



Soil Health

Produced through The Northern Rhode Island Conservation District 's ***Providence County Urban Growers Leadership Program***, in partnership with Southside Community Land Trust.



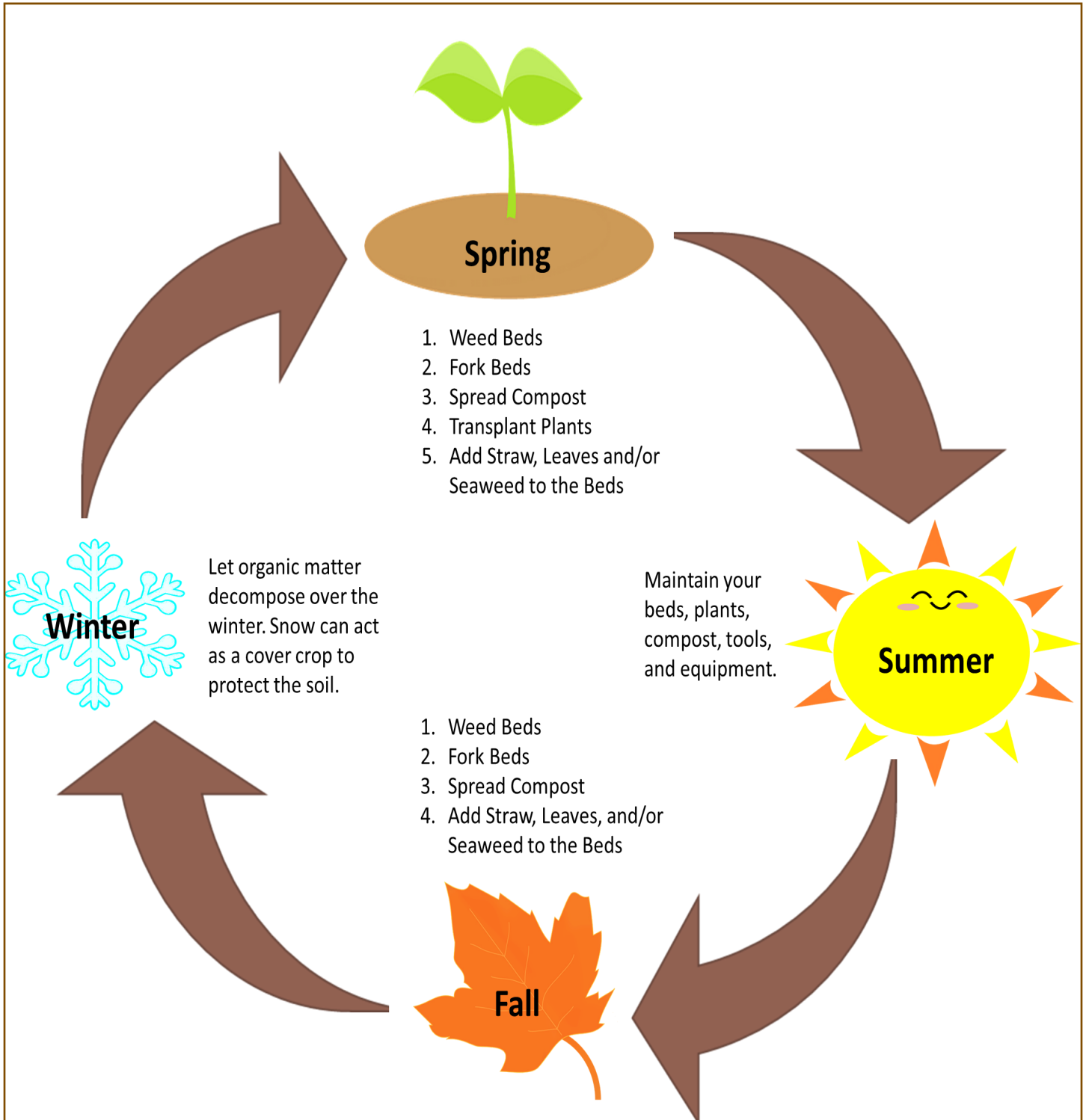
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“Healthy Soil Grows Healthy Plants That Make Healthy Communities.”





Book:
Bio-intensive Growing
by John Jeavons

Bio-intensive Growing: ◦

Bio-intensive growing (also called bio-intensive agriculture) is an agricultural practice that focuses on increasing biodiversity and maintaining soil health. In other words, respecting the environment and farm land by giving back to the soil through composting—continuing a “full circle” approach to farming.

For example, composting the uneaten foods grown in the garden.

“Every Time Something is Extracted from the Earth, Something is put Back into the Earth.”

Key Question: How to we produce a lot of food production, to feed as many people locally as possible, and do it in a sustainable way that is impacting the earth in a positive way?

Ideal Soil and Garden Beds:

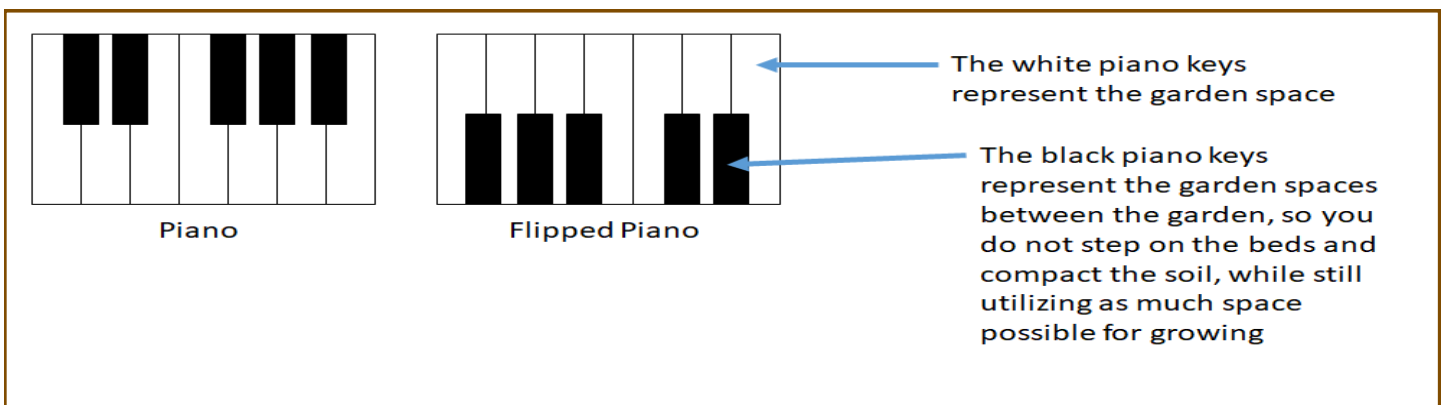
Your ideal soil to be like chocolate cake.

- Light and fluffy
- Moist
- Dark in color
- The frosting on top of a cake is the compost



When making the beds, to conserve space, pretend the beds are piano keys and connect them at the top of the beds. Make sure that you are able to reach the weeds at the top of the beds that are connected, without stepping into the beds

DO NOT step on the beds. Stepping on the beds compacts the soil.



Soil Testing:

You want to make sure you have good quality soil!

Top three soil analyses you should have each year are:

- Nutrients (this includes organic matter. It is ideal to have 10% or higher organic matter)
- pH Levels
- Lead Levels



Where and When to Test:

- You should test you soil once a year.
- For faster results it is best to send your soil sample out in Spring or Fall. This way you have time to change the soil health if need be.
- You can send your soil samples to:
 - The University of Massachusetts (UMass)
<https://ag.umass.edu/services/soil-plant-nutrient-testing-laboratory>
 - The University of Connecticut (UConn)
<https://soiltest.uconn.edu/>

How to Take a Soil Sample for Testing:

Tools:

- Hand shovel
- Small bucket

Steps:

1. Collect small amounts of soil about 6 inches from all around your field and place in the bucket. If you have a large farm take samples of every field in a zig zag pattern.
2. Mix the soil samples in the bucket well.
3. Put soil in a dry place like in your home or a green house. Make sure the soil is dry! This might take a week for the soil to completely dry out. Drying the soil prevents mold from forming when you send it to the lab.
4. After the soil is completely dry, take 1 cup of the soil sample and follow the directions to send your soil sample out to be testing. Instructions to send a sample may vary from lab to lab.



Ideal Soil Test Results:

Ideal result vary depending on what you are growing. Below is an average range. Please refer to other resources for specific leaves for each plant:

- Organic Matter: Typical ideal range is from 5% to 10% in the soil
- pH levels: Typically ideal range is 6.0—7.0 (6.5 pH), which is lightly acidic, to neutral soil
- Lead levels: Lead can cause serious health risks. There are extremely small amount of lead that occur naturally in the soil. According to the Rhode Island Department of Health (RI DOH) and the Environmental Protection Agency (EPA), you want to make sure to have extremely low to no lead levels in you soil. Please consult your physician and State and Federal regulations. Check out the following links for more information.
 - EPA, Lead: <https://www.epa.gov/lead>
 - Lead in Garden Soils: <https://soiltest.uconn.edu/factsheets/LeadGardenSoils.pdf>

Lead in Soil:

There are two ways to remediate lead in the soil. You can either dig the top 2ft—3ft of your soil out and replace the soil with uncontaminated healthy soil or you can build raised beds with a plastic liner on the bottom.

You can reduce lead uptake by plants, through keeping a balanced and natural soil pH.

Lead can splash on plants from soil and water not remediated in the near-by area of the growing plants. Be sure to wash your plants very well to make sure you get all the lead off.

Making Compost:

Compost is the most important thing on your farm. Your goal is to develop the proper “pet” bacteria by creating the optimal composting conditions for beneficial bacterial to thrive in (creating an effective biome). Bacteria will break down the organic material as their nutrients to grow and reproduce, all while producing carbon, water and heat as their end product.

Composting Container Options:

- Open bin
- Black barrels that are made for composting

Composting Materials:

Compost consists of 3 parts Carbon (C) and 1 part Nitrogen (N), a 3C:1N Ratio. This ratio can be by weight or by volume of matter, but the measurements must remain consistent. Please keep in mind that each farm, organization, or individual may have their own individual and different methods of farming and composting.

Carbon Materials (Browns):	Nitrogen Materials (Greens):
<ul style="list-style-type: none"> • Carbon (C) based organic compounds • Think of the browns as food or nutrients for the bacteria • Ex. Leaves, woodchips, paper (shredded), hay, plant matter, weeds, etc. Most organic substances have carbon. 	<ul style="list-style-type: none"> • Nitrogen (N) based organic compounds • Think of the greens as vitamins for the bacteria • Ex. Food Scraps, some vegetables, meats, donut scraps, coffee (coffee is in the middle of the spectrum but has slightly more N in it), and animal manure.

Making Compost (continued):

Compost materials (continued):

- Adding animal manure, meat, and/or dairy to Compost:
 - You can add livestock manure such as horse, chicken, goat, etc. Do NOT add pet waste to you manure pile for it can contain harmful pathogens that will not die during the decomposition of composted materials.
 - If you add meat or dairy to your compost, by state law, the compost must reach 130°F for 3 or more consistent days of during compost to be considered safe to use for growing food.
 - Be sure to follow state composting laws and regulations when composting.

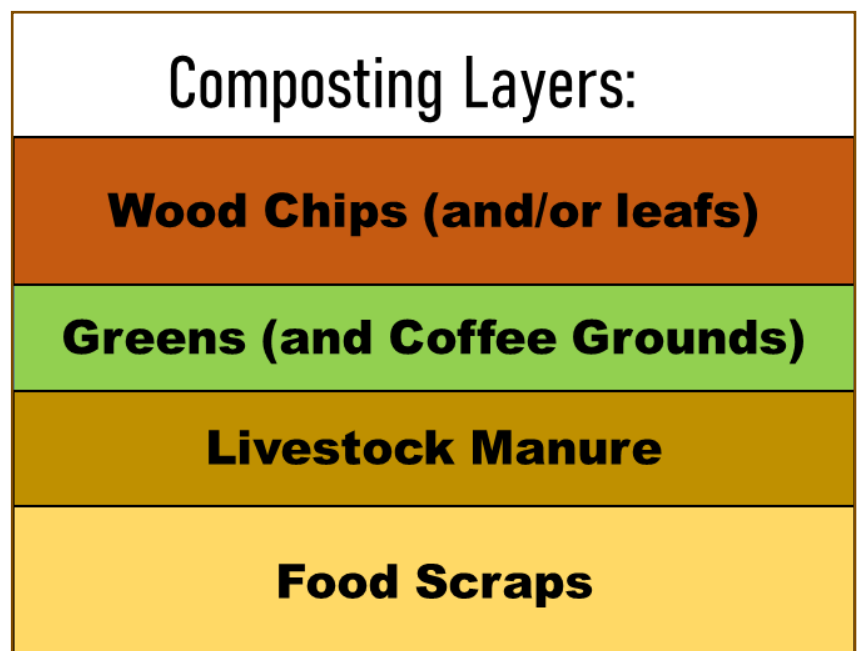
Composting Layers:

1. Add food Scraps first to keep the pests and smell away

2. Add Manure second

3. Add Coffee grounds (optional, for added nutrients)

4. For an above ground compost pile you have to add carbon, like wooden pallets or leaves on top of the pile to reduce pests and smell.



Composting Process:

- Organic matter needs oxygen to decompose, therefore it is important to aerate a compost pile. Stab the compost pile with a heavy metal rod to add holes into the pile.
 - There is no such thing as “too much aeration”. The more oxygen the pile has, the more “fuel” given to the pile to break the compost down
 - BONUS: Aeration of the compost pile can agitate the pile and deter rats from nesting in the pile. You can also covered compost bins to prevent rats from getting into the compost.
- The temperature of the compost pile should be around 120°F to 140°F for ideal decomposition. Keep in mind state and local regulations for your compost if you add materials such as manure into your pile.
 - To produce the ideal decomposition temperature (critical mass of decomposition), you must have a minimum composting pile of 4ft x 4ft x 4ft
- Compost Moisture is very important. The goal is to create compost with the consistency of a wet leafy mush.
 - During the shifts from season to season, if there is a lot of compost, it can catch on fire if it gets too dry. This is due to the amount of heat the compost pile will naturally create.
 - Keep an eye on the pile, add some water to the pile when the pile looks and feels dry.



Adding Compost to the Soil:

A sifter is a wire netting that will separate large debris from the smaller pieces of compost. This can be a 1/2 inch wire netting (like chicken wire) in a wooden frame.



1. Place the sifter over a wheelbarrow. Use the sifter to sift through the compost, to remove all compost debris.
2. The composted soil left in the wheelbarrow is the soil you can use on your garden.
3. Debris you can find in the compost can include plastics, fishing line, pens, or large rocks. Sometimes you might come across some organic matter like bones, that have not completely decomposed. This organic matter takes longer to decompose and can be thrown back into the compost pile.

Fertilizer:

- Compost and Manure:
 - Do not add manure directly to the soil. Add finished compost and composted manure into the soil by mixing in the currently present soil.
- Fish emulsion (fish guts):
 - 2 tables spoons with 1 gallon of water (\$25-\$80) every 2 weeks
- Pro-grow from Milfa (2 bags) certifier organic fertilizer:
 - 1 handful (whole, water, fertilizer, plant, water) \$25-\$50/bag



Total added to the farm and around \$100 for 3/4 acre of land





Straw:

Benefits of Straw cover for Beds:

- An insulator, to keep the soil warm
- Provides organic matter to the soil
- Prevents soil erosion

An alternative to straw is leaves (either works):

- Shredded leaves break down faster than whole leaves, providing organic matter to the soil more quickly.
- Whole leaves make a mat on the soil and it is harder for the plants to grow compared to broken up leaves, which create more surface area and it act more like a mulch to allow plants to grow through the soil easily.

Seaweed:

- Adding Seaweed to your garden beds is an old indigenous practice.
- Beds can be covered with seaweed in the fall for healthier soil in spring

Benefits of Seaweed:

- More nutrients for the soil
- It has no weeds
- It is local
- Provides organic matter
- Prevents soil erosion
- Free fertilizer



EVERY Rhode Island resident has the right to go to any public beach and collect seaweed. You can collect seaweed in bags or buckets.

- Be careful of washed-up seaweed having some rocks and/or fishing line, hooks, and other debris
- There is no need to wash the seaweed before use, the salts do not harm the soil.

Straw vs. Leaves:

Straw	Leaves
<ul style="list-style-type: none"> • Less compact than leaves • Straw can be used in the warmer season to hold water in etc. • Good for plants that like the heat • Prevents soil erosion 	<ul style="list-style-type: none"> • More compact than straw • Cover crop • Organic matter • Prevents soil erosion

Feed the Soil, Cover the Soil:

You want to create light and fluffy soil, which indicates healthy, nutrient rich soil.

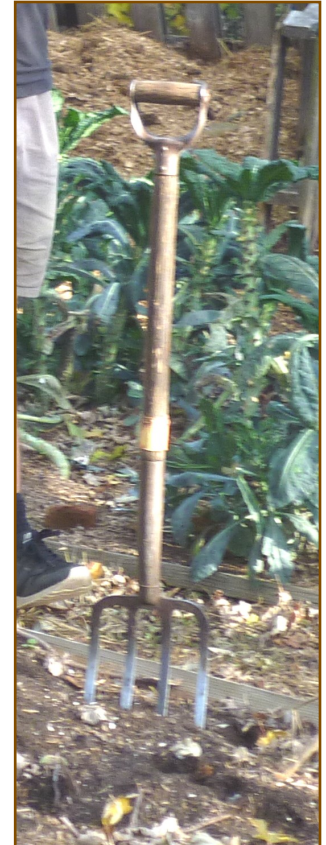
- On a small urban farm or garden using cover crops in the fall or practicing crop rotation for maintaining soil health can be inefficient because you can not have empty space for a growing season. Cover crops and crop rotation can be efficient and effective on larger farms or gardens.
- Instead of cover crops or crop rotation on a small urban farm or garden, you can cover your beds with hay or leaves to reduce the soil's exposure to the natural elements throughout the season. Hay and leaves can act as a cover crop.
 - In the field you can turn the hay and leaves into the soil by hand, or by tilling it when you are ready to plant.





Fall:

- Clear beds (most, leave specific species of plants to decompose over the winter)
- Fork the bed
- Weed the bed
- Spread sifted compost
- Add straw, leaves, or seaweed to the beds (depending on what you plan on growing in the beds)



Winter

- Let the organic matter decompose over the winter
 - You can throw any dead leaves onto your compost pile
- Seaweed:
 - Put seaweed all over beds of garlic, and any extra can go into the compost piles
 - You can either sprinkle seaweed or have a solid layer of seaweed over the beds
- Snow can act as another kind of “cover crop” to protect the soil





Spring:

1. Weed, pull the undesirable plants and clean the beds. Dead plants, leaves, etc. can be thrown into the compost pile.
2. Fork the beds and turn the straw and leaves left from the winter into the soil.
3. Add sifted compost to the topsoil. Using a rake, spread the added compost over the beds. The more compost the better. Keep in mind that lots of compost is good for your soil if you have bad soil. If you have good soil, you do not need to add a bunch of compost to it.

Note: You will want to complete steps 1-3 in one day.

4. Direct seed and transplant plants. Add GrowPro or another fertilizer to the soil BEFORE you transplant, by making a big hole where the plant will be transplanted, adding GrowPro or another fertilizer, and transplanting the plant. When transplanting, ONLY turn or fork beds.
5. Add straw, leaves or seaweed to the beds (depending on what you plan on growing in the beds).



All Season Long:

1. Weed beds

2. Fork Beds

3. Spread Compost





Summer:

(Throughout the growing season)

- Make sure to properly maintain your compost bin by
 - Adding compostable organic matter and manure
 - Reducing smell and pests by adding carbon matter like wooden pallets
 - Continually aerating your compost pile
- Property maintain your tools and equipment (you can do this in the winter too)
 - To keep wood durable and metal tools from rusting by coating it in olive oil or linseed oil



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