more about this (in reference to specific “critter” groups) later on in the guide.

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**Setting Up Worm Composting Systems**

There are many ways to “skin a cat”, so to speak (who comes up with these terrible sayings anyway?? LoL), and I don’t want to imply that I’m a “my way or the highway” kinda guy – not at all. In fact, and as discussed early on in the guide, I highly recommend that people draw from a wide range of sources, and of course try different things out for themselves. The methods/ideas outlined here are simply based on my own research in the field and what I’ve found to work well for me.

Regardless of actual methodology, our basic goal should be the same – preparation of a system that is well suited (and just generally “ready”’) for the composting worms we will be adding to it. In order to achieve this we should refer back to those “key requirements”. Again, these were: 1) Moisture, 2) Oxygen, 3) Warmth, 4) Darkness, 5) Habitat/Food, and 6) “Peace and Quiet”. We’ve likely
already picked a good location for our system that will help with numbers 3) and 6), and hopefully a “structure” that will help us ensure 4) – so we will now focus on moisture, oxygen, and habitat/food.

When I first started learning about worm composting the most common approach I encountered for setting up a worm bin went something like this:

1) moisten strips of (black and white) newspaper – wring them out (“wet sponge”) and add to bin
2) mix in food scraps and some garden soil (for “grit”)
3) add composting worms

What I always found strange though was the fact that many worm composting experts seemed well aware of the fact that microbes were a vitally important part of the process – breaking down the waste materials, and serving as a valuable source of nutrition for the worms – yet they were basically recommending that the worms be added to a pretty sterile environment!

I certainly don’t mean to imply that this is approach amounts to “vermicomposting suicide” or anything like that (haha) – when it comes down to it, the 1-2-3 method (above) is a nice simple way to set up your bins and beds. I simply prefer to make the system as “optimal” as I possible can before the worms get added – and a big part of that involves the establishment of a thriving microbial community.

For a decent overview of my own approach, I recommend watching my YouTube video called “Setting Up a Basic Worm Bin”. As per usual, I recommend zoning in on the main principles rather than the exact methodology. Also, I want to add a few additional thoughts here:

- I no longer see the value of adding garden soil. As mentioned earlier, this info seems to suggest to people that soil is a good worm bin substrate (not the case at all). Worms do rely on having some “grit” to help grind up materials in their gizzard, but I honestly don’t think this needs to be added. If you want to add something, perhaps some finely crushed egg shells or rock dust might be a better way to go.
- It’s important to mention that you should be checking on the system during the aging period (not sure why I failed to mention this in the video). The materials will likely
benefit from some thorough mixing, and there is a decent chance you may want to add some more water (if the bedding seems a little dry). This should help to curtail any fungal growth that may be taking place in the bin as well.

- The longer you plan to leave the system before adding worms, the more food materials you can likely get away with adding initially. Again, you will definitely want to work with the system while everything ages though, and don’t be afraid to add more bedding at any point (if it is a long aging period you will likely see a significant settling of the bedding materials)

- I now recommend adding a lot more air holes in the lid and upper walls of the bin. I’ve discovered just how vital good air flow can be for the proper functioning of a worm composting system. This could involve drilling more holes and/or adding actual vents, as shown in my “Mini Bin” video.

Some will likely be wondering about my “Deluxe Worm Bin” video. I should point out that, in all honesty, I am no longer a big fan of this approach. As I think I’ve mentioned, I am a huge fan of K.I.S.S. (helps to explain why I’m not a stacking bin kinda guy in general), and simply found that using a reservoir ended up being messy, and invariably worms crawled down into the lower bin etc. I would definitely prefer a simple open tub system over the “Deluxe” bin any day! That being said, please don’t take that as implication of a completely flawed approach – to each his/her own I say! I know some people love this design, and that’s great (obviously if I thought the Deluxe bin was a terrible idea I’d just take down the video).

So what about ALL the various other types of worm composting systems (i.e. the ones that don’t use an enclosed plastic tub system)??

Again, I urge everyone to zone in on the main principles. Generally speaking, regardless of the type of system we are setting up, we want to create a habitat for the worms that provides them with moisture, oxygen, darkness, and of course some food. With systems that provide really good aeration and drainage, you’ll likely want to add a fair amount of water right off the bat (whether via soaking of the bedding beforehand, or actually watering down once set up), but I still recommend letting everything age for a week or two. This can be really important with larger systems simply due to the potential for overheating when mixing larger volumes of organic wastes.
Quick ‘N’ Dirty System Set Up

Sometimes, there are going to be situations that force us to get a worm composting system up and running ASAP – such as obtaining your composting worms before you’ve had the chance to set-up and/or age the habitat. Obviously, I would never suggest that people simply make the worms wait in their cramped shipping bags (or whatever travel container they happen to be in) while the microbial community becomes fully established!

In these cases, my recommendation is to attempt to add materials that already have a community of microbes living on them. Perhaps you already have some rotting fruit/veggie waste in the back of your fridge? Or perhaps you can track down some “living material” such as partially composted wastes (from a backyard composter, or better still, from another worm composting system), old dried up grass clipping or well-rotted leaves? Basically, anything (worm bin friendly) that has been decomposing for quite some time already.

There are also food materials than tend to break down a lot more quickly than others (and thus attract the worms a lot more quickly than others). I’ve found that various melons (cantaloupe, watermelon etc) can work really well – it hardly takes any time for these to start breaking down, which helps to explain why you can often find groups of worms zoning in on these wastes the same day they are added.

Before adding the worms, be sure to soak/drain the bedding (aged tap water or rain water are best, if possible), and then to mix it thoroughly with your food and “living” materials. I recommend adding less food in this case than if you were going to age the system (perhaps ¾ bedding to ¼ food), but with good earthy leaf mold and other “living” bedding materials you can more than likely add as much as you want. Really well-aged manure/straw (or something similar) mix would also be very valuable in a situation like this – but again, if you are really new to all this, it may be best to steer clear of any and all manures initially (at least in the case of setting up a small, enclosed bin).

Setting Up a Vermicomposting Backyard Composter

Typical “backyard composters” can actually work really well as worm composting systems if they are set up properly. Unfortunately, many
people seem to simply use them as garbage bins for yard waste, rather than putting any real effort into optimization of the composting process. I’ve certainly done this myself when in “lazy” mode, and given enough time, it works just fine – the stuff WILL eventually break down. That being said, if we want to support a thriving population of composting worms, we will certainly need to put a lot more effort into the set-up system, or at least take the time to “fix” what’s already there.

If starting from scratch, here are the steps I’d recommend taking:

1) Dig a depression in the ground down below the composter (somewhat smaller than the lowermost diameter of the bin)
2) Add lots of absorbent bedding materials, such as shredded cardboard or strips of newsprint
3) Alternate layers of food materials and bedding materials until the bin is basically filled
4) Soak everything down and leave to sit
5) If at all possible, incorporate some of those “living” materials I talked about earlier
6) Let age for at least a week or two, adding more water periodically (you may actually prefer to soak the bedding before it is added to the system – especially useful in hot/dry locations)

The pit down below not only adds more space for the worms to spread out in, but it can also serve as a protective winter habitat for them. If you mound soil, leaves, straw etc around the base (and do the same with snow once it arrives) you should be able to keep worms (or at least cocoons) alive until spring in most wintry locations without too much difficulty.

In the case of composters that are already up and running, my recommendation is simply to remove most of the tough plant wastes, sod, woody materials etc, add lots of absorbent bedding and food, and water everything down well. If you have already been adding a fair amount of food waste, bedding etc, the bin may in fact be ready for worms without the need for aging.

OK, well there is certainly plenty more that could be said about setting up worm composting systems, but I think that’s a good start. Again, I strongly recommend keeping those primary requirements in mind at all times when focusing on the task of setting up your own system. This alone will greatly help to ensure your chances of success!
Vermicomposting Q&A

This section covers many of the common questions I receive regarding various aspects of vermicomposting. I’ve grouped questions according to sub topic, and have attempted to order them in a manner that reflects the progression of a typical vermicomposter. There is certainly some overlap with topics I’ve discussed earlier in the guide, but I think this will be a handy reference for those who want to find answers quickly.

Getting Started

Can I use a compost tumbler as a vermicomposting system?

While the vessel itself could likely work great as a worm bin (as long as it wasn’t sitting in direct sunlight during the summer), to me this is not the best use for these rather expensive systems. Worms don’t want to be disturbed all the time, so you certainly couldn’t expect to be tumbling the contents on a regular basis. I also suspect that removing the compost/worms would end up being a hassle. My suggestion is to use a tumbler for “pre-composting” – or even just mixing - waste materials prior to use in a worm composting system (I suspect it would be really helpful when used for this purpose).

Can I use clear plastic bins for my worm composting system?

I generally recommend that you don’t use clear containers. For starters, worms do not like light, so you will more than likely need to keep a clear bin some place dark if you don’t want to force your worms to stay in the composting zone during daylight hours. Secondly, the clear plastic bins tend to be made of harder material which has the tendency to crack more easily than “Rubbermaid” style bins (which tend to use a softer, more flexible plastic) – you may even end up cracking the bin simply by attempting to drill air holes in it.
What quantity of worms should I add to my system?

This all depends on your overall goals. Being a bit of a “slow ‘n’ steady” ecosystem-balance kinda guy, I typically prefer to start small and let the worm population grow into a given system. As such I never do any sort of calculation to figure out how many worms I should be adding. If I see that the activity of the worms is really slow, I may opt to add more worms – but again, I don’t tend to treat this as an exact science. In my humble opinion, I think this is a great approach for those just getting into worm composting – I’m always nervous when I see “newbies” placing multi-pound orders right off the bat, without having first “played” a bit with a vermicomposting system. It’s important to remember that there is a bit more of a learning curve in comparison to tossing wastes in our backyard composter – we’re dealing with living creatures that have certain requirements and thresholds (as tolerant as they are).

I’m certainly not trying to suggest that you can’t succeed if you start with lots of worms – even if you end up losing some worms, there’s a good chance you won’t end up killing off your entire “herd”. I just don’t see the sense in spending all that money when you don’t really need to. What you WILL however need if you take my advice is some patience – especially early on! Don’t expect to start processing all your waste materials right off the bat, that’s for sure.

If you are looking for a more concrete number that you can calculate, you may want to go with Mary Appelhoff’s “1/2 lb of worms per cu ft of bin volume” (“Worms Eat My Garbage” 2nd ed. 1997). In other words, if you have a 10 gallon bin, this will work out to just over 1 lb (technically 1.34) of worms using this formula (here is a great conversions website to help with these sorts of calculations: http://www.onlineconversion.com). Appelhof still suggests that you let the worms grow into the system, though, pointing out that we should be aiming for an eventual population density of “1 lb per cu ft”.

How many worms are in 1 lb?

The short answer is “it depends”! 😊

Obviously, the size of the worms is a very important factor. The generally accepted average for Red Worms is 1000 per pound, but that can probably range from 700-1500 per pound, depending on how big they happen to be. European Nightcrawlers tend to be in the 300-400
per pound range, and I’m pretty sure big African Nightcrawlers can be even fewer per pound (200ish?)

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**How much soil should I add to my bin/bed?**

I don’t recommend adding ANY “soil” to your worm bin (as mentioned earlier, I *did* suggest adding a pinch of garden soil in a couple of my YouTube videos, but don’t even think this necessary any more). Remember that these are not soil worms. Bagged “potting soil” can be ok (since mostly peat moss anyway), but it is VERY important that there not be any sort of starter fertilizer in it! Worms are very sensitive to salts. I definitely don’t recommend adding regular garden soil either since it tends to be very heavy, and will almost certainly impede air flow in your bin.

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**Do I need to add lime to my system when setting it up?**

I have never used lime to be totally honest. So you can certainly get away with never using it. I do however add plenty of egg shells (help to buffer acidity) so if you don’t eat eggs, perhaps adding a small amount of lime early on and periodically won’t be a bad idea. Make absolutely sure you have the RIGHT type of “lime”. It should be agricultural lime, or sports field lime – CaCO$_3$ (calcium carbonate – aka “chalk”). Dolomitic lime (CaMg(CO$_3$)$_2$) should be fine too – in fact, since this lime also contains Mg it may be a better choice. According to Edwards and Bohlen (1996), vermicomposts can often be deficient in this element.

Do NOT EVER use “builder’s lime”, “slaked lime” – or basically *anything* other than the two chemical compounds mentioned above (look for those on the bag – and make sure the material has a very high percentage of the compound).

You may also want to try out various rock dusts instead of lime. These can contain calcium, along with a wide array of other beneficial micronutrients etc.

Once last thing to mention here. If you do plan to use lime, I recommend adding small amounts on an ongoing basis – NOT dumping in large quantities to try and counter excess acidity (“sour” worm bin etc). The latter approach is just a recipe for disaster since it will more than likely throw your compost ecosystem off kilter, and potentially lead to a total system meltdown.
**Can I use cereal box cardboard in my worm bin?**

I personally prefer to recycle this type of box cardboard since it usually has glossy color ink on it (which can contain a variety of chemicals). Toilet paper and paper towel rolls are a similar cardboard, but these are great for use since they don’t have ink on them.

**Can I use bleached office paper as a worm bin bedding?**

I definitely recommend that you don’t use this as your main bedding material, although using in moderation should be ok. Bleached papers can contain various chemicals (bleaches, dioxins) that can potentially irritate/harm the worms and/or potentially add unwanted chemicals to our soil (when we use the vermicompost). When I was still a little wet behind the ears (in terms of vermicomposting experience), I once set up a worm bin using only bleached paper bedding and the worms were NOT impressed to say the least (I ended up having to redo the bin).

**I am seeing a lot of condensation forming in my new bin. Is this a bad thing?**

Condensation on the inner walls of an enclosed plastic bin is very normal. It is simply an indication that moisture is being released during the decomposition of the waste materials. Nevertheless, we DO want to make sure there is plenty of air flow in the bin, so perhaps you might want to drill more holes (add more vents etc). Keeping a thick layer of dry bedding up top should also help to decrease moisture levels up here (as we’ll discuss in a minute, this can be helpful if worms are roaming early on).

**I have lots of mold growing in my bin during the aging process. What should I do?**

Make sure you frequently mix everything up while you wait (a small garden hand fork works very well). This will break up fungal mycelium, not to mention just generally creating a more homogeneous habitat for the worms. Once the worms are in the system, you’ll likely see a lot
less mold growth (but we’ll talk about what it means when you DO see it a bit later on).

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**My worms arrived dry and lifeless – should I just throw them out?**

Absolutely NOT! Worms are usually shipped quite dry, especially during the summer, since this helps to prevent overheating (and worm death) in the shipping bags. Add the worms to your (hopefully moist) system and just leave them be for awhile. People are often utterly amazed to find their “lifeless” worms vigorous and healthy within a day or two. The key is to give them the chance to re-hydrate (worms are basically just little bags of water!).

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**How do I add the worms to my new system?**

My recommendation is to simply create a small depression on your moistened bedding, then dump the breathable bag (or whatever container the worms are in) into it. Spread the worms out a bit, but don’t fiddle with them too much. It’s not a bad idea to only partially put the lid back on (to help provide lots of air flow) and put the bin in a well lit area (NOT in direct sunlight though). Come back and check on the worms periodically to see if they are starting to move down into the composting zone.

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**My worms are crawling up the walls/lid of the bin and trying to escape. What did I do wrong?**

Don’t worry – this almost certainly the MOST common question I get from new worm composters. You are definitely not alone – and this is definitely very normal. Keep in mind that these worms have likely been bumped around a lot lately – harvesting, shipping etc certainly shakes them up! They may also be coming from a somewhat different habitat than what you are introducing them to. Worm farmers often raise the worms in large open beds and feed them different materials (aged manure, special “worm chow” etc) than what you may have added to your bin.

Generally, it just takes a little time for the new system to seem like “home”. If it is an enclosed plastic bin, it can be helpful to add LOTS of dry bedding up top (also make sure you have LOTS of moistened
bedding down below – I find that a lot of new vermicomposters don’t have enough habitat bedding in their bins) since this will dry out the upper zone, making it less worm-friendly. Keeping the bin under lights (perhaps with lid off) can also help.

If the worms seem to be in serious distress – all balled up in certain parts of the bin (in the handles etc) or are trying to leave en masse (especially if there is a light shining over top) this likely indicates a serious problem. Think about how you set up the system (review the list of things that can harm worms at beginning of guide) and see if you can figure out where you may have gone astray. I recommend adding a LOT more moistened bedding down below (ideally, something like shredded corrugated cardboard or strips of newspaper) and keeping the lid off (in case it’s a toxic gas issue), and under lights.

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Food/Feeding (Waste Addition)

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**How much food should I add, and how often?**

If you refer back to my list of “Golden Rules”, you’ll find my recommendation to let the worms “guide” you. This simply means that the amount you add (and frequency of feeding) should depend entirely on the activity of the worms. Initially, assuming you have set up the system in a similar manner to what I recommended earlier, you should have plenty of food material for the worms to munch on once they are added to the system, so there likely won’t be any need to feed for at least a few days. This provides the worms with some time to get settled in, and helps to prevent any early disasters. Remember that other “Golden Rule” – it is WAY easier to kill off our worms by overfeeding than by starving them!

Moving forward, my recommendation is to start slowly and see how the worms do. If it seems like the worms are making good progress with a particular collection of food material, you are probably ok to add some more – but don’t EVER let it pile up. Toss excess food in your freezer or out in your backyard composter if you have one.

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**What’s the best way to feed my worms?**

It all depends on the system and what your aims are. For the average “worm bin warrior”, I recommend adding “food pockets”. Simply create small depressions (with your trusty hand rake) add the food, then cover back up. In the case of really wet foods, it’s not a bad idea to also add some dry bedding in the bottom of your hole – but if you are maintaining a thick layer of this up top at all times, this may not be necessary. Set up a number of pockets around your bin/bed – adding them gradually over time (perhaps a new one every few days or so). Once you get back to the first pocket, see how the worms have made out with the material – if it looks well processed by then you are probably ok to add more. If not, definitely let them mellow out for a few more days.

If you are using some sort of flow-through system and your aim is to produce lots of nice vermicompost, employing a layering feeding approach may be your best bet (since it helps to ensure that materials at a given level are all at a similar stage of processing). This works really well with non-food-wastes in particular (food wastes have the potential to develop fruit fly infestations, and/or growths of mold more easily if they are not buried). Even with a layering approach, it is a good idea to keep a thick layer of bedding over top if at all possible (apart from deterring pest it will also help to keep in moisture).

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**Why is it taking so long for my worms to eat the food?**

As per usual, I recommend reviewing the “basics” section to see if you are providing the worms with an optimal environment for processing the wastes. Temperature, for example, can play a very significant role in slowing down and speeding up the vermicomposting process. As temps drop, the microbes slow down a lot, as do the worms. Aeration is also another really important factor. Unfortunately, enclosed plastic bin systems are not ideal in this regard. They often end up wet and anaerobic down in the lower reaches, which can really slow things down (it’s not uncommon to dump out a plastic bin many months after starting it and find perfectly intact food and bedding materials in the bottom)

I also recommend you have a look at my “Optimizing Food for Vermicomposting” section. One very common cause of slow vermicomposting is the addition of materials that just don’t break down very quickly. If you employ various optimization strategies
(chopping up the wastes, freezing them etc) it can make a big difference.

Why is there mold growing on my food when the worms are there?

If you have lots of worms in the system, this could be an indication that you are adding way too much food for them. Again, I recommend following some of the advice I shared in an earlier feeding question (outlining how to feed) to help ensure that you don’t run into this problem. Also keep in mind that certain types of waste are more prone to mold growth than others. Bread for example, will quickly develop a dense mat of mold if left unchecked. Break it up, and burying it should however help to keep this growth to a minimum, and prevent any serious spore production.

Food waste in my scrap holder turned into a stinky, goopy mess. What should I do (and how to prevent in future)?

Just as it’s important to use “bedding” in our worm bin, so too is it helpful to use these materials in our scrap storage containers. The goopy stuff should get mixed with a lot of dry absorbent bedding, and then be left to sit for awhile longer (until it no longer smells). If you were going to use it in a bigger outdoor system you could probably just add it to the bed right away, but I definitely don’t recommend doing so with smaller systems since the stinky stuff can contain harmful compounds.

When setting up a scrap holder, start by adding a nice thick layer of absorbent bedding down in the bottom – then simply start adding your scraps. Often you don’t even need to do any more than this, but you may want to put in additional layers of bedding as your add more wastes.
Ongoing Maintenance

Do I need to “turn” the contents of my vermicomposting system?

Unlike a regular compost heap, you don’t really need to turn the contents of a worm composting system. As long as there is good air flow into the system, the activity of the worms should be able to take care of the rest. That being said, it’s certainly not a bad idea to periodically take your hand fork and loosen everything up a fair bit, to help get more air in to where it’s needed. Over time, bedding tends to get compacted, so this should definitely help.

How often do I need to add new bedding?

The initial set-up of your system should involve adding a LOT of bedding materials, so you likely won’t need to worry too much about adding more bedding for at least a few weeks. I definitely recommend getting into the practice of adding some every time (or every other time) you feed, though, since it helps to ensure that you won’t run into problems down the road. Probably the ultimate “lazy” method, however, is to simply maintain a nice thick layer of bedding up top at all times. When you create your feeding pockets, this material will naturally end up getting mixed in with the food, so you likely don’t have to worry about adding any in the bottom of the hole (unless the waste is really wet). Over time this upper level with shrink down and get processed by the worms, and can simply be topped up when it looks like the level has gone down somewhat. This can generally be a great way to wick up excess moisture in the system, and help to keep the worms down in the composting zone.

My worms have been totally fine for weeks/months, but are now suddenly roaming a lot more (trying to escape etc). What’s wrong?

There are a variety of possibilities here. For starters, think about what food/bedding materials you have recently added to your system. Anything different (than the usual)? Larger quantities than normal?
Also look for obvious signs of something going wrong (other than worms roaming) – any population explosions of other organisms? Any foul smells?

If nothing has really changed (again, other than the restlessness of the worms) this may indicate the onset of something I refer to as “mature worm bin syndrome”. Often this seems to occur in systems that have been up and running for quite some time (typically months). Much of the bedding/food has been converted into vermicompost. Perhaps a person has been a little lax with adding new bedding, but has still continued to add food waste. There definitely seems to be a big difference between simply leaving a bin to sit for several months (with no additional food) and continuing to feed the system without adding more bedding. In the neglected bin the worms still turn everything into vermicompost (mostly worm castings), but there is no indication that this material causes them harm (I’m almost always amazed by how well the population is doing every time I open up one of these neglected bins). In the systems that have continued to receive food, however, trouble invariably strikes at some point.

My first recommendation would be to take the lid off the system (assuming it has one), since there may be some sort of gas build up that’s causing the problems (be sure to put the bin under a light as well so the worms stay put). If there IS a lot of vermicompost in the bin, you should probably start to think about harvesting the material and starting up a new system for your worms. We’ll talk more about that in the harvesting Q&A section.

My worm bin is starting to stink. Why? How can I remedy it?

Typically, bad smells in a worm bin are the result of anaerobic conditions developing. It’s inevitable that you will end up with at least some anaerobic pockets in your system, but the more you have or the larger they are, the greater the chance of having foul odors reach your nose. With plastic bins unfortunately this tends to happen a lot more than in other bins (with better ventilation). For starters, make sure you haven’t added “too much” food at once – refer back to the feeding Q&A section for a review of my recommended feeding approach. Next, check on moisture levels in the bin – if it’s starting to get swampy down in the bottom I recommend adding lots of dry bedding. You could move everything over to a new bin (with a thick bottom layer of dry shredded cardboard ready to go), or you might try to create absorbent wicks in the corners of your bin by pulling the materials
back (until you see the bottom) and then shoving something dry and absorbent into the hole (make sure to get it all the way to the bottom). If you do this in all four corners you should be able to soak up a fair amount of excess moisture.

Just leaving the lid of your system for periods of time (preferably during the day) and/or keeping a thick layer of dry bedding at the top of your bin all the time should also really help to reduce moisture levels, and help to reduce issues with bad smells as a result.

Worm Bin/Bed Organisms

If I keep my bin inside will all the creatures infest my home?

Keep in mind that the vast majority of the creatures in your worm bin (including your worms) are specifically adapted for that environment. Many of them require some sort of warm, moist, dark environment, with plenty of organic matter in order to thrive. Some critters DO end up finding their way out of the bin, but you’ll find that they often perish pretty quickly. I’ve found plenty of springtail and mite “dust” (dead bodies) near my bins over the years, and of course some dried worms every now and again! Bottom-line, you definitely don’t need to live in fear – worm bin creatures won’t end up in your room feeding on you while you sleep, or attacking your pets etc.😊

What’s the difference between fruit flies and fungus gnats?

Fruit flies look a lot more like miniature houseflies, and tend to be brownish or gray in color. They also seem to be somewhat more full-bodied. Gnats look more like miniature mosquitoes, then tend to be closer to black in color and their body isn’t as robust. Fruit flies seem to be primarily associated with food waste (especially fruit wastes of course), while fungus gnat larvae seem able to grow in a wider range of substrates (making them more of a pain to get rid of, unfortunately). Fungus gnats have a distinctive mating habit – adults come together end-to-end, making them look like some sort of bigger insect.
**I have a fruit fly infestation. What should I do?**

I generally recommend my “three-pronged approach” for dealing with fruit flies that have already become established (we’ll deal with prevention in a minute). For starters, I recommend using a vacuum to suck up adults every day – sounds funny, but it’s a great way to reduce the number of “breeders”. Secondly - remove excess food waste from your bin, and only feed with bedding materials until the fruit flies are gone. Lastly, set up a bunch of apple cider vinegar (or wine vinegar) traps – simply pour a small amount in the bottom of a jar (with a drop of dish detergent to reduce surface tension), cover with plastic wrap and add some small holes in the plastic. Swirling the cider around a bit should help to release the tempting smells. The traps aren’t as effective as the vacuum, but it’s a nice passive approach.

Prevention is always going to be better than having to deal with an infestation. It’s important to key your eyes open for fruit flies around the house, especially during warmer weather and/or when you have lots of fruit sitting out. It’s not a bad idea to keep a few traps going all the time in your kitchen so you’ll have a potential early warning system. It may help to keep a really thick layer of bedding over top of the main composting zone in your bin. This will help to filter out the tempting smells and should also help to discourage adult fruit flies from trying to make their way down to the wastes. Similarly, make sure to bury your waste materials when feeding since this will definitely help. One last recommendation would be to freeze your wastes (especially fruit wastes) before using them – this should kill off any fruit fly eggs/larvae that may be in the skin already.

**I have a fungus gnat infestation. What should I do?**

As mentioned earlier, these flies can be a little more challenging to get rid of since the larvae can thrive in a wide range of materials. I still recommend switching over to a bedding-only feeding approach since it should at least reduce the amount of nutrition they can obtain. In general, it’s probably not a bad idea to employ the very same strategy as recommended for fruit flies (previous response), since A) the two flies can sometimes be mixed up, and B) similar methods can work (definitely vacuuming – but surprisingly, I’ve actually found a lot of gnats in cider traps as well). Unlike with fruit flies, I’ve had great
success with sticky traps for gnats – they seem to really be attracted to light. Hang fly paper next to a light near your bin and you may be surprised by how many you’re able to trap. Fungus gnat larvae seem to thrive in really wet conditions, so try reducing the moisture level in your system – obviously don’t go overboard with this since the worms also need moisture, but try adding lots of dry bedding and/or keep the lid off for periods of time. Some people swear by coffee grounds as a gnat deterrent but I haven’t yet been convinced of this myself (may test it out again at some point though).

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**The inside of my bin is covered with small, white “eggs”. Are these worm eggs?**

If you suddenly one day find an abundance of shiny white spheres in your worm bin they are almost certainly white mites. They are very slow moving, often appear in clusters, and don’t seem to have visible appendages so it’s not all that surprising that they are mistaken for eggs. Just so you know, worm cocoons are larger, oval-shaped (often look like mini lemons), with a straw to dark brown color (depending on maturity) and tend to be down in the actual habitat matrix (not on the sides of the bin).

White mites (and mites in general) often appear when conditions are quite wet and when there is an abundance of food, and often as conditions are starting to “sour” a bit. They seem especially fond of the cucumber-family (squash, pumpkins, melons etc). If your worms are starting to die off for whatever reason, you may notice clusters of the mites on the dying and dead worms. I have yet to see any harming a healthy worm, so I suspect they primarily serve as scavengers and general waste processors (like the worms themselves).

Interestingly, I don’t see nearly the same abundance of mites in my well-ventilated systems, so you might try leaving your lid off for periods of time (during the day) and perhaps adding lots of dry bedding up top if you seem to have a huge outbreak of them. You may also want to cut back on the amount of food you are adding.

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**I have red “spider mites” in my bin. What should I do?**

It is important to realize that there are literally thousands of species of mites, with really only a handful (relatively speaking) of varieties being
very common in worm composting systems. The ones that ARE in our compost heaps and bins are adapted for that environment – they are generally NOT going to be human/pet parasites (or harm us in any other way) – nor are they going to be plant parasites. The term “spider mite” most accurately refers to the group of tiny pest mites that live and feed on plants (often crop plants) and create headaches for gardeners and farmers – they are not the same mites that you find in your worm bin.

There is a small, reddish-brown variety of mite that seems to be very common in worm composting systems. I have noticed that it seems to be parasitic on some insects and isopods (“sow bugs”), but I have found no evidence of them harming worms (although some claim they do). If you do see a LOT of these mites in your bin, you may want to take the steps outlined in the last response (improve ventilation, dry things out a bit, cut back on feeding). Another approach that seems to be effective for removing excess mites involves luring them onto pieces of melon/pumpkin/squash etc and then simply washing them off before putting the “lures” back in the bin.

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**I have lots of little white bugs in my worm bin. What are they, and should I be concerned?**

I’ve talked about white mites already, but if these “bugs” tend to move fairly quickly, and are more oblong (rather than spherical) they are more than likely springtails. Strangely enough – at least in my experience – the springtails that occur in composting systems often don’t seem to have the spring appendage (called the “fercula”). So don’t assume that just because they are running (rather than springing) that they aren’t springtails.

Some people seem to get stressed about springtails, or are convinced that their worms are stressed because of them. I tend to be a lot more mellow about their presence. I have a huge abundance of them in my systems and have seen no evidence to indicate that they cause any harm. In fact, I think they can be really important helpers for the worms. They feed on microbes (especially fungi), but definitely seem to prefer drier conditions than the worms, so you will often find them coating waste materials that are closer to the surface in zones where the worms likely wouldn’t be hanging out anyway. They also seem to be perfectly happy with some materials the worms aren’t all that thrilled with, such as orange peels etc.
**I have lots of big grubs/maggots in my bin. What are they? Should I be concerned?**

These are almost certainly black soldier fly larvae. Believe it or not, there are MANY people who purposely try to attract these critters into their composting systems because they are incredibly effective processors of organic waste. If you have fish, birds, lizards etc, these are also a fantastic food organism!

That being said, in my mind the jury is still out re: the impact these larvae have on a worm composting system. Many people claim they can work well together in the same system, with the grubs doing most of the processing and the worms feeding on their wastes, but I’m tending to think that over time they can end up outcompeting the worms. This is something I definitely plan to look into in greater depth before too long.

In the meantime, if you don’t want these larvae in your worm composting systems – assuming you live in an area where this species is found (they tend not to be in cooler, more northerly locations) – my suggestion is to keep your system indoors, or at least set up a small indoor bin as an insurance policy.

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**I have centipedes in my worm composting system(s). Should I be worried? What about millipedes?**

I have plenty of centipedes in my outdoor systems, and while I’ve read that they can prey on young worms, I honestly don’t think they have a major impact on populations of composting worms – especially considering the vast array of “critters” that are available (springtails etc) as well. I’m not a big fan of having them in my indoor systems, but really, that’s just a personal preference.

Millipedes are completely harmless, and in fact can be very helpful in a worm composting system. Like sow bugs, they generally serve as “shredders”, fragmenting some of the tougher materials like leaves, thus helping the microbes and worms to turn these materials into compost.
I have lots of ants in my worm beds. What should I do?

Ants can definitely be a pain in the neck for us vermicomposters – especially in the case of fire ants and other aggressive species. Generally speaking, they don’t like really wet conditions, so you may want to start by focusing on keeping your system nice and moist (assuming it has drainage). If your bin is small enough, you may want to take things a step further (in the moisture department), and literally put the bin in a container of water (up on blocks if it doesn’t have legs). It is unlikely that there will be a lot of ants willing to swim across your moat just to get to the bin. Adding a little dish detergent to the water should help to take care of any that DO attempt the swim (will reduce surface tension and they will likely drown).

I have read that borax mixed with something sweet (like honey, syrup etc) can be a relatively “eco-friendly” way to dispose of ants. Try putting out some shallow containers with this stuff in the immediate vicinity of your bin/bed. The other benefit of this approach is that the ants will likely take it back to their nest, potentially killing even more ants in the colony. Speaking of which, if you really feel like inflicting some punishment at the “source”, you may want to see if you can actually find where the ants are nesting on your property. I’ve read that pouring boiling water over an anthill can be a good way of killing off most of a colony (especially if done at night, I would imagine).

Some suggest that you can repel ants quite well with various members of the mint family and things like cinnamon, but I’m not really convinced that repellents are worth the effort. Diatomaceous might be beneficial as long as it is used carefully. I don’t think I would actually put it in a worm bin (since it would harm other critters, and potentially even the worms), but similar to the moat idea, if you surround your bin with it, that could help to discourage them from attempting to reach the bin.

Whatever you do, please don’t attempt to get rid of ants with any sort of pesticide. Aside from potentially harming your worms, you can also harm lots of other critters in the local ecosystem. In my experience, the common ant varieties (we have larger black ants and smaller reddish-brown ones) up here in Ontario don’t seem to do much more than annoy me (haha) – I’ve even had nests in the middle of garden worm beds, and have yet to see any signs of them actually attacking the worms. Again, I do realize there are some really troublesome species out there, but my point here is that we shouldn’t always assume they are an “enemy”.
Harvesting

How do I know when it’s time to harvest?

It will depend on the type of system you are using, but my basic recommendation is to wait until there is a considerable quantity of dark compost in the lower half of the bin/bed. If you have been using the system for a few months already (and it has remained reasonably warm, and aerobic), there should be enough vermicompost to make it worth the effort. Harvesting also provides you with an opportunity to freshen up your worm habitat, so that’s an added bonus as well.

When using a stacking bin, it’s not a bad idea to wait until you are at least up to the third tray (some only have this many trays) before harvesting the lowermost tray. Again, if there seems to be a decent quantity of dark compost, and most of the bedding etc has been processed, it probably won’t be a bad time to harvest that tray – you MAY need to take steps similar to those recommended for tub systems if there are still loads of worms in the material though.

What steps should I take when preparing for harvesting?

In the case of a single-compartment flow-through system (Worm Inn, OSCR etc), it’s typically just a matter of starting to remove vermicompost from the bottom. With tub systems you should stop feeding and leave the system for a week or two. Whatever loose material remains unprocessed after this period can then simply be removed by hand. You may also want to set up a new system and let it age while the worms are finishing off the material in the older bin – this way they will have a new home ready to go when you separate them from the vermicompost.

With a stacking system, it is generally when you have filled up the last tray (usually the 3rd or 5th depending on the size of the system) that you would start to think about harvesting compost from the bottom tray. If the compost is fairly wet and/or has lots of worms, refer to my next response.
What is the best way to harvest vermicompost? What if my compost is really wet?

I recommend having a look at the harvesting section on the “HOT TOPICS” page for starters. You will find a number of different approaches. The “garbage bag” approach and “David’s Tub Method” will likely be your best bet if using some sort of plastic tub system and don’t feel like taking the time to dry out the material (tends to be fairly mucky in these sorts of systems). When you have a reasonably dry (crumbly) material – such as the vermicompost harvested from an open system – I recommend the “turbo light harvesting method” or use of some sort of rotary screen harvester.

Drying out muddy vermicompost definitely isn’t a bad idea, since it should help to “finish” the material, and generally improve the quality. Simply taking off the lid of your bin for a number of days would likely make a big difference, but if you want to accelerate the process I’d recommend dumping the contents of your bin out into a shallow tub/tray, or even simply onto some layers of corrugated cardboard sitting on your basement floor (in a shed, garage etc). I don’t recommend simply leaving a heap of your wet compost out in the sun. For one thing, it may decrease the quality of the final product (especially if it ends up getting rained on as well), and it may in fact result in it drying out too quickly – potentially resulting in a big ol heap of vermi-cement!

Even when drying indoors you should regularly break up the material with your hand fork during the drying process.

What about cocoons and baby worms? Is there some way to harvest (or at least save) them?

This is definitely a common worry/frustration among passionate vermicomposters – and understandably so. The “future composting potential” of the worms/cocoons left behind in vermicompost can often be quite high – it’s next to impossible to end up with a completely worm-free material.

I tend not worry about this too much myself since I have so many different composting worm zones out in my yard – I know the worms will have a fairly easy time finding a favorable habitat close by, regardless of where the vermicompost is used. In fact, I am very often using my worm compost (typically pretty coarse grade stuff) in my
various hybrid gardening systems, so there will be habitat available right there. That being said, I realize that a lot of people are adding their worm compost to regular soil beds (potted plants etc) so it might not be the sort of habitat the composting worms will thrive in.

I personally don’t know of any method that will help you remove baby worms and cocoons really quickly, but if you don’t mind waiting a little while before using the vermicompost, you should be able to get a lot more of the left-over worms out. Once you have removed unprocessed food/bedding and have left the system to sit without food for a little while, try creating a small feeding zone up at the top. Mash up some tempting food like cantaloupe or melon and cover it with some bedding. As the rest of the material dries out, this zone should become even more tempting. Again, this may potentially take a fair amount of time (especially if you want to wait for cocoons to hatch), but if it coincides with some drying time (often a very good idea with plastic tub vermicomposts it may not seem like too much of an inconvenience. For those who DON'T really feel like making the extra effort, rest assured your remaining worms (undoubtedly the vast majority of your population) will replace the lost worms quite quickly once they are settled into a new home.

By the way, if you happen to have a vermicompost that's dry enough (and with good texture) for screening, you might try to see if you can screen out cocoons with 1/8” or 1/16” mesh (good idea to start with 1/4” to get most of the bulky stuff). You will undoubtedly still end up with a fair amount of other material as well, but if you have loads of cocoons in the mix, perhaps this won’t be something you'll be overly concerned with.

**Vermicompost**

*What's so great about vermicomposts? How are they different from normal composts?*

As touched on early in the manual, good quality worm compost will have a very high percentage of worm castings (aka “worm poop”) in it. This is quite a different material from “normal” compost. The passage of the waste materials through the earthworm gut seems to result in an end product with some pretty unique attributes. What does make it
similar to other composts is the fact that it is humus-rich, and stabilized – so it offers great water and nutrient holding properties and general soil-conditioning abilities.

It differs in that it seems to contain various potent growth promoting compounds, such as plant growth hormones and humic acids, not typically found in normal composts (or perhaps not in the same abundance anyway). Academic research has shown that vermicomposts can very often offer more plant-growth-promoting ability than other composts, and can be very effective even when relatively small amounts are used.

People often think of composts as “fertilizers”, but if you compare the nutrient profile (“NPK” etc) to many inorganic fertilizer mixes (available in stores) they actually tend to be a lot lower. What's really important to remember is the fact that they offer a LOT more than just nutrients. Apart from the properties mentioned above, vermicomposts contain a rich community of beneficial microbes – these can help to make certain nutrients more readily available to plants, and the microbial biomass itself can serve as an important long-term nutrient reserve (as the microbes die they will release nutrients). As RWC “Worm Friend”, Allison Jack (Cornell researcher), has discovered, vermicomposts can also help to protect plants from diseases.

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**What is the best way to store my vermicompost? How long with it be good for?**

Vermicomposts should be fairly dry before being stored for any length of time. You definitely shouldn't be able to squeeze any moisture out of it, but at the same time, it definitely shouldn't be bone dry either. We want to keep the “beneficial microbes” alive and well for as long as possible. As the material dries, many of them will likely go into some sort of resting stage, thus helping to ensure that there will still be some potency for quite some time. Still, it is inevitable that the material is going to gradually lose some of its microbial oomph as it sits, so it's not a bad idea to use it within a few months if at all possible. Again, proper storage will definitely help to extend the “life” of the material.

Once the material is “fairly dry”, my recommendation is to store it in a plastic container with some ventilation – it doesn't need to be as well ventilated as a worm bin, but you don't want it hermetically sealed either! I don't recommend keeping vermicompost in plastic bags for
any length of time, *unless* you add a lot of small air holes in the sides (or it is rendered “breathable” in some other manner).

I definitely wouldn’t recommend leaving your worm compost to sit outdoors for any length of time (a coolish, indoor location is likely your best bet if possible) since rainfall and sunlight will more than likely take a toll on the material fairly quickly. If you must keep the vermicompost outside, I recommend at least putting a tarp over it or putting it in some sort of (ventilated) storage bin.

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**Is it ok if my vermicompost freezes?**

This almost certainly “depends” on the type of freezing we are talking about. I suspect that if your vermicompost is sitting someplace that’s reasonably well protected (in a bin in your garage/shed for example) and the temps gradually drop over time, the vermicompost will likely remain in pretty good shape. Most of the microbes will likely enter a resting state that should be able to withstand some freezing, so once the material thaws again the microbial community should bounce back.

If, on the other hand, your vermicompost is much more exposed and very cold weather blows in quickly, it may have more of a damaging effect on the material. I’m sure it will still have plenty of beneficial properties – it just might not quite as potent once it thaws out again.

Keep in mind, this is all speculation – I have not tested this out, or come across any references to it in the literature.

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**What’s the best way to use vermicompost?**

I tend to think in terms of different “grades” of vermicompost, and will use different grades for different jobs. Coarse grade material – vermicompost that may contain a lower percentage of worm castings, and has not been screened at all – can be used in a similar manner to most other “composts” (assuming you have enough of it). It’s great to use in your planting holes, around the base of your plants, and even as a top dressing in your garden in general. I very often don’t even worry about separating out the worms from it, and tend to use it for creating various “vermi-gardening” systems since it still has some decent food/habitat value, and of course can be a great way to stock a system with worms.
Be sure to check out these blog posts if you want to get a better idea of what I'm talking about here:
The Vermi-Mulch Bean Garden
In the Night Garden

The more a given vermicompost mix has been processed (by the worms), screened etc – essentially, the higher the percentage of worm castings in it – the less I will tend to use. Vermicompost that is almost pure worm castings can be used very sparingly, yet with excellent results. In fact, according to research (and my own findings) using high-grade vermicompost (which you could just as easily call “worm castings”) as a container mix on its own can actually sometimes impede plant growth! My recommendation is to add a small scoopful in your planting holes and in soil mixes for your potted plants and/or a small amount around the base of the plant.

Vermicomost Tea

*I don’t have any “worm tea” dripping out of my bin. Am I doing something wrong?*

Stacking worm bin manufacturers and marketers seem to have done a bang up job of confusing a lot of people about what “worm tea” is, and how it's made. As such, many new owners of these systems end up with the expectation that some sort of magical elixir of plant perfection is going to come pouring out when they turn the spigot on their reservoir for the first time. Unfortunately, this just isn't the case. As touched on at the beginning of the guide, the liquid that comes out the bottom of a worm bin is more accurately referred to as “leachate”, but the name is irrelevant – the key here is that it's definitely NOT the same thing as really good quality “worm compost tea”. The “real deal” is made by soaking high quality (stabilized) vermicompost in water (generally aerated), with perhaps some other beneficial ingredients (often “microbe foods”) mixed in as well. As such, I guess you *COULD* say that the older the system, and the longer it's been left without adding new food, the closer the drainage liquid will be to actual worm compost tea. This is why I would never say that all leachate is “bad”. Even liquids drained from a newer system could certainly be used (although I'd recommend using them in your garden, rather than on potted plants).
Getting back to the question of why there is no liquid draining – in all honesty, there is nothing wrong with this scenario, assuming the worm habitat/food zone is nice and moist. In well ventilated systems it isn’t uncommon for there not to be any drainage, so this certainly isn’t something to be concerned about.

Again, if you DO end up with some liquid in your reservoir during the vermicomposting process, feel free to put it to good use (mix with some rainwater and use it out in your garden), but if you want some really top notch “tea”, focus more on first producing some top notch worm compost in your bin!

How do I make a “good” vermicompost tea?

Let me point out right off the bat that I am certainly not a vermicompost tea expert. I keep meaning to get more serious about it each year, and then end up dabbling at most. SO, I really don’t know all the ins and outs of making a really good brew. Likely the easiest way to make a very basic vermicompost tea is to simply fill a cloth bag with vermicompost then dunk it repeatedly in a bucket of water, as I wrote about in this post: http://www.redwormcomposting.com/gardening/quick-and-dirty-worm-tea/

If you are looking for something a wee bit more refined, you might make yourself a simple tea “brewer” using a 5 gallon pail and an aquarium air pump: http://www.redwormcomposting.com/worm-tea/making-vermicompost-tea/

While there are certainly lots of “recipes” etc, when it comes down to it, making a decent vermicompost tea is not “rocket science”. Start simple, stick to the fundamentals and you should be just fine!

How can I store vermicompost tea?

Generally, the recommendation is to use worm compost tea fairly soon after you finish brewing it, so I’m not sure I would really recommend “storing” it at all. It does however depend on how you make it. I suspect that if you take the ultra low-tech “dunking” approach mentioned a minute ago, you will end up with a liquid that should be ok in a jug/bucket etc for some time (assuming you don't add anything
to it, and assuming the vermicompost was already well stabilized). The potential problem here lies in the fact that a liquid that's loaded with aerobic microbes and then allowed to go anaerobic (won't take long once aeration is shut off) will invariably end up becoming pretty foul – especially if you've added a bunch of “microbe food” (molasses etc) as well. It's the same idea as what takes place in the bottom of a sealed plastic worm bin.

There are still definitely some “mysteries” (for me anyway) with this topic though. How does a company like Terracycle bottle their tea with no issues (undoubtedly other examples as well)? I also have a good worm friend who tells me she has left vermicompost tea in bottles for literally years and it's still been great to use!

Anyway – this is certainly something I want to look into in more detail!

What are the best ways to use vermicompost tea?

One of the great things about vermicompost tea that sets it apart from the actual vermicompost is the fact that you can apply it as a foliar spray, so this is definitely a great way to use it. The has been academic research demonstrating that this practices can help to ward off foliar diseases, and of course – like vermicompost – the tea also has some great plant growth promoting properties as well.

Another common approach is the basic “soil drench”. Simply pour tea into the ground at the base of your plants to help promote growth and encourage the development of a rich community of beneficial microbes in the root zone of your plants.

Miscellaneous

I am going away on holidays. Should I add a bunch of food before I go so my worms don't starve?

Definitely NOT! I suspect that a lot of vermicomposters end up losing their “worm herd” by doing exactly that. Remember, it is a LOT easier to kill our worms via overfeeding than it is to starve them! If you add a
heap of food waste in an attempt to leave your worms with “enough” to tide them over while you are gone, there is a decent chance that a lot of this material will break down at the same time, potentially creating some pretty nasty conditions – especially if you are using some type of enclosed plastic bin system.

I've literally set up bins then left them to sit for weeks and even months. Invariably, when I finally do open them up I find a thriving population of worms and a lot of well-processed material. I should point out, however, that a well-ventilated system – especially one sitting outdoors in hot, dry weather – is a different kettle of fish. Moisture loss from well-ventilated systems (open systems, wooden bins etc) is definitely more of a concern while you are off on holidays than lack of food. If you can't get someone to come and check on the system (and add water as needed), my recommendation is to: 1) add some very resistant, but still water-rich, materials like carrots, potatoes, cauliflower (all uncooked, and split once), 2) make sure you have some really absorbent bedding materials like coir, aged manure (with bedding) etc incorporated, and 3) add LOTS of bedding at the top of the system to help keep moisture in. Again, this is ONLY for systems with a lot of ventilation/drainage that tend to dry out fairly quickly – NOT for enclosed plastic bin systems!

For the plastic bin folks, my recommendation would be to simply add more bedding materials, and perhaps a few semi-resistant “food” materials (assuming you don't already have a fair amount of food in the bin). It's definitely better to err on the side of caution here!

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*I went away on holidays and returned to discover that my worms are all gone? What happened?*

One thing that can happen (as discussed in previous response) is that concerned vermicomposters can add a lot of food to their system before going away, resulting in a worm bin “meltdown” (likely a matter of days after you leave) - everything rots all at once, and there isn't enough ventilation/drainage/buffer-zone to protect the worms. The evidence of such events tends to disappear rather quickly (especially the worms), making it seem as though they have vanished.

A variety of things can happen with outdoor systems. Heat is one very common culprit – primarily during the summer, but also when using larger systems. The combination of overfeeding AND heat can be even more deadly – since the warmth serves to accelerate microbial activity
(which quickly depletes oxygen, and can result in the release of various nasty compounds such as ammonia), and of course the “evidence“ can disappear even more quickly as well.

Solar heat (and just summer heat in general) can create issues as well, even if you haven’t added a bunch of food. If temps in the system are creeping over the 35 C (95 F) mark, there is a decent chance that Red Worms and Euros will start to die off (especially if there are any other harmful things going on at the same time). Well ventilated systems that remain at least somewhat moist will definitely remain quite a bit cooler than any sort of plastic system – definitely keep this in mind if you are keeping your bin outdoors!

Was there a cold snap while you were away on vacation? Perhaps this could be the culprit – especially if you are using one of the tropical species (in an outdoor system).

In all honesty, other factors – such as predation – aren’t nearly as likely to wipe out an entire system in a short period of time. Unless you happen to live in a warmer region and your outdoor system happens to get invaded by predatory flatworms while you are away.

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**I am moving and would like to take my worms with me. Are there any special methods for preparing the worms for travel?**

If you already have a “bin“ type of system set up (hopefully it’s been up and running for long enough that the worms are nicely settled in), you don’t have to do a whole lot. Again, unlike with your children and pets, I DON’T recommend loading up your worms with lots of snacks for the ride (haha). Lots of bedding and perhaps a few new food items (preferably more resistant materials) will be your best bet. A couple “rules for the road“ would be: 1) don’t put your worm bin in the trunk of the car – keep it out in full light if at all possible, 2) try to prop it up on some padding (blankets, towels etc) so as to reduce some of the harsh vibrations produced by your moving vehicle (speaking of which – the worms should go with YOU, not the movers), and 3) don’t leave your worms in the car for extended periods during warm/hot weather!

If you have larger systems that can’t easily be transported (or at least not with the worm population still inside), you simply need to decide what you are going to attempt to move. If you want enough worms to get started in your new location, perhaps you will just fill some bins with worm-rich material and take those with you. If on the other hand
you actually have a worm farming business, obviously you are going to want to put more focus on moving as much as you can (perhaps dedicating an entire moving truck to the task). The things to keep in mind will always be the same:

- don't overfeed before the trip
- make sure there is good ventilation and lots of bedding
- add padding to reduce harsh vibrations
- don't leave worms to sit in vehicle during hot/freezing weather
- try not to put the travel containers in a dark location – if you are using a moving van perhaps you can set up some sort of battery-operated light in the back.
- Appendix A -

References


- Appendix B -

**Recommended Reading**


*Casting Call*. 10 volumes of back issues available from [Vermico](#). Great for learning about the worm composting industry and vermicomposting science.

*Worm Digest –* Issues 1-36. Along with *Casting Call*, the original Worm Digest publication was one of the most important educational resources for me, especially early on. Unfortunately the back issues are very expensive now (new ownership) – but still likely worth the price if you want to learn more about vermicomposting, and those involved in the industry (past and present).
- Appendix C -

**Recommended Online Resources**

Red Worm Composting (yeah, baby – yeaaaaah!!)

Vermicomposters Forum

Worm Digest

Cornell Vermicompost
[http://cwmi.css.cornell.edu/vermicompost.htm](http://cwmi.css.cornell.edu/vermicompost.htm)

Ohio State University Soil Ecology Lab
[http://www.biosci.ohio-state.edu/~soilecol/index.htm](http://www.biosci.ohio-state.edu/~soilecol/index.htm)

Soil Foodweb

Gardenweb Vermicomposting Forum