The Miracle Farm Blueprint

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Introduction

A crisis of epic proportions is on its way. I don't say this to frighten you or turn you into an eccentric survivalist. I tell you this because many experts agree that some sort of mainstream crisis is inevitable. Whether it is caused by a political shakeup, cataclysmic event, natural disaster, war, pandemic, or an economic explosion, no one really knows. What we do know is that history has experienced, time and time again, the kind of crisis that disrupts routine life, forcing everyone involved to completely change the way they think and live.

It has been a long time since this kind of crisis has occurred, which is making a lot of people edgy. After all, how long can we go without this kind of natural upheaval?

If what the experts tout is true, then what can you and I do to ensure that we are ready to handle whatever comes our way? One of the most important things we will have to handle is providing food for our families.

When a large-scale crisis occurs, lootings, scavenging, and violence become commonplace. Even so, the food supply is going to run out and unless you know how to replenish your own supply, you and your loved ones are going to go hungry.

Practicing Vermiponics can help you grow your own food, regardless of available space, ground contamination,

knowledge, and more. It doesn't matter whether you live in the middle of a big city or have acres of sprawling farmland to cultivate, vermiponics gives everyone what they need to grow the basics.

What Is Vermiponics?

What would you do if food was in short supply and you either didn't live in an area with enough ground to grow a garden, or the soil had been rendered useless with contamination? You would have to find another way to grow the plants and food you need. Vermiponics offers a way to grow plants without traditional soil. Instead of dirt, it uses worms (and their waste) to grow plants, thus offering a new way to farm without the need for large tracts of suitable land.

Vermiponics is a relatively new practice and the name was coined by an Australian research team who discovered a new way to grow food. Integrating vermiculture and hydroponics into various designs, the researchers learned how to use worm waste to fertilize vegetables in a safe manner. Using this new fertilizing method, they then began growing vegetable plants vertically in windowsills and along walls in order to conserve space. The results have been astounding.

Seeing the benefits of using vermiponics in a crisis situation, survivalists began touting its results, going out and teaching the concepts and methodologies throughout the world. Using this method of farming, just about anyone can produce enough food for themselves and their family.

Being able to completely produce enough sustainable food in a crisis could mean the difference between eating and starving. As we've seen, based on past experiences throughout the world (Niger 2005 & Sahel 2010), an entire civilization can be thrust into chaos when food becomes scarce. Don't be one of the millions stuck looking for food when there is none. Prepare yourself now to become self-sufficient and feed your family.

Whether you are an advanced survivalist, or have just recently begun to understand the importance of learning what to do in a disaster situations, you can learn a lot about the Vermiponic strategies outlined in this book. Here are just a few things that you will discover:

- how to choose the best worms, fish, and plants for your own vermiponics food growing system
- why vermiponics is a healthier way to grow vegetables
- the easy way to build a completer vermiponics system
- how to maintain your new vermiponics system, no matter the climates or conditions

Why Vermiponics?

Freeze dried food is great in an emergency, but when that short-term emergency turns into a long-term problem, you are going to need more than freeze-dried meals to stay healthy.

Vermiponics offers a simple growing system designed to give you the nutrients you need. The body thrives on Phytonutrients, antioxidants, and amino acids under normal conditions. But when under the kind of extreme stress a crisis situation will cause, these important nutrients are going to be even more important to keep you healthy.

What Are Phytochemicals?

Phytochemicals are special disease fighters found in green plants. They work by protecting cells and inhibiting their destruction from disease. There are three types of Phytochemicals that can be found in green plants and vegetables:

- Isoflavones : which work to balance hormones
- Indoles: these stimulate enzymes, which helps to fight disease
- Allicin: offers a potent anti-bacterial effect for the skin

What Are Antioxidants?

Similar to Phytochemicals in many respects, antioxidants not only help to prevent damage to the body from dangerous free radicals, but they can also help the body repair itself. The most common antioxidant that can be grown using vermiponics includes:

- **Vitamin A and Carotenoids**
  Carrots, squash, broccoli, sweet potatoes, tomatoes, kale, collards
- **Vitamin C**
  green peppers, broccoli, green leafy vegetables, strawberries, and tomatoes
- **Vitamin E**
  green leafy vegetables

What Are Amino Acids?

Amino acids are the body's building blocks. Unable to function properly without these important protein builders, amino acids cannot be produced by the body, but rather, must be consumed. If food is in short supply, the odds of getting enough amino acids are slim – unless you can grow the types of foods you will need to supply these important nutrients. Although meat is the best source of most amino acids, soy is a complete protein, offering many of the same amino acids levels as animal products. Fresh green plants also offer good levels of amino acids.

Disruption in Food Supply

There are a lot of things that could disrupt the food supply: inflation, rising energy costs (which limit transportation), labor system breakdowns, fertilizer, and water and fuel scarcities. As the world's governments become more and more unstable, it is becoming increasingly clear that sooner or later our food supply may be hindered. This will cause a spike in prices that few normal folks will be able to handle.

The fact is that no matter what else is happening in the world, we all need to eat; and being prepared to grow your own nutritious plants is going to give you an edge over everyone else when turmoil hits.

Flavor and Quality

Not everyone is interested in vermiponics solely as a way to prepare for a future disaster. Some are looking at this unique growing system simply because it offers a higher quality(and more nutritious) plant and a better tasting food. If needed during a crisis, the flavors vermiponics offers will help make mealtimes more enjoyable for those using the system. Survival isn't just about staying alive; it's also about enjoying the life you have.

The Psychological Aspect of Vermiponics

A lesser considered (yet just as important) aspect of vermiponics is the psychological benefits offered its users. Research shows that people exposed to plants enjoy a happier, more fulfilled and stress free life. What more could you ask for during a major crisis? Being able to grow your own plants can ease your worries about finding food, as well as give you the psychological benefits experienced through gardening.

How Vermiponics Works

Vermiponics combines hydroponic gardening (growing pants without soil), aquaponics (fish farming), and vermicomposting (worm composting).While each of these growing methods is useful, each can be hard to handle, or impossible under certain circumstances. This is why vermiponics is becoming so popular: it takes the best from

each of these methods and combines it into one simple method that can be used virtually anywhere, no matter what environmental conditions you face.

Aquaponics

Aquaponics — including the flood and drain method — is a good and useful way of growing nutrient-rich foods. The problem is that the system relies on using fish as fertilizer. This can cause several problems: you have to know a lot about rearing fish, you can only grow plants for part of the year, and you have to find somewhere to maintain or store your plants during the off season.

If these restrictions are too debilitating, what can you do? Use vermiponics! Vermiponics is a superior method over Aquaponics for several reasons:

- it uses the castings from red wiggler worms as the main fertilizer
- it is a self-sustaining eco-system
- it requires less set-up
- it uses less water
- it is less work and needs less maintenance

Still not convinced that a worm-based growing system can do the job as well as a fish-based one? Let's compare the two:

How an Aquaponics System Works:

An Aquaponics system is pretty simple. Comprised of a fish tank, pump, and gravel bed, the waste from the fish living in the tank is recycled as the plants remove it from the water. This is done when:

- the water is circulated, capturing the waste within the plant's roots
- the bacteria in the roots break down the waste
- the plants remove any nutrients the bacteria secrete during the process

Not only does the entire process clean the water, but it feeds the plants high levels of nutrients that will be stored there until consumed by you.

Fish waste contains a lot of important nutrients like nitrogen, potassium, phosphorous, and ammonia. While a fish-backed aquaponics system works well to grow nutritious plants, vermiponics does offer some real benefits too. Before we discuss them, let's take a quick look at how it works.

Ina vermiponics system, you provide a food source in the form of animal manure or vegetable castings that the heterotrophic bacteria can convert into ammonia. This is then converted into nitrates by autotrophic bacteria. The worms in the system then eat this bacterium to create the vitamins and minerals the plants need to grow.

Once mineralized, the water in the tank is then used to flood and drain the grow beds. This type of irrigation helps to better distribute the nutrients. With an ebb and flow action of the water, the worms, plants, and bacteria thrive.

Why is Vermiponics Better than Soil Based Gardening?

Conventional gardening is good, but may not offer the best results in a crisis. Vermiponics is better for several reasons:

Vermiponics is more efficient. Vermiponics uses just one-tenth the water of a conventional garden. This is good news during a situation where water becomes scarce or in an environment prone to drought.

It also allows you to store your water within a system that is actually working for you.

Vermiponics is less strenuous. Vermiponics systems require a lot less back breaking effort. There is no weeding, soil prep, or even back-bending harvesting required.

Vermiponics is more flexible. Not all gardens can be planted indoors and outdoors: from hanging planters or on the ground containers, underground or on roof tops.

Vermiponics gardens can. They can be placed in the tightest of spots or even within an empty closet if needed. Anywhere in any condition is the rule of vermiponics gardening.

Vermiponics is eco-friendly. There are quite a few ecological benefits to vermiponics gardening.

It doesn't leech nutrients. Soil based gardens lose nutrients on a regular basis from over gardening, runoff, weeds, and even the wind. With vermiponics, all of the nutrients get sucked up by the plants, giving you a better food supply.

Vermiponic Systems Are Better Producers. On average, a vermiponics growing system will produce two to three times more plants per square foot than any other method of gardening. This is accomplished through better spacing, a lack of weeds, and more nutrition.

Before You Start, Consider Safety!

Vermiponics systems take some time to set up and get running. Plus, there are some safety concerns that need to be addressed. Before building your system, think about ways

you can make your system as safe as possible. Here are some basic dangers to consider:

Drowning
If you have children that will be around your system, be sure to install screens or racks on the top to keep little people from falling in. Animals too can drown in these systems if not supervised properly.

Electrocution
Electricity and water never mix well. Here are some tips to alleviate the danger of electrocution:

- use GFCI (ground fault interceptor outlets) only
- make sure all of your equipment is rated sufficiently
- use only submersible pumps
- keep your system away from outlets if possible

Labor
The one drawback to a vermiponics system is how heavy it can be. By replacing standard soil with gravel and rock, the weight of the system is increased, making it harder to lift. To keep injury at bay, always lift with your legs (not your back) and consider using raised beds that won't need as much bending to maintain and harvest.

Tank Breakage
Be sure to support your tanks well as you build them. That way you won't have to worry about them falling or splitting during use.

Toxic Substances

In most cases you will use an intermediate bulk container (IBC) for your system. This is because they are big, sturdy, and cheap. The problem is that some of them aren't safe. Depending on what has been stored in them before, you could introduce chemicals or pesticides into your system that can make it toxic to your fish, worms, and even you. To make sure this doesn't happen, only use tanks that you know contained food items previously.

The Magic Ingredients: Worms!

A vermiponics system requires worms. But what kind? Red wigglers are considered the best. Not only do they reproduce more easily than standard earthworms, red wigglers help to enrich the soil more with abundance of nutrients.

Another benefit of red wigglers is their ability to endure all sorts of temperatures and conditions. They also thrive in enclosed spaces and even indoor environments.

European Nightcrawlers work well, too. You can fill your beds with mature worms, young ones, or even eggs that are ready to hatch.

When choosing worms for your vermiponics system, be sure to look for ones that decompose well, reproduce easily (and quickly), are easy to find, and are cheap to buy.

Vermicomposting

What is vermicomposting? Simply put, it is the production of organic matter that comes from worms. Containing the nutrients, conditioning, and fertilizer your bed needs to grow the best plants, vermicomposting ensures your soil (or gravel) is ready for planting.

Properties
Full of microbial life, vermicomposting helps nutrients break down in the soil so that plants can use them. One of the most beneficial components of vermicomposting is the mucus left behind by the worm castings.

Able to hold moisture better than regular soil, the mucus creates a nutrient-rich soil that is great at growing plants from fruit and seed pits.

Other seeds that grow quickly in vermicompost include veggies like tomatoes and eggplant.

Soil containing vermicompost has many benefits:

- it is better enriched
- it can hold more plants
- it encourages stronger roots
- it enhances plant structures
- it looks better

When building your vermiponics system, always be sure to keep your bedding moist. Keep it out of the direct sun and add waste a few times each week. Always be sure the worms have consumed all of their food before adding more.

Feeding Your Worms

When making food for your worms, you will want to mix scarps that contain both carbohydrates and nitrogen. Be wary of using too many food scraps that are void of protein. This will lower the nitrogen levels in your system.

That said, there are plenty of different food scraps that can be used to feed your worms, Just stay away from animal matter – it contains contaminants that are poisonous to worms!

Instead, opt for adding some of these to your compost:

- paper filters
- shredded paper
- vegetable peels
- fruit peels (no citrus)
- tea bags

- coffee grounds

Since the microorganisms in the compost will soften your new additions, grinding isn't necessary. However, if you chop your food scraps and other items into smaller pieces the entire process will take less time. Also try and keep the mixture moist with purified water if you use a lot of food items that mold.

When choosing what food scraps to feed your worms, keep these important things in mind:

- worms do not thrive with too much protein so stay away from beans and other high-protein scraps
- keep food waste low. Too much isn't good for your worms
- avoid feeding your worms grains
- prepared foodstuffs should also be avoided
- use plenty of fruit and vegetable matter in your worm bed
- stir mixture regularly to give your worms enough oxygen
- use bedding to dry overly moist mixtures
- add some carrot tops and tomato leaves to your mixture regularly
- adding a bit of garden soil to your mixture will help your worms better digest their food.
- never use grass clippings in your food mixture (it may contain pesticides)
- never add fat to your worms' food (this can suffocate them)
- avoid species and salt-laden food scraps
- Keep acidic and starchy foods to a minimum in your food mixture

Two Ways to Feed Your Worms

There are two main ways to feed your worm bin. They are:

Top Feeding: top feeding contains one layer of organic feed matter on top of a layer of bedding with another layer of food scraps added to it.

Pocket Feeding: pocket feeding uses a top layer of bedding on top of the food. When using this feeding procedure, the food is never buried in the same place. Instead, it gets rotated so that the food decomposes in the pockets where the worms have already been fed. When the top layer of bedding is empty, then more food is added.

You can use these two feeding methods separately, but for the best compost, it is best to use them simultaneously.

There are a few things to be wary about when it comes to feeding your worms. For one, always keep a fresh layer of bedding over the food scraps. Failing to do this will invite a swarm of flies to the area!

Also, overfeeding your worms will result in a nasty smell coming from your worm bed. This of course will lead to bugs, and rodents infesting it. Be sure to feed your worms in moderation to avoid this problem and always use small morsels of scraps to make the composting process faster.

There is no need to feed your worms daily. In most cases once or twice a week is enough. If there is still food in the bin then don't feed them again until the food is completely gone.

One thing to keep in mind though: worms reproduce every few months. When new worms appear you may have to boost your feeding amounts to accommodate the fresh arrivals.

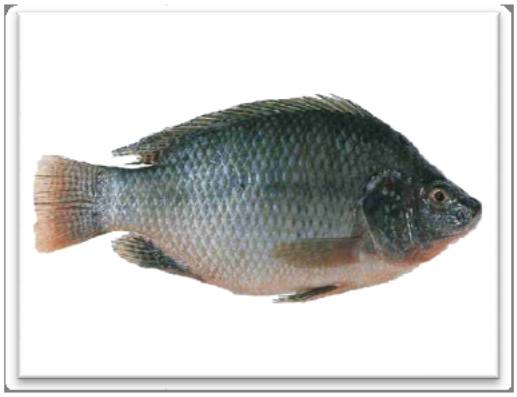
Feeding your worms properly is not only good for the worms, but it is good for you. The healthier your worms, the more nutrient castings they will provide and this is what makes your soil so good for growing.

The Fish

Worms aren't the only creatures you will need for your vermiponics system: you will also need some fish. When choosing fish, you will have a big decision to make: will you be using the fish solely for the benefits of your plants and worms, or will you be eating some of them too? The kind of fish you add to the system will depend a great deal on your answer to this question.

Not sure which fish will be best? Here are several varieties that can be used for either purpose:

Tilapia



A great eating fish, Tilapia are commonly found in shallow streams, ponds, lakes, and rivers. They feed on algae and other plant-based foods, which makes them easy to breed. They also grow fast, which is good for supplying your family with food. Although they can survive in poor water conditions, this breed of fish does need relatively warm water to thrive.

Trout

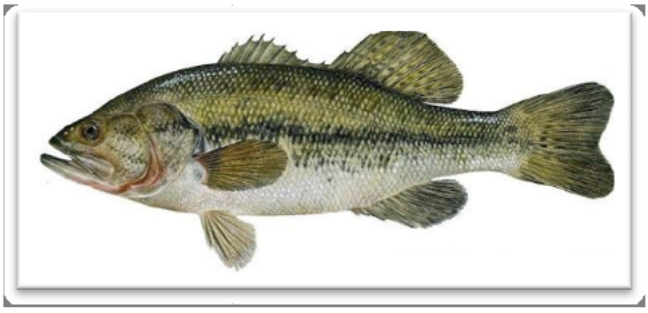
Another good eating fish, trout thrive in cooler temperatures (10-20 degrees Celsius) and offer great food conversion rates. Since they grow fast, they can be farmed

relatively easily, making them a good choice for vermiponics.

Carp

A type of fresh water fish that reproduces easily and can adapt to various environments, the Carp is a good choice for a dual vermiponics system.

Largemouth Bass



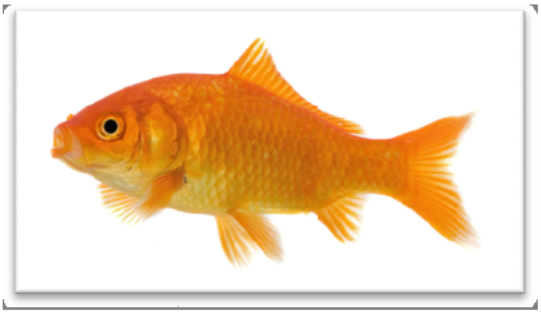
A great eating fish, the largemouth bass eats a varied diet and can be easily used in a vermiponics system if cared for properly. Finger lings are small and take longer to grow, but provide a lot more waste than older fish do. In a larger system, it is advisable to use both fingerlings and mature

bass so that your system gets the waste it needs and your family gets the food it needs.

Catfish

High in Vitamin D, this easy to manage fish offers a wonderful food conversion ratio and grows quickly. Since they can thrive in just about any environment and temperature (the only place they are not found is Antarctica), Catfish makes an excellent choice for a vermiponics systems.

Goldfish



Although not a good choice for eating, goldfish make an excellent choice for a vermiponics system that relies on them for nutrients. Although they need plant cover to breed in a tank environment, they do tend to make a lot of waste which is great for a vermiponics tank.

Koi

Part of the carp family, the koi is known for its beauty and is often used in decorative ponds. They thrive well in a Vermiponics system and are very resistant to common parasites, which allow them to live for a long time. They aren't however, good for human consumption.

Taking Care of Your Fish

Choosing the right fish for your tank isn't as easy as picking one that looks nice or that tastes good. You also have to consider what your system will be like. For instance, how warm or cold will the water be? How much oxygen can your

tank hold? And how clean will it be? New tanks are usually dirtier than systems that have been running awhile, so it's always good to start off with more tolerant fish first. Once your system is up and running for a few months, you can add new varieties if you like (just be sure different species get along).

When it comes to taking care of your fish, keep these important things in mind:

Water Quality
One of the most important aspects of keeping fish healthy is the quality of the water in which they live. If left unchecked, dangerous levels of ammonia can build up and this will kill off your fish. This can be averted by keeping the water well oxygenated. A good circulation system can help in this matter.

Temperature too, is very important. Check to see what temperature the type of fish you choose thrive at and be sure to use proper circulation and/or heaters to keep temperatures just right. A simple thermometer placed in the bed will let you know daily whether or not the water is too warm or too cold for your specific fish species.

Testing your water periodically (maybe once a week) is also a good idea, to make sure that toxic compounds are not building up. The most important things to check for are high levels of ammonia, nitrite, and nitrate. Your test kit will tell you what to do to equalize high levels.

Another simple test you can do is a quick eye test daily. Look for murky water. Cloudy water can signal a bacteria or algae growth.

Algae
Some fish species handle algae blooms quite well; others do not. Tilapia, goldfish, and carp all handle algae bursts well, but most other don't, so you will need to control algae if using these fish.

The simplest way to check for algae is to roll up a sheet of newspaper and stick it in the water. Keep lowering the page until you can't read the print any longer. How deep did it go? If it doesn't go very far, then you may have a problem.

The best way to cut algae in your system is to cut back on your fish food. Feeding your fish too much will increase algae growth.

Keeping fish healthy requires keeping a good handle on your water's temperature, ammonia, nitrite and nitrate levels, and keeping large growth under control. But there's one more thing: feeding your fish.

People have a lot of questions when it comes to feeding their fish. The biggest question most people have when it comes to feeding their fish is how much. The best way to determine if you are feeding your fish the proper amounts is to time them to see how long it takes them to eat all of the food provided. If it takes them more than 5 minutes to snatch it up, then you are feeding them too much. But, if they eat everything within 1-3 minutes, you likely could add a little more at mealtime.

Another important question you may have is how often to feed your fish. That really depends on their size and how many plants you have. Small fish need to be fed smaller amounts more frequently (several times a day) in order to make the amount of waste your plants need. Larger fish generally only need to be fed once or twice each day. In addition, if you have too many fish for your plants, you can reduce their food intake so that you don't get too much in the water. This too can cause some problems.

The type of fish food you use is also important to ensure that your plants grow well and contain the kind of nutrients you need. Commercial fish food works well since it is packed with just the right amount of protein, carbohydrates, fat, and minerals that your fish will need. Of course you will need to know whether your specific species is carnivorous or omnivorous, since they will need their food tailored to their special needs.

In the event you cannot get a hold of commercial fish food, or simply want to make your own, try these basic ingredients:

- Duckweed (is easy to grow and contains loads of protein)
- Worms (fish love them)
- Larvae

Keeping your fish well fed will allow them to make the waste necessary to grow nutritious plants. With the right care,

your fish can make your Vermiponic system yield more abundantly than you ever imagined.

Stocking Your Fish

Knowing how many fish your system can handle depends on a lot of factors:

- feed rates
- water flow
- oxygen levels
- the number of plants
- pumping rates
- fish species
- water temperature

Still, a good rule to go by is to keep about 10-12 fish for a standard 250L of grow bed media. Larger grow beds can accommodate more fish of course, while smaller ones need fewer. If you are using fingerlings, it will not look as if you have enough fish at first, but remember, those fish are going to grow! As they reproduce you can either expand your grow bed to accommodate more plants (and fish) or you can eat the excess fish!

When stocking your fish be sure to follow the breeders' recommendations for transport. Short distances usually aren't a problem, but if you must haul your fish for several hours, you may have to take precautions to ensure their safety.

Types of Veggies You Can Grow

Just about anything can grow in a Vermiponic environment, still, herbs and vegetables tend to grow the best. Tomatoes, beans, cucumbers, eggplant, basil, chives, and cilantro grow very well in a vermiponics system. Using media filled beds can give you more variety .Of course, the size of your bed also matters since some plants need more space to grow.

What about Root Crops?
Just because you are growing your garden in a bed of media instead of soil doesn't mean that have to forget root crops. Potatoes, carrots, and beetroot all do very well in a vermiponics grow bed.

What about Deficiencies?
Keeping your system full of the right minerals does take knowledge (and practice).Remember, it isn't just the water and bed you must protect; you also have to make sure that your fish, worms, bacteria, and plants all get the minerals they need so that you are eating absolutely the most nutritious food you can.

Keeping mineral levels right starts with your fish. Feeding them a high quality food that contains a good portion of minerals will ensure that their waste is also mineral rich.

Adding extracts to your system can also help, but unless you are very knowledgeable about these extracts, care should be taken to ensure you aren't putting in the wrong kinds or the wrong amounts. Seaweed extract is usually a good choice, since it contains many of the minerals that are commonly lacking in a Vermiponics system.

Can I Plant Seeds?

Of course you can! But there is a better way to plant your new beds. I recommend starting by sprinkling seeds over the top of the bed, and then adding seedlings. Be sure to wash off as much of the soil from seedling roots as possible and then plant them in your growing bed. They will grow quickly.

Meanwhile, the seeds you sprinkled on the top will fall between the gravel and begin to take root. Although they won't sprout until the seedlings have grown and died off, the seeds' root systems will be strong and once the canopy opens, they will grow strong, reaching maturity very quickly.

As you might have figured out, this is very similar to the way plants grow wild in nature. Scattered seeds take root, but are unable to grow amidst stronger plants, but once those older ones die, the new ones grow quickly.

What Are Growth Rates Like?

Plants grown in a Vermiponic system almost always grow faster and bigger than plants grown in normal soil conditions. The reason for this is simple: Vermiponic systems keep plants watered constantly despite weather conditions, which allows them to prosper in all climate conditions. With this in mind, it is no wonder that most plants growing in a vermiponics system have growth rates that are four times greater than other growing methods.

Some of the best plants to use in a Vermiponic system include:

- lettuce
- peas
- cucumber
- spinach
- onion
- tomato
- broccoli
- beets
- basil
- parsley
- watercress
- chilies
- chives
- celery
- snow peas
- egg plant
- cabbage

- coriander
- garlic
- sage
- lemongrass
- comfrey
- rock melons

Of course, depending on the type of system you make, other plants may do just as well. Be sure to consider the kinds of plants that will grow well in whatever Vermiponic system you create.

Plant Nutrients in Vermiponic Systems

The plants you grow are the most important thing in your vermiponics system. After all, the entire system is designed so that you can grow nutritious food without a lot of land. Still, few people actually understand much about plants – even the ones they grow. This lack of information can make it difficult to cultivate a good crop.
Misunderstanding plant nutrients can set your garden up for disease and pests. Worse yet, you may misdiagnose some problems, causing even more frustration and damage.

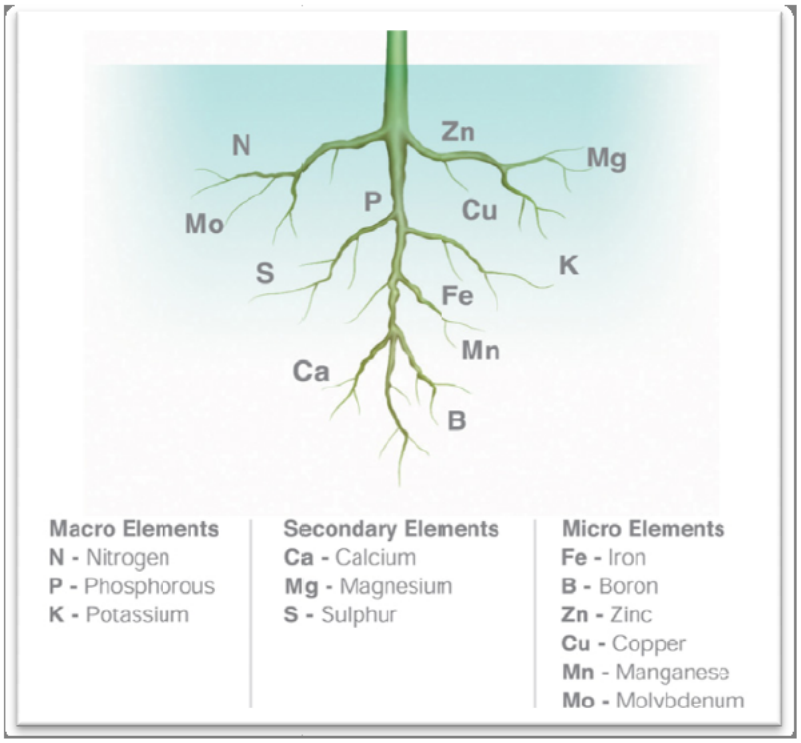
Why Plant Nutrients Matter in Vermiponics

Without the proper nutrients nothing can survive – not even plants. Without the right kind of nutrients the plants in your system can't grow, thrive, and reproduce. Nutrients help them grow strong and ward off pests and disease. They also

help to determine how well they will flower and how much (and how large) their fruits and vegetables will be. Sickly plants won't produce much food. More often than not, a plant that isn't growing is missing some vital nutrient. Even missing just one nutrient can send a plant into a tailspin.

So What Plant Nutrients matter Most?

All plants need 16 basic nutrients to survive (and thrive).Three of these nutrients (oxygen, hydrogen, carbon) are non-mineral, and the last 13 are minerals. Let's first talk about the mineral nutrients your plants need:



Carbon
A plant's structure is composed of carbon chains (with hydrogen attached) and water.

Water
The cells of plants aren't able to support themselves – they are too thin. Instead, plant cells use water to fill their cells and give them structure and strength. But that's not all a plant uses water for. Plants also have this great ability to break water down and use it for spare parts. Once the oxygen is removed from the water, the plant can use the hydrogen for all sorts of important things.

Mineral Nutrients
The 13 mineral nutrients plants need is what we most often use in fertilizers and plant foods. Soil naturally contains most of the nutrients a plant uses, but under certain circumstances those minerals can be stripped from the soil making it difficult to grow certain plants.

Vermiponic growers don't have to worry about minerals in soil but they do have to worry about the mineral content in their systems. Depending on the pH level in your system, some minerals may be present, but unavailable. This is because, the ph level may be too high or too low, and some minerals may harden, and then sink to the bottom of the tank. This makes it impossible for the plants in the system to soak it up. Iron is a good example of this. Almost always found in Vermiponic systems, it is rarely available to the plants thus causing problems.

This can all make it difficult for vermiponics growers to keep their plants happy. But, knowing what nutrients are necessary for good plant growth and how to make it available to your plants can help give your garden bed exactly what it needs to thrive.

Mineral plant nutrients are divided into three groups:

1. Primary Plant Nutrients

The primary nutrients are:

- Nitrogen N
- Phosphorous P
- Potassium K

In addition to these most consumed nutrients, they come in three concentrations (N, P,& K)

2. Secondary Plant Nutrients

The secondary nutrients are:

- Calcium(Ca)
- Magnesium(Mg)
- Sulfur(S)

These are the most commonly supplemented nutrients ina vermiponics system. Agricultural lime is a good way to add calcium and magnesium to your system.

3. Micronutrients

The micronutrients you need to be aware of are:

- Cooper (Cu)
- Zinc(Zn)
- Boron(B)
- Molybdenum(Mo)
- Iron(Fe)
- Manganese(Mn)
- Chloride(CI)

Iron is the most needed supplement in vermiponics. Copper is the least needed to supplement since it is often found in high concentrates in the feed, and zinc usually doesn't need to be supplemented because it is found in most fish foods so it finds its way into the system.

Other supplements you may want to consider include:

- a pinch of borax soap every nine months or so into your system (no more than that or the levels will be too high)
- Molybdenum: although low levels are required, most pants have what they need already. If you grow several generations of certain plants, you may need to supplement Molybdenum though since the plants will be void after awhile.
- Manganese: rarely a problem, you almost never have to add it to a vermiponics system.

Boosting Your New System

New vermiponics systems sometimes need a bit of a boost when it comes to getting the right levels of nutrients to make your plants grow. Seaweed Extract (Sesol, Maxicrop, kelp, or fish emulsion all work), can act as a good tonic for a new system, helping it establish the right level of bacteria.

Remember, a new system isn't operational right away. It takes time to build the bacteria and microbes that are needed to convert and release the right level of nutrients for your plants. This can take a few weeks. Think of vermiponics as a complete and balanced eco-system.

The main job of vermiponics is to supply enough beneficial bacteria so that ammonia produced by the fish and worms is converted properly. Be patient. Once the system has a chance to begin this process naturally, you'll be ready to add your plants and your garden will grow faster than you ever thought possible.

If you are worried about kick starting the nutrient cycle in your bed, don't. The worm juice that your worms will create will build up quickly and works well. However, to give your bed an even higher nutrient consistency, add just one capful of seaweed extract each day until you add new fish to your system. This will build up much more slowly in your system.

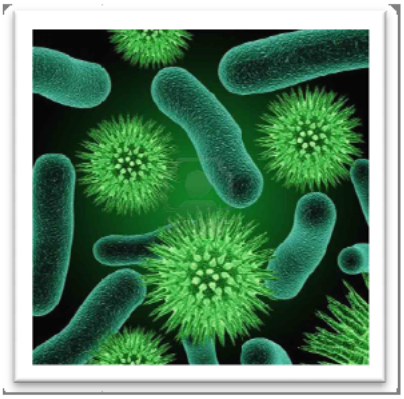
Other supplements you might want to consider are fish and kelp concentrate or sea sol, which should be applied every 3-4 months just to help keep your system working well. Always

add it at the grow bed water entry point so it gets flushed through the entire system properly.

If your pH level is over 7 then you may want to consider adding a half teaspoon of chelated iron to one or two of your grow beds every month. There's no need to add it to every bed since it will spread through the entire system over time. Remember: vermiponics systems run best when pH levels hover between 6.2 and 7. Anything higher and your plants may not be able to absorb all of the nutrients available.

The Nitrogen System

Most people think bacteria are bad. That's not always the case. Sure, some bacteria can be harmful and even make you sick, but sometimes bacteria can be good. This is the case when it comes to your vermiponics system. Bacteria are a main vermiponics component. It is what keeps the nitrogen cycle stable.



Ammonia can build up in your system simply by rotting food and fish excrement. This can have some detrimental effects on your fish including:

- tissue damage (especially to gills and kidneys)
- impaired growth
- an increase in disease and illness
- death

The good news is that if you have enough of the bacteria Notrosomonas sp in your system, it will eat the ammonia and convert it into nitrate, which is much less poisonous to your fish. Still, too much nitrite in the water can suffocate fish, so your system also needs other bacteria called Nitrobacter sp which eat the nitrite and turn it into nitrate which plants love to eat. Plus, nitrate is much less dangerous to either your system's fish or your worms.

In this system of conversion and filtration that will keep your vermiponics system working at peak capacity, the best way to establish a healthy nitrogen cycle is to make sure the good bacterium you need have the foods they require to grow in the right amount.

When setting up a fresh tank you will want to add bacteria when the pH levels get to 4. Healthy longstanding tanks won't need these supplements until their pH levels reach about 6.The healthiest tank for fish, worms, plants, and bacteria is around 7 to 7.4.

Starting a Vermiponics System with Bacteria

When starting a vermiponics system from scratch the first thing you need to do is feed your bacteria. This is done by adding pure ammonia (not the kind you find on supermarket shelves).

If you are lucky enough to know someone with an established system, see if they will give you some of their water to start your tank. That way you will have an established colony of bacteria to begin breeding in your system.

You can start the decomposition process by throwing in a dead fish or some shrimp. Also, peeing into your system a few times can also help build up ammonia levels and get bacteria to begin reproducing.

One of the hardest parts of getting your system up and running is setting up the nitrogen cycle. If you set it up when temperatures are warmer, it will take less time to get ready. Colder temperatures can cause bacterium to become dormant and this will keep your system from cycling for weeks. This will of course delay your ability to add plants and get growing.

The best way to determine if the cycle is complete is to use a test kit. Stay away from the ones with colored strips; they aren't reliable for vermiponics systems. I recommend the API Freshwater Master Test Kit that comes with small glass

vials that allow you to tests independently for ammonia, nitrites, nitrates, and pH.

You should notice some changes in your test kit after about a week of cycling. That is when the ammonia starts to rise, and the bacteria begin to convert it into nitrites. This will cause your nitrate readings to increase (this happens around week 2 or 3 of the cycle), followed by a good reading for nitrates. When this level is stable, you can begin adding plants to your system.

Be patient. Sometimes the entire cycle takes a few weeks, but if conditions are poor it can take a few months to get the bacteria levels stable enough to cycle through properly.

Balance is the key to a healthy vermiponics system. If you consistently have too high nitrate readings, you may have to remove a few fish or expand your beds. Older, more mature systems sometimes show low levels of nitrates. This is a good thing. It means that your plants are eating exactly what the worms and fish are excreting, keeping the entire system working in sync.

Where to Place Your Vermiponics System

When choosing a place for your vermiponics system, there are some important factors to consider:

- the level of the ground: you need a good piece of flat ground to build your system

- electricity availability: you will need a safe source of electricity that can handle your system pumps
- the ability to cover the system: a healthy vermiponics system must be kept covered both for your safety and the maintenance of the system

Ground Level
Your pumps are going to need to use gravity to work properly. While it is possible to build a system on as lope, it is not recommended.

Electricity
You will need a sustainable, safe, and reliable power outlet to hook up your pumps. Running extension cords is not only a safety hazard, but usually results in a loss of power from time to time, which can be detrimental to your entire system.

Coverings
Depending on the size and type of system you build, you may want to consider adding some sort of cover to keep rainwater from flooding it. Some people use a solid covering or even a roof. Take a look at your system to determine if a cover is needed to both keep it from flooding and for the safety of those living around it.

System Placement
There are several things to consider when scouting out a place to put your vermiponics system. Ground levels are one thing. While the pumps are horribly loud they do run non-

stop and should be kept away from bedroom windows or other areas of the home where they could become a nuisance. On the other hand, don't build your system next to your neighbors' house either or they may become disgruntled and annoyed by the constant racket.

Also, your system will need at least six hours of sunlight each day, so placing it along a south facing wall or inside of a greenhouse works well.

How Much Space Will My Vermiponics System Need?

One of the biggest questions people asked when determining the size of their vermiponics system is how big to make it. Well, that depends on how much space you have and how much food you intend to grow. A 264 gallon tank can support 50-80 fish or between 317 and 475 gallons of grow beds that are made to be at least1-2 inches deep. This size system will need about 200 square feet of space (or a 10 x 20 space).

Now think about the number and types of plants you want to grow to decide how big of a system you will need. Use the measurements above to get started, doubling or tripling the size as needed.

Vermiponics Shelters
Most personal systems do not require a shelter to protect them (unless of course this is your ONLY source of food).

Commercial systems, however, will require some sort of sheltering to protect your investment –and your income.

When designing your vermiponics shelter, here are some things to keep in mind:

- You will need a dark area for your fish and a lighted area for your worms and plants
- you cannot use any sort of insect control (pesticides) in your system, so you will have to create natural insect barriers to protect your plants
- water temperature is extremely important

When building your vermiponics system shelter, consider installing curtain sides that are shade cloth. This will keep out bugs while also allowing good air flow. Ina small system, you can use a manual winch. An electric winch will be needed for larger systems.

White or clear shades are always best because your plants need plenty of light. However, zip up shades may be necessary in regions where insects are plentiful. An air lock system can be added if needed.

Backup
Powering your pumps is essential to keep your fish from dying. Without the right amount of oxygen in the water, your fish can't last long. This means that even when the power goes out you must have some way to keep your pumps running so the water can circulate, oxygenating it.

Some people simply have battery powered generators or aerators on hand that can be hooked up if the power goes out. This is great, but unless you have them already ready and placed on automatic power backup, you will need to be home to do it manually.

Having a system that switches on automatically in the event of a power failure is always best. Most internal batteries last about 10 hours, which gives you time to find another solution should the power outage last longer.

Pests

Pests can cause all sorts of problems with your vermiponics systems, making your fish sick, killing your plants, and even killing your worms. Here are some of the most common pest problems you may encounter and what to do about them:

Caterpillars: apply Bacillus Thuringiensis to the system for control.

Sap Sucking Insects: chili and garlic sprays work well. But use in moderation!

Molds and fungus: spray potassium bicarbonate directly on affected plants.

Slugs: fill a saucer with beer and set near the system. The slugs will climb into the saucer and drown.

Thrips, aphids, and white flies: and colored sticky traps around the area.

Dealing with Deficiencies

If you take good care of your system, the odds are you won't have to supplement it much. One way to avoid mineral deficiencies is to add some seaweed extract once or twice a year. High in micronutrient and mineral levels, seaweed extract works to stabilize your overall system. Specific deficiencies (like iron or potassium) may need separate supplementation.

Indoor Vermiponics and Lighting

If you are short on outdoor space and instead want to build an indoor or greenhouse vermiponics system, you are going to have to figure out the lighting. This can be confusing to many people.

The first question you may have is: what is the difference between visible light and the light needed to grow plants?

Lighting
The sun is the absolute best light for growing plants. So, how do you give your plants the light it needs for photosynthesis when gardening indoors?

Photo synthetically Active Radiation (PAR) is made up of 400-700 nanometer wave lengths. This puts it just within the visible spectrum of 80-770 nm. This is seen as white light by the human eye, unless viewed through a prism when the entire spectrum of color (blue, green, yellow, orange, and red) can be seen.

Plants use the blue to red light as their energy source for photosynthesis.

What do the terms color temperature and lumen mean? Color temperature has nothing to do with how hot a lamp or bulb is. Rather, it signifies the whiteness of a piece of tungsten still heated to that temperature in Kelvin. For example, High pressure Sodium lamps (HPS) have a red color temperature of 2700 K, while Metal Halide (MH) has a blue coloring of 4200K.Daylight spectrum bulbs most closely replicate the sun at 6500K.

Lumen, on the other hand measures light output. It refers to the amount of light emitted by a single candle that falls on one square foot of surface located at the distance of one foot from the candle.

Although it was always believed that brighter lamps grew stronger plants, recent studies have shown that a lamp featuring a broader spectrum of color makes plants grow better.

What is HID Lighting?
An even brighter light is called High Intensity Discharge (HID). This is a more intense lighting system consisting of ballast (which acts like an engine),a reflector, socket, and bulb.

Although HIP light comes in four options (High pressure Sodium, Metal Hilade, Mercury Vapor, and Low pressure Sodium), the two most commonly used to grow plants are:

High Pressure Sodium (HPS)
Emitting a yellow, orange, red spectrum light, HPS lamps are ideal for plants that are flowering or fruiting. They also make a good supplement to natural light.

Metal Hilade (MH)
Perfect for growing plants, MH lamps are mostly used when natural light is limited or unavailable.

What is the difference between magnetic HID ballasts and electronic/digital HID ballasts?

The biggest differences between magnetic HID ballasts and electronic ballasts are the frequency output to the lamp and energy conversion from electricity to usable light. Magnetic

ballasts produce a frequency of 60 Hz. Electronic ballasts vary from manufacturer to manufacturer. The frequency produced can be 400 times that of magnetic ballast. Magnetic ones also produce more heat than their electric counterparts and are more efficient at converting electricity into usable light. The cost of running both is very similar.

What is the difference between HID fluorescent lighting with regard to plant growth?
In the past, seedlings, cuttings, and plants had low-level light requirements, so fluorescent lights worked well, while HID lights were only used for established plants and those that needed more intense lighting.

Recent advances in fluorescent lighting technology now give growers more options.T5 lighting is a good choice these days, offering high output with low heat and energy consumption.

What are the benefits of using T5 fluorescent lighting to grow plants?
T5 lamps provide the ideal spectrum for plant growth. Photosynthesis rates peak at 435 nm and 680 nm, a 6500K T5 lamp can output 435 nm to 615 nm. This wastes little light energy while promoting healthy plants. It also helps seedlings establish a strong root structure. This makes T5 lights a wonderful choice for starting seedlings.

It also allows the lights to be placed just 6-8 inches above the plant canopy, which increases photosynthesis responses.

What is the difference betweenT5's, T8's,T12's, and compact fluorescents?
You are probably familiar with these three fluorescent bulbs. They are long and rounded tubes that hang from the ceilings of most stores, warehouses, and even office buildings. The bigger the number associated with the T, the bigger the bulb. T12's are usually used in workshops while T8's are used in commercial settings. T 5"s are the standard for growing plants. The reason is, they can be used in bunches which intensifies the light.

Compact fluorescents called CFL's pack a maximum amount of T5 grow light tubing into a small space by bedding the tube. You can use lower watt CFL's in regular household outlets, but higher wattage bulbs will require specialized fixtures to be installed.

What are the advantages of LED lighting?
Light Emitting Diodes (LED) lights offer a more controlled light spectrum source, are very energy efficient, and last a long time.

What are the advantages of induction lights?
Offering many of the same benefits of LED lights, induction lighting is more efficient, lasts longer (they never have to be replaced), and comes with a good warranty. They also run cool and can convert 95% of the wattage that goes into them in PAR usable light. While they are more expensive than

other light sources, they are cheaper to run and can save you thousands over the long haul.

Why can't I use an incandescent bulb? Normal household bulbs simply aren't strong enough to grow plants well. They emit only 15 lumens per watt and are not efficient at all.

How much energy will my light use?
You can count on using about 25 watts per square foot of garden space, regardless of the type of plants being grown. Less light may be required for some plants (like lettuce), or if you are using your lights as a supplement in low natural light conditions.

Increasing your wattage can sometimes help plants grow faster, but making the bed too hot can cause problems too.

Also, light should only be used 12-18 hours per day – remember, plants need some darkness too!

How much will it cost?

The average lighting system will cost about $8-$20 per month, depending on your wattage and how long your lights run. To calculate your cost, multiply the bulb wattage by the number of operational hours and then divide by 1000.

This figure is the number of kilowatt hours of electricity used. Next check your power bill for a kw/hour costs and

multiply that cost by the number of kw/hours you expect to use.

How should I run my lights?
How long you should run your lights depends on what type of plants you are growing, what stage of growth they are in, and how much natural light may or may not be available.

For general purposes, most growers recommend 14-18 hours per day for the vegetative stage and 12 hours when plants are fruiting or flowering.

How high should I hang my lights?
Plants should never feel warm to the touch; this could cause burning. To see if your lights have been placed at the right level, hold your hand under them for several minutes. If it feels hot (or uncomfortable), the lights are too low. In most cases, the lights need to hang between 12-48 inches from the top of the largest plant. Remember that your plants will grow so consider their mature height when placing lights.

Low heat lights can be hung lower, but again, watch for warmness. If you think your plants need the intensity of a lower hung light you can always install an air-cooled reflector to diffuse the heat and keep your plants safe from scorching.

Here are some other tips to consider when installing growing lights:

- HID lights are hottest, so they need to be hung farther away from tender plants
- Adjust light as necessary as plants grow taller
- Higher watts emit more heat

How big an area will my lights cover?
You will determine your wattage needs by how big your garden is. Gardens that have no natural light source will need 1000 watts of HID lighting for about a 7 x 7 patch of growing bed. A 6 x6 bed will need about 600 watts and a 4 x 4 bed will need 400 watts.

Keep in mind that your entire garden may be larger, but this is how big your primary growing area is that will be lighted. Adhering fixtures in a way that overlaps light from different lamps can help cut down on phototropism.

Getting Started

What You'll Need:

Before we get to building your own Miracle Farm, you need to know exactly what you'll need. Regarding the parts of which a system can be made of, there are quite a lot of different options and it's really up to you to decide what you want to obtain for your "miracle farm". Another important aspect you should keep in mind is your budget.

The Tanks

A Vermiponics system can be made from just about anything that resembles a barrel .Barrels are one of the greatest, cheapest options you can go with when building your Vermiponics system. Usually barrels are made from strong plastics which can be very easily cut, drilled, or glued.

One of the best and widely used types of container for Vermiponics is the IBC. I**ntermediate bulk container** (**IBC**) or **IBC Tote** or **Pallet Tank**, is a reusable industrial container designed for the transport and storage of bulk liquid and granulate substances (e.g. chemicals, food ingredients, solvents, pharmaceuticals, etc.). IBCs have a volume range that is situated between drums and tanks, hence the term "intermediate“. The most common sizes are 1,040 liters / 275 U.S. gallons or 229 imperial gallons and 1,250 liters / 330 U.S. gallonsor275 imperial gallons (the 1040 liter IBCs are often listed as being 1000 liters). Usually people use the IBCs and the barrels together in different ways.

New IBCs are usually pretty expensive but you can easily find used IBCs for as low as $80.

When purchasing a used IBC you must ask the owner of the tank what the tank was used for. Stay away from IBC that held toxic substances; they can easily harm your fish and your plants and worms.

The same rules go for barrels or any other container you may find. Do your research before you start cutting, drilling, and building.

From recycled bathtubs to discarded Jacuzzis to even small pools…any other container that can be filled with water will do for your Vermiponics system.

Or if you want to take your project a step further, you can always build your own tank. You can do that by using some 2x4 to create a cube-like object. You can also use some plywood or OSB for the walls of the tank and some vinyl fiber for the inside of the tank.

You can build your own tank for very little money and the main advantage is you can decide the volume of the tank according to your needs.

Air Pumps and Water Pumps

Figuring out the kind of air or water pump to install in your system can be a challenge. With so many options on the market, even a seasoned pump expert may wonder which is best.

When looking for a good water pump, the first thing you must understand is that there really are only two major types: in-line and submersible pumps. Right now, submersible is best. Later on, when you have your system up and running well, you may want to switch over to an in-line pump, but you don't have to.

Submersible pumps have a casing that is filled with some sort of coolant (oil). This keeps the pump lubricated and cool. Some pumps actually use the water they sit in for this purpose.

In-line pumps, on the other hand, are air-cooled and sit outside of the water in the system. This requires an electric pump and hoses to continually pump water out of the system, through the pump, and back into the system. It is vital that this kind of pump stays dry at all times. Otherwise, they short out and can die. Larger systems usually do better with an in-line pump. However, I always recommend starting small until you understand how to care for your vermiponics system, so a submersible is a good pump to start with.
Every pump offers different advantages and disadvantages. When choosing your own pump, consider these important points:

- How many amps of electricity it will use
- The head high height
- How high the pump can pump water
- How much water the pump can move

- Whether or not you need aeration

Remember, higher height pump less water; while lower height pumps can handle a bigger volume. This makes a big difference depending on the size of your system.

Another thing to consider is how hefty your system is stocked with fish. If you are heavily stocked, you may need to install an air pump to help oxygenate the water. In most cases, though, natural aeration is enough.

One easy way to increase aeration in your subsystem is to install Venturi fittings, which allows the pump to suck in air as it pumps the water and spit it out with the outflow. This will let you aerate your system without the extra cost of installing an air pump too.

Now, if you decide to install a raft system (or any other system that requires an air pump), you'll have to choose which one. There are plenty of choices. From the tiniest half-amp blowers to several horsepower blowers, air pumps are easy to find and fairly cheap. I always recommend integrating the two pumps if possible for ease of use and simpler maintenance.

Airlift pumps are very energy efficient and work with low head heights. They work by blowing a bubble through the pipe and as it rises it carries water above it. By introducing bubbles quickly into the system, it pushes water to the top of the pipe.

Plumbing

As we stated earlier, the main principle of the system is moving water from one point to another. In order to do this, you'll need some plumbing parts. You'll need pipes, hoses, joints, and valves which will connect to or from the pumps in your system. You'll also need poly pipe and fittings that are cheap as chips, and can be purchased almost anywhere. Depending on your design you may also need irrigation grommets.

Another way to approach this system is by using the force of gravity instead of the pump for running water from one part of the system to the other.

For the flood and drain system you can either opt to build it yourself or you can buy a really cheap mini irrigation system. This comes with all of the parts needed including connectors and tubing.

The Media

Next up is the media.

There are different options out there you can use depending on your budget.

In order to create what is called a filtration system you'll basically need hydroton or if your budget doesn't allow anything similar to this type of media will work just as well. We have successfully used gravel or granite for our filtration system.

Compost

Another key ingredient for your Vermiponics system is your compost.

Usually compost can be found bagged and ready to use at your local gardening store.

4 types of compost are often found in stores.

Yard waste compost made from leaves and grass clippings has a light texture similar to peat moss, is usually inexpensive, and available in bags or may be even offered for free from municipal mulch piles. Some municipalities also deliver composted leaves by the load for a fee. Check with your city or county government to see if this service is available. Local Master Gardeners may also know where you can get free yard waste compost.

Composted manure may be made from cow, horse, or poultry manures that have been combined with sawdust, yard waste, or other high-carbon materials to create rich yet heavy-textured compost.

Mushroom compost starts out as a rich, hot compost made from straw and horse or cow manure or plant meals. Then, just as the compost cools down, it is inoculated with mushroom spawn and given just the right conditions to produce delicious button mushrooms. After the mushrooms fruit, the leftover soil is packaged and resold. Mushroom compost is often smelly when you first open the bag, but the odor goes away in a few days.

Vermicompost or worm castings are produced from manures, food wastes, paper, yard waste, or other bulky material. Under carefully controlled conditions, the ingredients are processed by millions of red worms, and their waste becomes vermicompost. Before it is sold,

vermicompost is usually mixed with high-quality soil to improve its texture and dilute its nutrients.

Another option is to make the compost yourself.

Expanded clay aggregate(pebbles)

You'll also need baked clay pellets. The clay pellets are inert, pH neutral, and do not contain any nutrient value.

The clay is formed into round pellets and fired in rotary kilns at 1,200 °C (2,190 °F). This causes the clay to expand, like popcorn, and become porous. It is light in weight, and does not compact over time. The shape of an individual pellet can be irregular or uniform depending on brand and manufacturing process. The manufacturers consider

expanded clay to be an ecologically sustainable and re-usable growing medium because of its ability to be cleaned and sterilized, typically by washing in solutions of white vinegar, chlorine bleach, or hydrogen peroxide (H2O2), and rinsing completely.

Tools

You're going to need a drill or an electrical screwdriver. You can either use a cordless drill or one with a cord. It doesn't make a difference.

You'll also need an angle grinder with a cutting disk, a hole saw, a jigsaw, a permanent marker, a tape measure, a½-

inchdrillbit,oraspadebit. Spade bits are a little bit easier to work with when using on IBCs.

You'll also need some tech screws.

Some other important stuff you need is protection equipment. Safety goggles and gloves are a must when it comes to cutting and other similar operations.

Building

Step 1 – Preparing the Tank

For our version of the Miracle Farm– Vermiponics system we have chosen to use an IBC container. This kind of design has the optimal dimensions to provide the necessary supply of fresh food for an average size family while also being easy to build and maintain.
The first thing to do is to drain any of the products out of the tank and wash it out thoroughly.

The next thing you should do is to separate the plastic container from the cage. In order to do that you must first remove the two top bars holding the plastic container in.

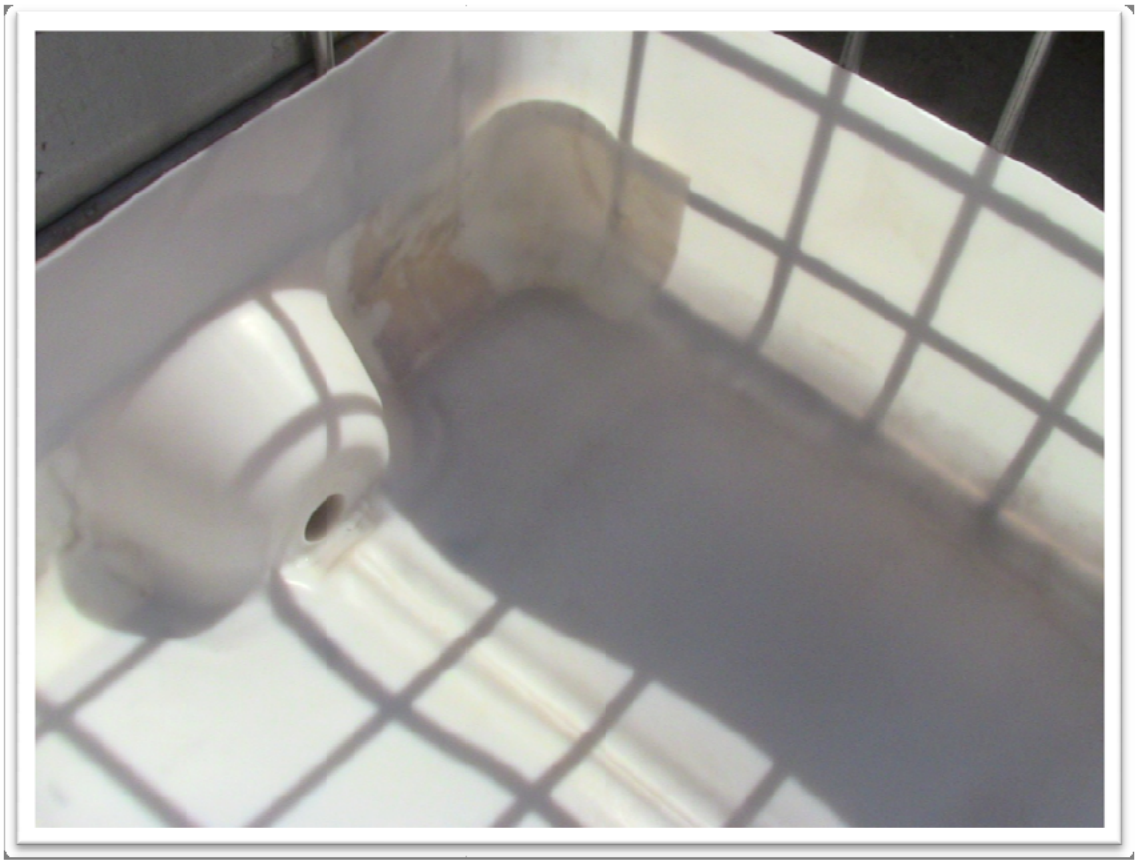
Use a regular screwdriver or an electrical screwdriver to unscrew the 4 screw holding the two top bars.

Now drag out the plastic container from the steel cage.

You need to cut out a 20 cm (7.87 inch) section from the middle of the plastic container leaving you with two 40 cm deep tanks.

In order to cut the plastic container, use a jig saw.

Now place the bottom half of the plastic container back in the cage.



Use tech screws to fix the bottom tank to the cage.

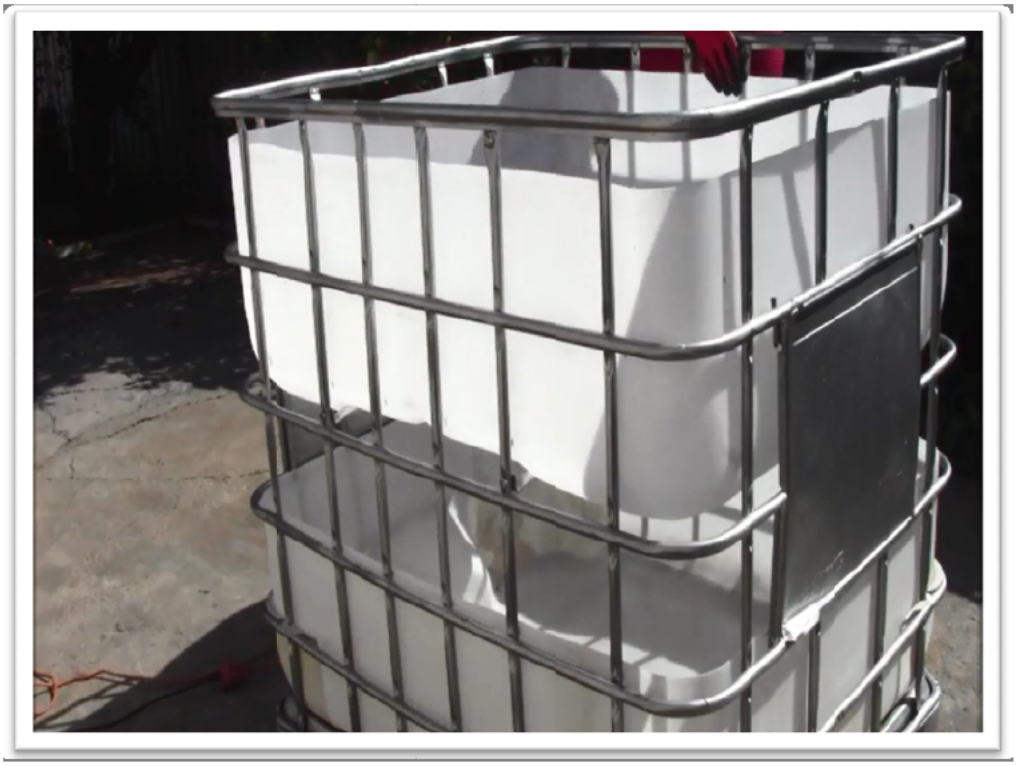
Next you need to fix the two bars you removed from the top of your IBC container half way up the middle of the cage.

In order to do that, you must first drill holes in the cage.

Use a cordless drill or a normal drill to do this operation. Keep in mind the size of the screws that will fix the two bars you removed from the top of the IBC and use the right size drill to make the holes.

Now fix the two bars half way up the middle of the cage.

Slide the top container, upside down on top of the bars.



Tech screw it in place!

Step 2 – The Pump

For cycling the water through the system, we have used a "Vario" submersible pump. For this Vermiponics system design you should use a pump capable of pumping at least 210 GPH (800L/H) and with a minimum head of 4.25 feet (1.2 m).

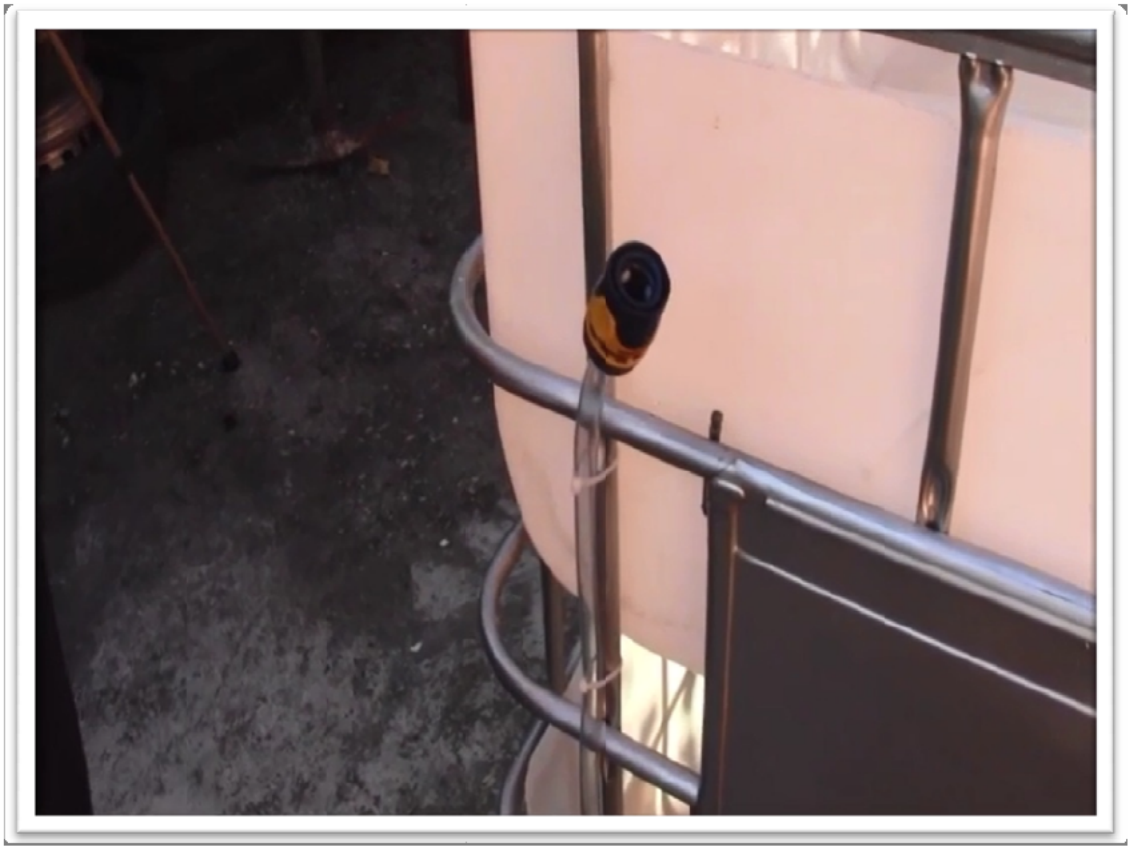
Use a plastic hose and connect it to the outlet of the pump.

Next, place the pump at the bottom of the tank and press hard to stick it there.

Using plastic fasteners, fix the hose to the cage. Using pliers, trim off the excess part of the fasteners to obtain a clean look.

Using an industrial knife, cut the excess hose.

Now fit a gardening type “quick” connector on the hose.



Connect the irrigation faucet adapter to the connector.

Use a few more plastic fasteners to fix everything in place.

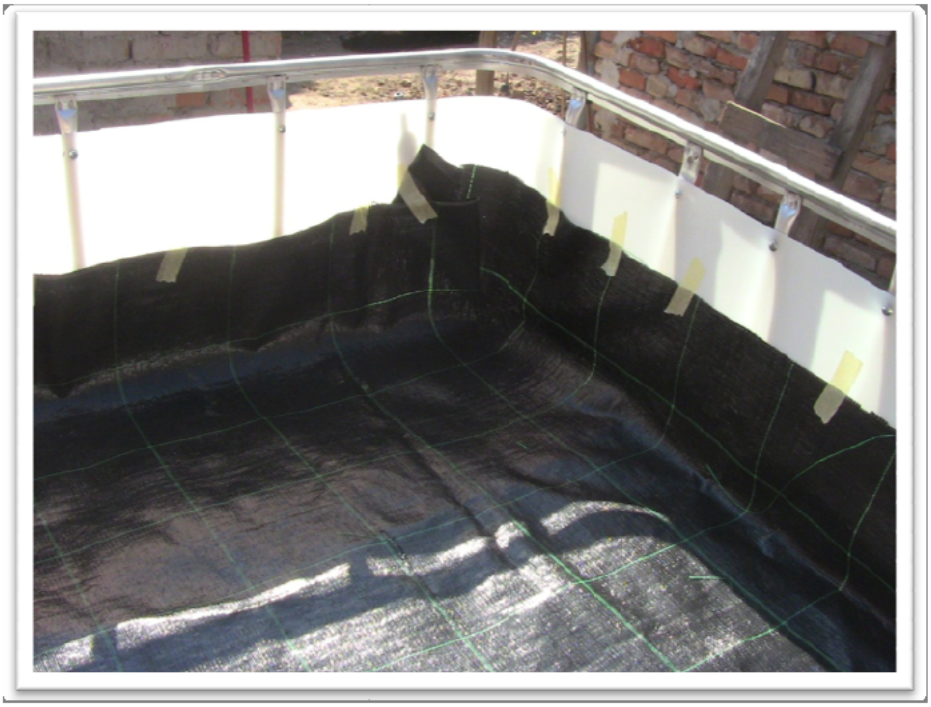
Step 3 – Media Layers

First you need to clean the surface of the top tank which will be your g owing bed.

After that, drill drainage holes in the bottom of your growing bed.

For your first media layer we have used gravel or granite pebbles. Pour in a nice layer of gravel. This will act as your filtration station. Level it equally to cover the whole bottom of your growing bed.

On top of your gravel layer, place a mulching cloth or a shade cloth or any type of similar material. This is used to stop the soil from passing through and getting into the gravel.



Fix it in place with duct tape.

Next up is your compost. You have two options here. Either you can buy readymade compost from your local gardening store or you can make it yourself at home.

If you chose to go with the DIY version of compost, just throw into your growing bed thin layers of straw, soil, wood ash, grass clippings, tip mulch, leaves, food scraps, animal manure, and sawdust, even paper and cardboard.

Mix it hard and let Mother Nature do its job.

After a month or two you should have your compost ready for the next step.

Step 4 - Introducing Worms to Your System

Once your compost is ready you can add the worms to the system.

This system works great with what is known as the red wiggler worm.

Simply add the worms to the system.

After your worms are cozy, top off with a layer of expanded clay pebbles.

Your growing bed is now READY!

Step 5 – The Irrigation System

For the irrigation system we have chosen to go with a commercial mini irrigation system that comes with all of the necessary parts.

You can also build it yourself from PVC tubing or any similar materials.

The mini irrigation system is pretty cheap and promotes growth and reduces water consumption.

The setup of your irrigation system is your own choice.

We have made a 5 rows setup for informational purposes.

The instructions found inside your mini irrigation system kit are pretty straight forward. Also “The Miracle Farm Blueprint” Video Guide covers this step in great detail so we won’t get into detailed instructions here.

After you’ve completed your irrigation system it’s time to fill up your bottom tank with water. Check for leaks!

Next you need to plug in your pump and begin cycling your system.

That’s it as far as building your Miracle Farm!

Water Quality

The quality of your system's water is integral to your planting success. Here are the most important things to keep an eye on:

Temperature
The temperature you keep your water at really will depend on the kind of fish you stock it with. Using fish that are found naturally in your area is the best choice, since they will adapt to weather and temperature conditions naturally, without the need for you to keep the water at a certain temperature year round.

pH Levels
Be sure to test your pH levels at least once or twice a week. Strive for levels between 6.2 and 6.4 for best results. If pH levels get too low, take out some of the stronger plants with larger root systems. This will allow more oxygen into the bed.

If, on the other hand, your pH levels are too high adding more plants can help stabilize things.

Oxygenation
Keeping an air pump running underwater will help to keep your fish healthy. No aeration for just 45 minutes can result in dead fish. Don't worry about too much oxygen in the water – any excess will come to the top as bubbles.

Cycling

There are several options for helping your Vermiponics system cycle properly. Here are some options to consider:

Peeponics
As long as you are not taking any regular medication, peeing into your system can help get the cycling going very easily. Although it is advised to age your urine for a few days in an open-air container before adding it to your system, this step is not completely necessary. Feel free to simply pee into your system's water a few times to get the first cycling stage started.

Urea fertilizers
Available from most agricultural supply centers, nurseries, and hardware stores, adding urea fertilizer to your system is a great way to get ammonia levels up at the beginning of your cycling.

Ammonia
When using household ammonia, be sure it contains no additives, scents, etc. Use food grade ammonia only. Also be sure to test your water regularly since it is easy to overdose a system with straight ammonia.

Dead Prawn or Fish
To create natural ammonia for bacteria to feed off of, simply add a few dead fish or prawn (shrimp) to the system.

Fish Feed
A quick and efficient way to start your system cycling is by throwing in the same fish feed you will eventually give your stock. With no fish in the water yet, it will sink to the bottom and begin decomposing. This process will release enough ammonia for your bacteria to begin feasting.

Feeder Fish & Fingerlings
Adding cheap bronze comets or goldfish to your system is a great way to get the cycling started. Not only is this simple, but inexpensive and effective. Once you decide on the species of fish you would like to raise in your system, buy fingerlings to start the process.

To do this properly though, you need to adhere to a few rules:

- Feed your fish sparingly. For the first two months, only add one tablespoon of feed per day for a 500L of media.
- If an algae bloom occurs, completely stop feeding the fish until the algae disappear.
- After 2 months, begin increasing the feed you give your stock. Just keep an eye on ammonia levels.

Introducing the Fish into Your System

The most important thing to remember when introducing fish into your Vermiponics system is to make sure that it has cycled through properly. Otherwise, your fish may die before they have a chance to get to work. Un-cycled systems are high in ammonia levels and low in bacteria levels; a horrible combination for the fish.

Tip: cycling takes about 6 full weeks.

How to Add Fish

Adding fish to your system isn't hard, but there are some important things to consider. For one, the water temperature must be about the same as the transport water. The easiest way to accomplish this is to put the fish inside of a 5 gallon bucket or large plastic bag with transport water and then place the bucket or bag (with their water) inside of the system water to help the temperatures between the two equalize. That way, when you put the fish in the system, they will feel about the same temperature and not be shocked by a sudden increase or decrease in water temperature.

Always start small. Throw in a few inexpensive feeder fish first to see how they acclimate to the water. That way if your

cycling is incomplete or anything is wrong with your system levels, you won't be wasting a lot of money by killing a load of expensive fish.

Monitor your water (and your fish for several days). If everything appears alright, then add some more. Remember: ammonia spikes are common when adding new fish to a Vermiponics system. As soon as fish are added to the system, they begin excreting ammonia-laden poop, which can poison the water if there aren't enough bacteria to keep up.

Planting Seeds

The easiest way to get plants growing in a Vermiponics system is to simply sprinkle seeds across the top of the bed. They will fall between the pebbles and germinate there. The important thing to do once they start to grow is to pluck out the smaller seedlings to give the stronger ones room to grow.

Other Seedlings Options

Another option is to use seed pellets made of peat moss to get your plants started and then replant them in your system once their roots have taken hold.

Harvesting

Keeping your system healthy requires regular harvesting. Older plants, plants that are infected with bugs, and overgrown plants must all be removed on a regular basis.

Plants
When harvesting most vegetables (except certain herbs and lettuce varieties that only require a few snips at a time), be sure to remove the entire plant, including the root. This will help keep the bottom of your bed from becoming too dirty.

When your plants are ready to harvest, simply pull out the entire plant. Take out as much of the root system as you can, leaving a little behind for your worms to eat.

Some crops that you can pick out the vegetables and leave the actual plants include:

- kale
- cucumbers
- zucchini
- mustard greens
- herbs

Although these types of crops will keep producing as long as the plants are viable, keep an eye out for signs of disease and mold. If you detect a pest or fungi infiltration, take out the entire plant to protect the rest of your garden.

Learning how to rotate harvesting to ensure a constant supply of food takes time and patience. Develop a growing schedule and stick to it as much as possible and you will never go hungry.

Fish
In the same way you harvest your plants according to their growing cycle, the same methods should be used when harvesting your fish for consumption.

When watching to see what fish to remove from your system (either to throw out or eat) you will want to take heed of these signs:

- fish that act funny (they could be diseased)
- fish that look bloated (this is a danger sign)
- Fish that are too large (they will eat too much or even begin to eat your smaller fish)

In smaller vermiponics systems, fish harvesting is done every couple of months. Some grow systems may require more frequent harvesting.

For those who want to breed their own fish, harvesting will be done according to the fish's breeding schedule. After all,

you can’t take out old fish until new ones are able to take over their job.

Always be sure that your system can replenish itself if you are unable to purchase new fish.

Maintenance

To properly maintain your new vermiponics system, you will need to follow a few simple rules:

Rule #1: Don’t forget to feed your fish. If you don’t feed your fish every day, they aren’t going to be able to give your system the waste it needs to work properly. Twice a day (morning and evening) is optimal.

Rule # 2:Don’t forget to check your tank’s water temperature.
Make it a priority to check daily your tank’s water temperature to ensure that fish, plants, worms, and bacteria are okay.

Rule # 3:Don’t forget to check for insects
Weekly checks for bugs can help keep any problems from getting out of control. Check plants carefully for residue and chewing marks regularly.

Rule # 5: Don’t forget to check pH levels
The pH level of your vermiponics system determines how many nutrients your plants can take in and how healthy

your fish and worms are. It will also determine how many bacteria your system holds. Maybe one of the most important factors in keeping a vermiponics system up and running, pH levels should be kept between 6.8 and 7.00Should this level fall below 6.5, consider adding some hydrated lime or potash to help boost pH levels again.

Rule #6:Don’t forget to check ammonia levels
Too much ammonia can spell disaster for a vermiponics system. Check ammonia levels weekly to help keep the system running smoothly. Levels should be equal to or less than 0.5 ppm. A sudden spike may indicate the presence of dead fish in your tank. A simple check (and their removal) should clear up the problem immediately.

Rule # 7:Don’t forget to check nitrate levels
Not something you have to do more than once a month, but checking nitrate levels is important and should not be overlooked. Levels above 150 ppm may indicate the need to add more plants, take out some fish, or even expand your grow bed.

Rule #8:Don’t forget to check your pumps and plumbing
Cleaning your pumps and plumbing should be done at least once a month to ensure they remain in good working order. A quick overall site check can be done daily, looking for immediate problems, but overall maintenance isn’t necessary more than once a month.

We hope you enjoyed our manual and video guide!

It can really help you build your own Miracle Farm.

Good luck!