New Jersey's Toolkit for Backyard Composting

NJ Organics Recycling Foundation

njorganicsrecycling@gmail.com | njorganicsrecyclingfoundation.org

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Acknowledgments

New Jersey's Toolkit for Backyard Composting was written by the NJ Organics Recycling Foundation in collaboration with its sister company the NJ Composting Council. This guide is intended to educate the residents of New Jersey on the various ways to approach backyard composting. Decomposition of food and organic waste in landfills results in the release of potent greenhouse gas emissions. By composting, every household can reduce their climate footprint and gain a valuable soil amendment to improve the quality of soil used for backyard gardening.

Authors:

Patrick Evans

New Jersey Organics Recycling Foundation Project Manager

LEED Green Associate

Jairo E. Gonzalez

New Jersey Organics Recycling Foundation /

WasteProGreen President & Founder

Isaac Bearg

New Jersey Organics Recycling Foundation Vice President

MBA Consultant

njorganicsrecycling@gmail.com | njorganicsrecyclingfoundation.org

Introduction

It is no secret that our Earth is in a critical state right now, however, we have the power to nurse it back to health. Currently food waste is the third largest source of the most dangerous greenhouse gas emissions in the US. We control how much waste we produce, how big our carbon footprint is, and how much harm we inflict upon our precious planet. Human population growth is directly correlated to the rapid increase of greenhouse gas emissions in recent history. It should be noted, however, that human health is deteriorating right alongside our environment. Rejuvenating our eroded and poor soils while also diverting organic waste so that it never reaches landfills are just some of the many challenges we face. Composting has been the prevalent answer for decades, yet the concept of composting has not been discussed or explained enough for the general public to fully understand.

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Figure A. Percentages of Food Waste Disposal in US

Food and yard waste have a lot of untapped potential that could benefit the environment in a multitude of ways. Figure A[1] shows that 40% of all food produced in the United States ends up being thrown away; half of this wastage takes place in our own homes. Food waste takes up 21% of the space in our landfills. Methane, a greenhouse gas that has proven to be 20 times more harmful to Earth than carbon dioxide emissions[2], is created from that food waste. All of the food and yard waste, otherwise known as organic waste, we produce could be diverted away from landfills to be put through a process known as composting. The final product of the composting process is rich, organic matter filled with nutrients and microorganisms that will nurture and improve soil quality. Many additional benefits will be discussed later in this toolkit.

[1]Disposal and Recycling, Inc., Flood Brothers. "Food Waste in the Us." n.d. Food Waste in the US.
[2]"Food Waste Problem." Food Waste Experts. Accesseed October 18, 2019. http://foodwastexperts.com/food-waste-problem.

What is Compost?

Compost is rich, organic matter produced from the controlled biological decomposition of organic material. Finished compost should be a dark, crumbly consistency, much like humus and should smell like fresh soil or even like the forest floor. Compost has the unique ability to improve the physical, chemical, and biological characteristics of soils and growing media[3]. On top of the benefits compost has for soil rehabilitation, composting can have a tremendous impact on the local economy. Compared to landfills, composting employs four times more people on a per ton basis and is a very marketable product.[4]

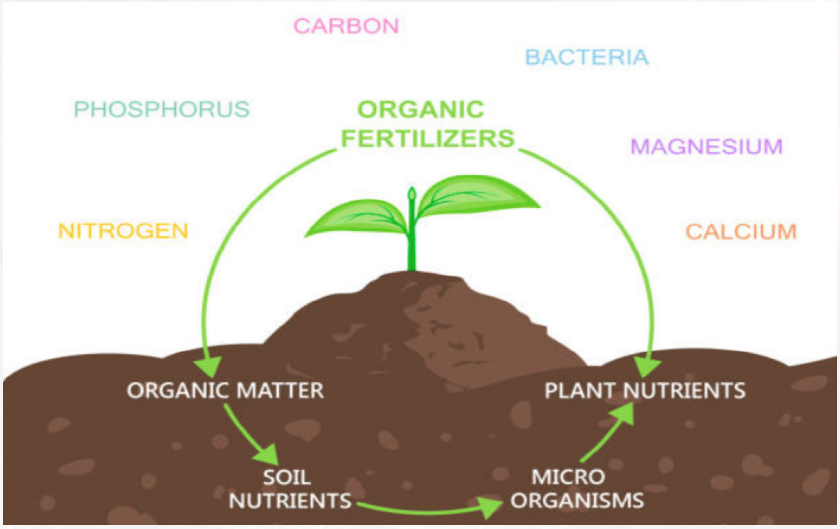
[3]US Composting Council. (2008). Uscc Factsheet: Compost and Its Benefits. Ronkonkoma, NY.
[4]Institute for Local Self-Reliance. (2014). Growing Local Fertility: A Guide to Community Composting. (pp. 1-121). Hardwick, VT.

Physical Benefits:

The addition of compost can greatly impact the physical structure of any soil. In fine-textured soils, improvements in porosity can be seen after compost has been added increasing gas and water permeability, which reduces soil erosion. When used appropriately, the addition of compost creates both short and long-term positive effects on soil structure. The humus content in compost is what provides these soil-binding properties. Humus is a stable residue resulting from a high degree of organic matter decomposition which acts as a 'glue' holding soil particles together. Thus, making them more resistant to erosion and improving the soil's ability to hold moisture.

Organic Benefits:

Adding compost to soil may modify the pH of the final mix. Depending on the pH of the compost and that of the native soil, the addition of compost may cause an increase or decrease in both pHs. In specific conditions, compost has been found to affect the soil's pH even when applied in quantities as low as 10-20 tons per acre. Compost products also contain a considerable variety of macro and micronutrients. These are essential for healthy soil, plants, and produce.



Biological Benefits:

The activity of soil organisms is essential in having productive soils and healthy plants. Their activity is largely based on the presence of organic matter. Soil microorganisms include bacteria, protozoa, and fungi, which all play an important role in organic matter decomposition and lead to compost formation and nutrient availability. Sufficient levels of organic matter also encourage the growth of earthworms, which increase water infiltration and aeration via tunneling.

The Compost Process

We have seen the rather simple, natural process of composting many times without ever fully realizing it. Everything that lives in nature eventually dies and will decompose, whether it is a leaf, a withering flower, or an animal. Once dead, they will decompose and act as nutrients to the soil. Within the soil, there are thousands of microorganisms that feed on any organic or food waste that is available to them. As these microorganisms feed on organic matter, they begin to generate heat, and this breaks down all the organic and food waste they come into contact with. Compost piles should reach at least 131°F and should maintain that temperature for at least three consecutive days to properly break down all materials. The natural process can take anywhere from weeks to months, depending on the type of system and maintenance that is being used.

Feedstocks, microorganisms, oxygen, water, and temperature are important elements in the composting process. Turning the pile allows oxygen – a necessary part of the process – to infiltrate and assist with the composting. A pile should have both greens and browns mixed thoroughly together with a ratio of greens to browns being 1:1 subject to your individual feedstocks. Each household will have different feedstocks, so it will take a little time to perfect the art of composting. As mentioned before, compost piles should reach at least 131°F to ensure that any pathogens are killed and the feedstocks are degrading. Given that their activity in eating all the organic waste produces the required heat, microorganisms are the drivers for this process. Just like humans, a compost pile needs to breathe and get oxygen in and out of itself. Turning the pile allows oxygen to infiltrate and assist with the composting process. Lastly, having the proper amount of moisture is vital. Squeeze a fist-sized sample, if any liquid leaches out, it is too wet. If the sample is crumbly, the pile is too dry. Troubleshooting is rather simple, as sometimes simply adding a sprinkle of water, or adding either greens or browns will do the trick.

What and What Not to Compost

A healthy compost pile will need to have a balanced ratio of both browns and greens. The term "browns" refers to the feedstocks that are carbon-rich and tend to be on the drier side. The carbon acts as a breeding ground for microbes to metabolize the carbon. This then drives the composting process. The term "greens" refers to the materials that are nitrogen-rich and tend to be wetter. Greens do a good job of balancing the carbon feedstock. In ***Community-Scale Composting Systems***, James McSweeney states, "Nitrogen is a critical building block of proteins. Microbes utilize it to build these cells and replicate."[6]

[6] McSweeney, James. Community-Scale Composting Systems: a Comprehensive Practical Guide for Closing the Food System Loop and Solving Our Waste Crisis. White River Junction, VT: Chelsea Green Publishing, 2019 (p. 66)
*These feedstocks are compostable, yet are highly recommended only for certain backyard systems.

Different types of backyard composting systems will require different ratios of carbon and nitrogen and require different types of maintenance. These systems will be covered in the next chapter. When tending to your compost pile, the rule of thumb is that if your batch is wet, smelly, and very saturated, then you should balance it out with some carbon feedstock. If the pile seems to be very dry, add some more greens and/or water your batch to get the right balance. This step is crucial to ensuring the proper maintenance of your pile. Remember, a simple squeeze test will help you determine right on the spot whether your pile is too moist. Grab a handful of compost and squeeze it, if water comes out, it is too wet. The compost should be as moist as a wrung out sponge.

The different materials that are used for backyard composting, otherwise known as feedstocks, are some you have all most likely been working with. Whether by raking the lawn, mowing the grass, or throwing out the inedible watermelon scraps. Each of these feedstocks comes at no cost. The following list shows common household food and yard waste that could be composted in your backyard!

Greens

- Grass and Yard Clippings
- Fruits and Vegetables
- Meat/ Poultry/ Fish*
- Coffee Grounds
- Bread and Grains
- Flowers

Browns

- Dry Leaves
- Straw
- Wood Chips/ Sawdust
- Sticks and Twigs (small/shredded)
- Bread
- Eggshells

Non-Compostable

- Dairy*
- Pet and Human Waste
- Oils/Fats/Grease
- Diseased Plants
- Produce Stickers

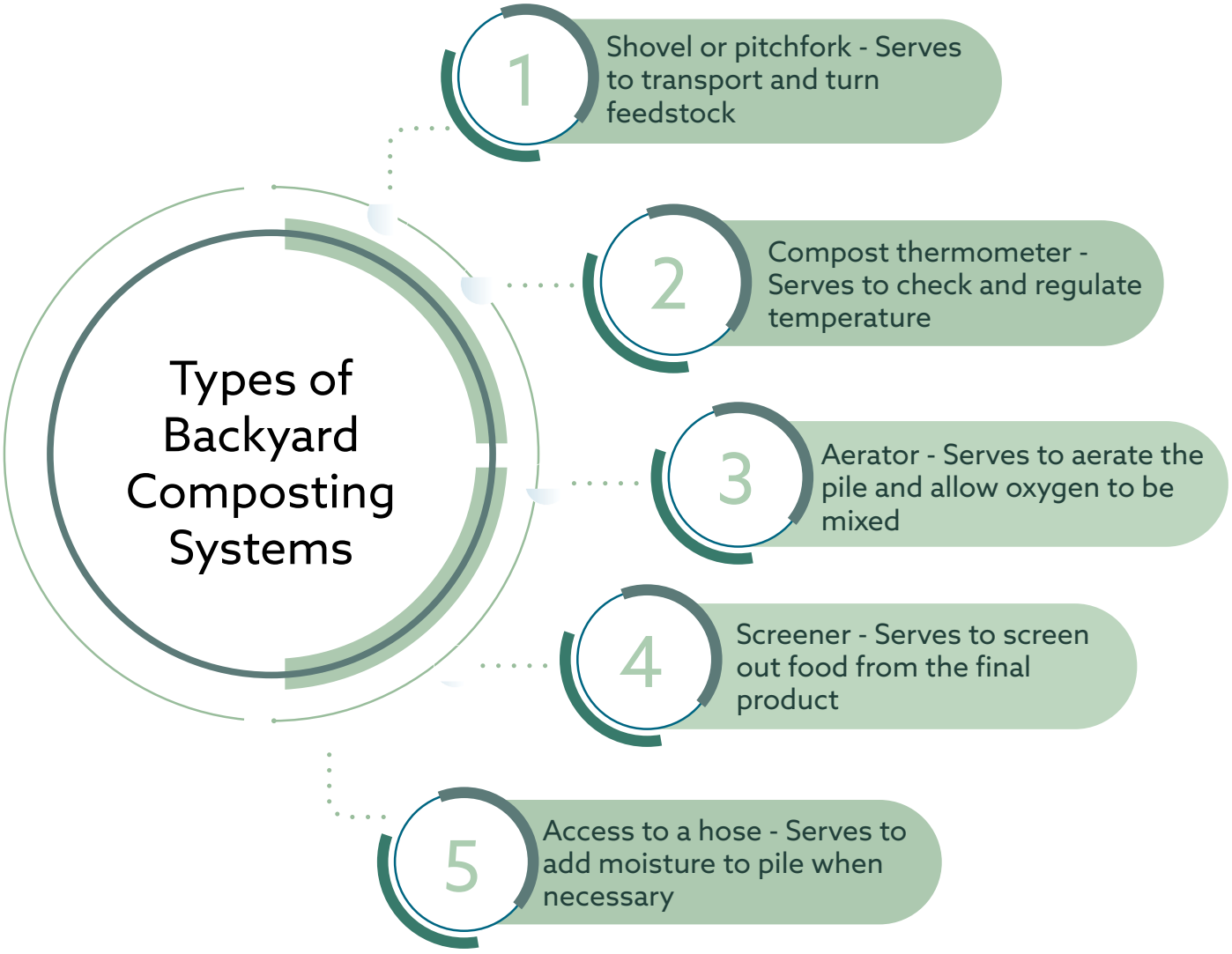
*These items can be composted in your backyard system, but you will want to be cautious and ensure that you have a good system and can reach the proper temperatures. Maybe don't compost them on your first try!

Types of Backyard Composting Systems

There are various approaches to backyard composting that you can choose from. The following section will go over five different types of backyard composting systems, and we will take a look into how each of them works. The five common backyard composting systems we will be discussing are known as the 1-Bin System, the 3-Bin System, Aerated Static Piles, the Tumbler System, and a Worm Bin. More than 25% of your average household waste consists of yard trimmings and food waste. This means you won't have a hard time turning your organic waste into a valuable soil amendment.[7]

[7] Rhonda Sherman Extension Solid Waste Specialist (vermicomposting. (n.d.). Home & Backyard Composting. Retrieved from https://composting.ces.ncsu.edu/home-composting/

There are many tools you should consider having handy when beginning your journey with whichever composting system you choose. These tools can make life a lot easier when it comes to turning and screening the finished product. Please note that it is not necessarily essential to have all of these tools, they are just suggestions for a more efficient process.



Before anyone gets started, there are a few things an eager beginner like you should consider: how much space you have, how much time and effort you want to put in, as well as which types of feedstocks and materials you will be composting. We will describe which type of household is most suitable for each composting system.

1-Bin passive Composting System

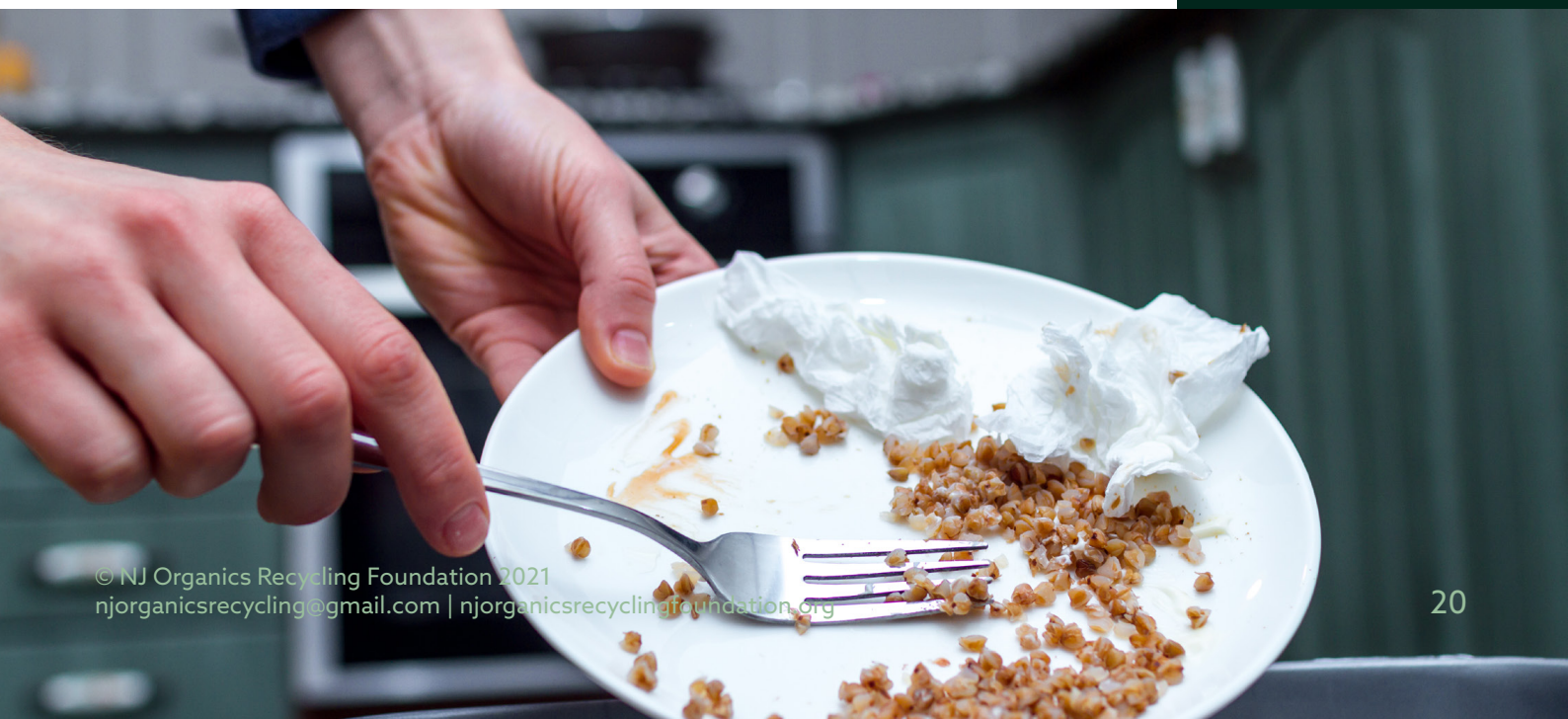
1-bin composting systems are ideal for small backyards and those who are not working with a lot of space. Ideally, a pile of compost should have some type of protective barrier, not only to help keep moisture in but also to protect against any potential pests or rodents. Keep in mind that smaller animals could burrow underneath your pile if it's not given proper maintenance. The appropriate surface area for a compost bin is 2x2x2 cubic feet. That size will assist your pile in reaching adequate temperatures. A well-maintained bin should maintain an internal temperature of roughly 131°F for at least 3 consecutive days to allow all the organic material to break down properly. A 1-bin composting system can be made of anything from wired fencing and cinder blocks, to bricks or pieces of wood.

Building a wire fence structure can be inexpensive if you plan to reuse materials. The struggle with wire fencing is that the temperature may not reach as high as it needs to and, depending on the type of wiring, pests could get into the compost pile. The use of cinder blocks will provide a long-lasting structure with adequate aeration. Building a layered brick structure will also provide proper aeration as well as being a long-lasting structure. When it comes to a wooden structure or pallets, the wood should be untreated. This is because treated wood can release chemicals into the compost pile. A downside of using wood is that the wood will have to be replaced when it starts to decompose.

Figure C. A 2x2, 1-Bin composting system constructed in South Carolina

For these 1-bin composting systems, it would be wise not to dispose of any meat, fish, dairy, or cooked food in them. These materials typically require higher temperatures to decompose. These feedstocks will also attract unwanted pests and insects as they produce a stronger odor. Composting any yard debris, leaves, food, and vegetable scraps is greatly encouraged with this type of system. Covering your pile with a lid, tarp, or browns will help keep the moisture regulated and tone down any potential odors. Figure C to the right depicts an example of a well-made 1-bin composting system made with wood and chicken wire that allows for easy access for turning the pile when necessary.

Feedstocks will vary based on which household they come from. Smaller households will produce more food waste compared to households with larger yards, in areas where materials such as leaves are abundant. If you do not have a lot of access to brown materials, reach out to your neighbors and community. Not many people out there mind if their leaves, cardboard, or other brown materials are taken off their hands. You will want to stockpile your food and organic waste to be able to build a decently sized pile when you first begin. Having any sort of bucket inside or outside your household to collect food waste will be helpful in this case. For example, a small countertop bucket in the kitchen and a large bucket outside in which to dump all materials.



As mentioned earlier in this guide, your compost pile will need moisture, oxygen, and warmth. The high temperatures come from the activity of the microorganisms as they break down all the organic waste. To ensure your pile is breathing properly, you should turn your pile to aerate it using the tools mentioned previously. You should only have to turn your pile every few days, and the food should be seen fully breaking down over a few months. This process will take longer if you are taking a more passive approach, and not turning your pile as much.

Once your pile seems to have broken down all feedstocks, and the waste has turned into a dark, crumbly, rich soil amendment, you should do one final screening to get out any remaining chunks that may not have fully decomposed. Once you've finished screening, you have your very own compost which can be applied to your yard, plants, and produce. You will notice the difference in growth and size in each of these areas.

3-Bin Passive System

Yards with ample space that can handle more bins would be well suited to the 3-bin composting system. It is suggested not to place your system directly against a fence, as the small nooks and crannies will attract pests looking for a new home. Keeping your systems in the open will make them unsuitable homes for vermin. Every bin in this system serves a unique purpose within each stage of the composting process. The process and maintenance required for the 3-bin system are very similar to that of the 1-bin composting system. Treat the first bin in this system the same as the 1-bin composting system. The first bin should house all the freshly decomposing materials to begin the microbial activity that will kickstart the composting process. It will take anywhere from a few weeks to several months for your pile to break down into a dark, crumbly soil amendment, depending on the size, maintenance, and feedstocks involved in your pile. You will need to turn your pile every three to seven days for it to be properly aerated. After your organic waste has degraded substantially, your pile will be ready to be transferred to the second bin for the second stage to begin.

Figure D. A 3-Bin Composting System

Ideally, when the temperature of the middle of your pile reaches 140-150°F, you should transfer the decomposing material to the next stage.[8] The materials will continue to break down in the second bin until the compost has cured to its final stage. Please refrain from adding new feedstocks to the second stage. The final product should be unrecognizable as the materials you initially put in and should remind you of soil. Options greet you at the third bin. This bin can either be used as a storage space for the final product after it has been screened, or it can be used to store feedstocks for future use. Just like the 1-bin composting system, the 3-bin composting system can be built by hand with common materials such as cinder blocks, wood, and bricks. The designs of these systems are completely customizable. Just as with the 1-bin system, it is recommended to refrain from discarding meat, fish, dairy, or any cooked food in your 3-bin system. These feedstocks will attract pests and rodents as they produce a stronger odor. Composting any yard debris, leaves, food, and vegetable scraps is greatly encouraged for this type of system.

[8] Weeks, P. (2019, November 19). 3 Bin Compost System: Everything You Need to Know! Retrieved from https://www.thedailygardener.com/3-bin-compost-system

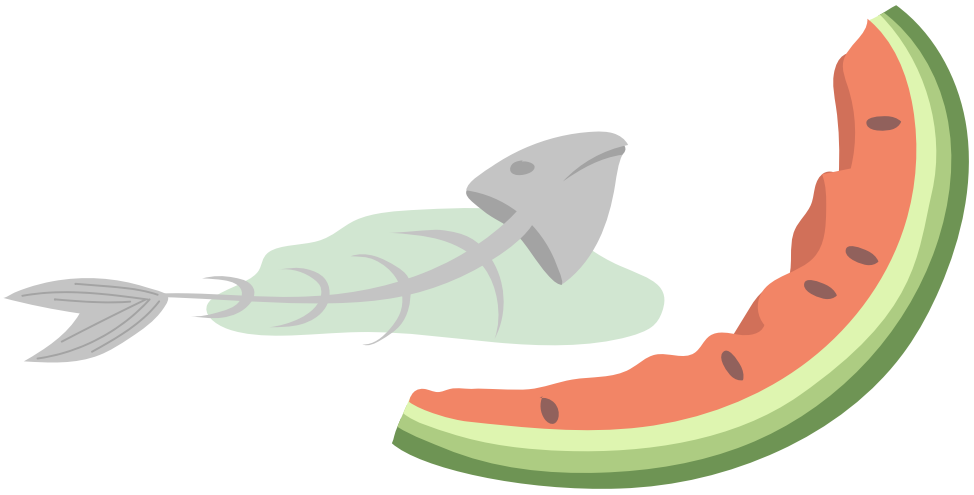
Aerated Static Pile Bin Composting Systems

Aerated static piles are unique in that they use “blowers” to aerate the pile; greatly reducing the need to manually turn the pile. Perforated pipes, otherwise known as ductwork, run under the pile to actively aerate it. This will save you time and spare you the hassle of turning your pile. Aerated static piles, or ASP systems, can be scaled down to fit into the space your household dedicates to it, or it can be made into a big commercial operation. The ASP system is ideal for any size household as the bin only takes up one cubic yard. However, it can be made bigger if you so choose. The active aeration involved in this system speeds up the composting process, so the final output will be ready faster, compared to other composting systems. ASP systems also tend to achieve higher temperatures than other backyard composting options so may be better suited for a wider range of feedstocks such as meat and dairy.”

Tumbler Composting System

Tumblers, otherwise referred to as in-vessel systems, make up an efficient system that has many advantages you can enjoy. These systems are quite aesthetically pleasing if you're worried about what your neighbors might say. They are also great at keeping pests out and odors in. Another perk of this type of system is the ease with which you can turn and spin the unit to aerate your pile. You will only need to do a few spins 2-3 times a week. Keep in mind that as more materials are added, your tumbler will become heavier and a little more elbow grease will be needed to rotate the pile. There are many tumblers on the market so, we will look into the general process of how tumblers work and how to use them properly to help you decide which tumbler is right for you and your needs.

Whether it is a single or dual tumbler system, each tumbler will have some sort of hatch or sliding door to allow for it to be easily filled and emptied. When you go to use your tumbler system for the first time, it is best to add some compost, soil, or compost starter to the feedstocks. This will help kickstart the microbial activity required for the composting process. Compared to simply having a compost pile, materials and feedstocks will break down faster in this process. Ideally, you should see the materials degrading and starting to look more like the final product in anywhere from a few weeks to a few months. The speed at which your materials degrade depends on how regularly you maintain and turn your tumbler. Once your material has reached its final stage, all that's left is for you to screen the compost. This will help separate any materials that have not yet fully decomposed from the final product, thus leaving you with a fine compost product. The materials can be transferred by opening the hatch and dumping the contents out onto your screen. Make sure to have a storage bin under the screen to catch your fresh compost and hold it for later.



Just as with any composting process, if your pile seems to be too dry, add some water or greens to your pile. In the same way, if it is too wet, simply add more browns to soak up the moisture. The range of tumblers on the market is great, so you can find the perfect tumbler to fit your budget, household, and how much organic waste it produces. Even large tumblers will work for smaller yards, making the tumbler composting system ideal for any size household. Some things to consider are whether the tumbler is insulated for year round use in NJ, whether it locks, and how far off the ground the tumbler is. As with any compost system, there's generally a trade off between cost and quality/ease of use of the tumbler, and you'll decide what's right for your setup.

Other Options

This toolkit doesn't cover every method of composting. There are additional home organics recycling options, specifically for very small spaces like vermicomposting, bokashi (anaerobic) or other small in-vessel technologies. We welcome you to explore any and all technologies!

Best Management Practices

Below are some of the best management practices and tips for eager backyard composters. These tips will help you create an efficient composting process and help deter any potential odors, pests, or problems that might arise during your composting journey.

Tip 1:

Cover your compost

Always cover any greens you put into the pile after mixing them in. This will help assist in trapping any odors within the pile. Having a stash of browns, such as leaves and wood chips, is ideal for these situations.

Tip 2:

Temperature checks

Temperature is one of the key indicators in composting. Check the temperature of your compost as often as you can using a backyard compost thermometer. Ideally at least twice a week to ensure the organic matter is decomposing correctly! If the temperature starts to fall you may need to ensure there is enough oxygen in the pile.

Tip 3:

Check your moisture

It is important to ensure your pile is not too wet, or too dry. There are tools on the market that can measure moisture, as well as other elements but don't forget that you can do a simple moisture check with just your hands. To do this, take a handful of your compost and squeeze it. It should feel like a wrung-out sponge. If any water drips down towards your elbow, the pile is too moist; if it crumbles in your hand, your pile is too dry.

Smell your compost

Tip 4:

Your nose is a powerful tool that can help you determine whether your pile needs more browns or greens. If your pile has a strong, rotten smell, then add some browns while turning your pile. This should help balance out the ratio of carbon to nitrogen and alleviate this strong odor. Odors are created when the process goes anaerobic, meaning oxygen is absent. On top of that, adding meat, fish, and dairy could also cause these odors in certain backyard composting systems. It is important to remember what you can and can't put into your pile, as it can be very easy to toss in the wrong materials.

Just like us, compost piles need oxygen to work efficiently, so make sure to turn your pile frequently. Ensuring to properly aerate your pile plays a pivotal role in the composting process.

Have feedstocks ready

Tip 5:

As mentioned before, having extra storage space for browns could be helpful. This is especially important if you do not have regular access to a lot of browns, so stockpiling or borrowing materials from neighbors can be helpful in these scenarios.

You can also buy pelletized wood chips from your local agriculture/garden store if you want to be sure you have your carbon source on hand.

Tip 6:

Find an ideal spot

There are many factors to consider. In general, you would ideally keep your operations close to a source of water. This is to simplify the task of watering your pile if it becomes too dry. Make sure to place your operations in an easily accessible part of your yard. Pests are not as comfortable without hidden space to sneak around in, so keeping your piles away from fences and walls will help in the long run. In some cases, especially when it comes to vermicomposting, try to keep your compost bin away from direct sunlight. This will prevent the overheating of your pile, which is harmful to the worms.

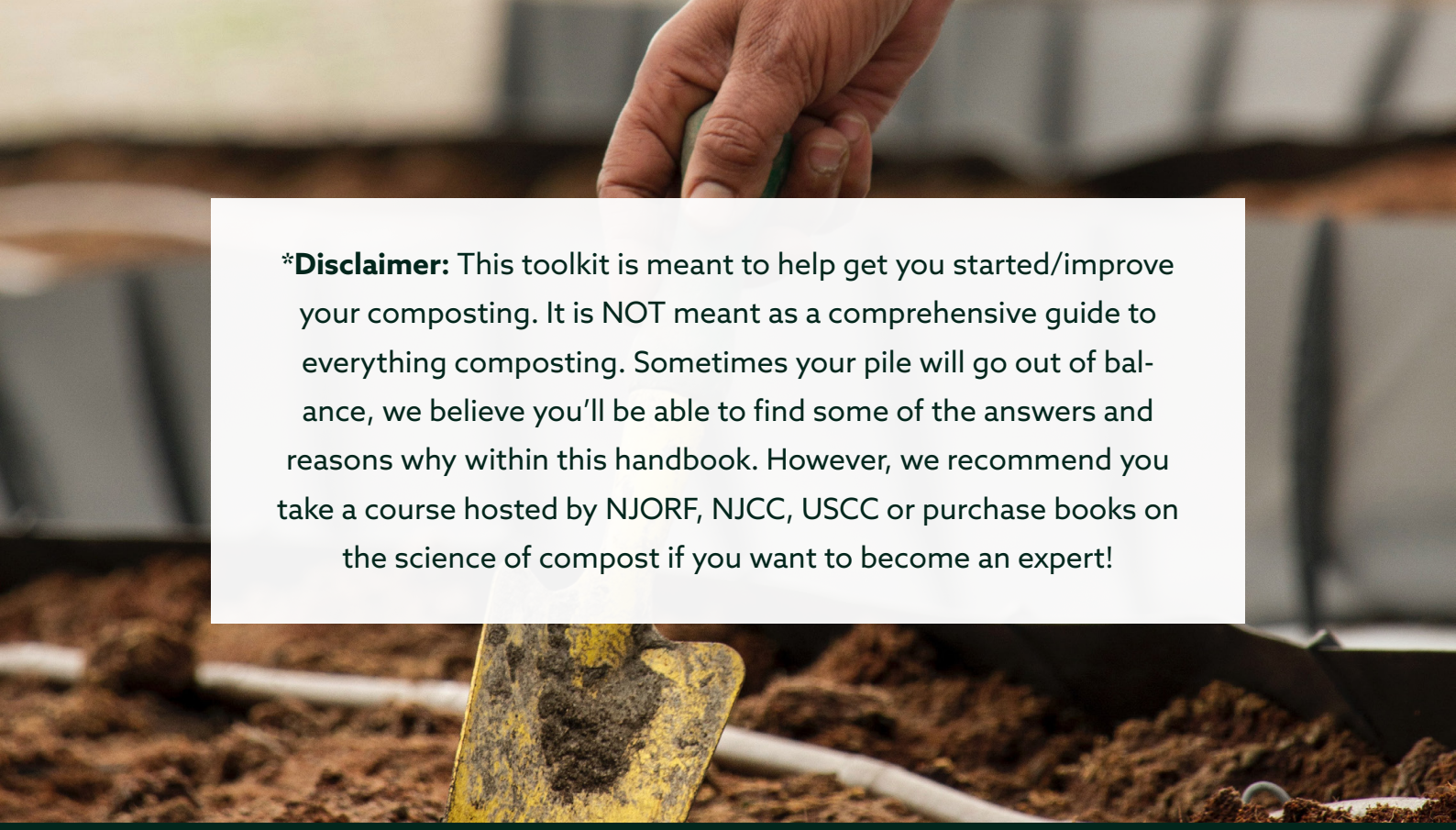
Tip 7:

Break down bigger chunks

To help speed up the process, break down any larger chunks of food and organic waste. For example, if you are composting a whole pineapple that went uneaten, it would be best to chop it up before you throw it into your pile. Chopping or shredding any waste will create more surface area for the decomposers to eat, thus speeding up the process.

Conclusion

This toolkit should have you feeling empowered and equipped to make a huge impact on our environment. Once you produce your first batch of dark, crumbly compost and see first-hand the effect it has on your soil and plants, you will never want to stop! Composting can be an individual hobby to get your hands dirty in the yard and can be a fun, family project to work on with the kids. Passing on this desire to rejuvenate our Earth's soils will only bring us closer to a sustainable society in New Jersey. For any questions, comments, or concerns, feel free to reach out to us at: njorganicsrecycling@gmail.com.



*__Disclaimer:__ This toolkit is meant to help get you started/improve your composting. It is NOT meant as a comprehensive guide to everything composting. Sometimes your pile will go out of balance, we believe you'll be able to find some of the answers and reasons why within this handbook. However, we recommend you take a course hosted by NJORF, NJCC, USCC or purchase books on the science of compost if you want to become an expert!

NJ Organics Recycling Foundation

The New Jersey Organics Recycling Foundation (NJCC) is a 501(c)3 non-profit organization founded to promote research and education around organic waste recycling in New Jersey for the benefit of our environment and economy. We are a sister organization to the NJ Composting Council. To help us continue and expand on our education and research work please consider donating via our website at https://njorganicsrecyclingfoundation.org/

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