



KNOW YOUR

SOILS

CREATING HEALTHY SOIL & PRODUCTIVE GARDENS

The foundation of a healthy garden is healthy soil.



Healthy and productive soil has a balance of nutrients and good structure that allows for ample microbial and plant growth. Building healthy soil takes time, even a few growing seasons, but there are ways to improve your soil and grow edibles and other plants at the same time. This booklet is your introduction to soil testing and using amendments to build healthy soil. We'll start with a brief introduction to soil structure, and dive into soil testing, and choosing and using amendments and fertilizers to create productive, healthy soil.

Soil Structure

Good physical soil structure, with plenty of pores for roots, air, water, and soil organisms, enables your plants to reap the benefits of your amendments. Maintain good soil structure by following these guidelines:

Decrease erosion

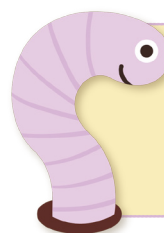
- Use mulch
- Keep soil covered year round

Avoid soil compaction

- Create footpaths around growing areas
- Avoid the use of heavy machinery, like rototillers
- Avoid over-watering

Protect soil life and waterways

- Fertilize responsibly
- Irrigate appropriately to keep nutrients where plants can use them



Don't treat your soil like dirt! We have all done it- we see a yellow or wilting leaf, and grab the nearest fertilizer. While this may give a jolt to the plant, it rarely solves the underlying issue in the soil.

What is a soil test?

Soil tests identify the amounts of certain nutrients that are present in your soil, and are recommended every 1–3 years. Soil samples should be taken in the fall for the next year's garden or a couple months before planting the garden in early spring. It is best to sample when the soil is not saturated.

For most lawns and gardens, a basic soil test which includes nitrogen, phosphorus, potassium, magnesium, calcium, sodium, sulfate, organic matter, and pH will suffice. It may take up to 2 weeks to receive your results. Give us a call if you need help interpreting soil tests or determining rates of application.

Every garden is different. A technique that works well in one yard may not work as well in another. Experiment with your garden, keep a journal, and observe over time which practices work and which ones do not.



Soil Testing: Taking Samples

1. Define your sample area(s). Remember each sample should be of similar use or conditions. Raised beds, lawns, and acid-loving plants (rhododendrons, blueberries) would require separate tests. In the example below, they are sampling (1) the large garden bed in front of their house and (2) the orchard area to the side of their house.
2. Gather your supplies. You will need a shovel or hand trowel, a clean plastic container, and sample bags, one for each sample area. New zip-top bags work as sample bags, too.
3. For each sample, collect at least 5 slices of soil from across the sample area in a random, but evenly distributed pattern. A zig-zag pattern works for larger sample areas.
4. Dig out a slice of soil with a shovel or trowel to a depth of 6".
5. Remove plant and root material, rocks, twigs, sod, and any debris from the soil. Place soil in a clean plastic bucket.
6. Move to the next spot and repeat steps 4–5 at least 5 times.
7. Once all of the slices have been collected, break up any clumps and mix the soil thoroughly. Remove any remaining plant and root material, rocks, twigs, sod, and debris from the sample.
8. Put a minimum of 2 cups of the mixed soil in the sample bag or zip-top bag. Label the bag with your name and five letters or numbers that will help you remember where the sample was taken.
9. Send samples to the lab of your choosing immediately, as soil chemistry changes rapidly with time. If you are not mailing them that day, place the sealed samples in a refrigerator or freezer. If samples are over-saturated, put the soil on a newspaper and let air dry overnight.



You have your soil test results – what's the next step?

The soil test report should include explanations about what the results mean and provide recommendations for how much of each nutrient to apply to help you grow what you want to grow.

For example, the report may show that nitrogen levels in your lawn soil are a little lower than is optimal for growing turf grass. The lab may recommend 2 pounds of nitrogen per 1,000 square feet of lawn for improved turf health. Nitrogen comes from many different sources and in different amounts depending on the source or product. How do you choose a product to supply the nitrogen and how much do you apply to your lawn?

The following pages will clarify:

1. How each nutrient affects soil fertility and plant growth.
2. How to choose from among the many different nutrient sources/products to meet your goals.
3. How to calculate the amount of each product to apply in your situation.



Organic Matter & Micronutrients

Organic matter is the amount of carbon compounds in your soil that were formed by living organisms. It plays a key role in supplying plants and soil microbes with the food they require. Organic matter also helps improve soil structure, binds pollutants, and increases the soil's ability to resist changes in pH. An ideal percentage of organic matter for most gardens is 3.5%. Basic soil tests also report micronutrients like magnesium, calcium, sodium, and sulfate. These are also important parameters to ensure plant health and growth.

Amendment	How to Apply	Nutrient Release Rate	Notes
Compost	Mix 2–3 inches into topsoil.	Slow release of nutrients.	Provides the best and most even infusion of nutrients, including micronutrients into your soil.
Animal Manure	Till in 4–6 inches or use as mulch.	Quick release of nutrients.	Use only fully composted manure from a reputable source. Don't use manure from pigs, cats, or dogs.
Cover Crops	Plant crops like crimson clover, oats, rye, and hairy vetch in the fall. Work them into the soil 3–4 weeks before planting your garden.	Slow release of nutrients.	Also suppresses weeds, reduces runoff, improves soil structure, adds organic matter to soil, and suppresses soil diseases and pests.
Mulch	Place 2–3 inches of leaves, wood chips, or grass clippings on surface of soil.	Slow release of nutrients.	Use grass or leaf mulch for edibles and woody mulch for ornamentals.





Soil pH

Soil pH is a measure of the acidity of the soil. The pH scale ranges from 0-14 with 7 being neutral. If pH is less than 7 the soil is acidic. If pH is greater than 7 the soil is basic. Soil pH directly affects nutrient availability. Due to our winter rains, most soils in the Pacific Northwest are slightly acidic. The optimal pH for lawns and gardens is 6.5. Soil pH preference lists can be found online.

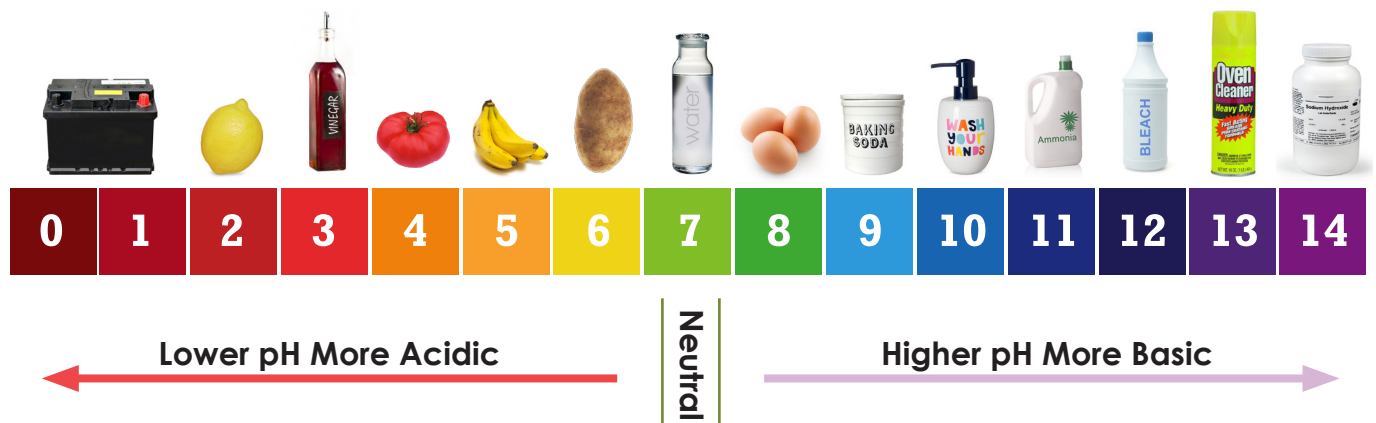
Lowering pH

Amendment	How to Apply	Nutrient Release Rate	Notes
Compost	Mix 2–3 inches into topsoil.	Gradually lowers soil pH.	This option takes time and is great for long term goals.
Acidic Mulch	Apply to top layer of soil.	Gradually lowers soil pH.	Conifer needles work great as an acidic mulch.
Sulfur	Work into soil 4–6 inches.	Gradually lowers soil pH.	Has a long lasting effect. Best to incorporate before planting. Hard to incorporate once plants are established.

Raising pH

Amendment	How to Apply	Nutrient Release Rate	Notes
Lime	Work into soil 4–6 inches or apply to surface. Apply when soil is moist in fall or early spring.	Gradually raises soil pH.	Use slow release granular or pelletized lime. For best results apply 2–3 months prior to planting.
Wood Ashes	Work into soil 4–6 inches in the spring.	Very gradually increases soil pH.	Not as effective as lime. Ashes should not come into contact with seedlings or plant roots.

pH Scale





Nitrogen (N)

Nitrogen produces the highest growth response in plants of all nutrients, and is essential for development and reproduction.

Amendment	How to Apply	Nutrient Release Rate	Notes
Compost	Mix 2–3 inches into topsoil.	Slow release of nutrients.	Provides the best and most even infusion of nitrogen into your soil.
Blood Meal	Work into soil 4–6 inches.	Rapid release of nutrients.	Especially good for edibles like broccoli, cabbage, etc.
Cover Crops	Plant cover crops like crimson clover, oats, rye, and hairy vetch in the fall. Work them into the soil 3–4 weeks before planting your garden.	Slow release of nutrients.	Also suppresses weeds, reduces runoff, improves soil structure, adds organic matter to soil, and suppresses soil diseases and pests.
Mulch	Place 2–3 inches of leaves, wood chips, or grass clippings on surface of soil.	Slow release of nutrients.	Use grass or leaf mulch for edibles and woody mulch for ornamentals.
Fish Emulsion	Dilute and apply according to instructions on bottle.	Very quick release of nutrients.	Comes in liquid form.
Feather Meal	Work into soil 4–6 inches.	Very slow release of nutrients.	Excellent long term solution.
Alfalfa Meal	Work into soil 4–6 inches.	Quick release of nutrients.	Avoid contact with roots and seedlings.
Soybean Meal	Work into soil 4–6 inches.	Slow to moderate release of nutrients.	Can inhibit seed germination, so apply after small seeds like lettuce have sprouted.



Did you know? Woody mulch or ‘Arborist’s Chips’ are ideal for trees, shrubs, and ornamentals. The best source is your local arborist. Sign up for delivery at www.getchiptop.com.

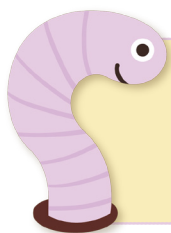




Phosphorus (P)

Plants must have adequate supplies of phosphorus for normal growth and maturity. Phosphorus plays a role in photosynthesis, plant growth, and is especially vital for young transplants, like edibles.

Amendment	How to Apply	Nutrient Release Rate	Notes
Compost	Mix 2–3 inches into topsoil.	Slow release of nutrients.	Provides the best and most even infusion of phosphorus into your soil.
Bone Meal	Work into soil 4–6 inches.	Quick release of nutrients.	Good for side dressing early in the season.
Fish Bone Meal	Work into soil 4–6 inches.	Quick release of nutrients.	Also contains good amount of calcium.
Rock Phosphate	Work into soil 4–6 inches.	Very slow release of nutrients.	Good for long term goals.
Bat Guano	Work into soil 4–6 inches or use as a top/side dressing.	Quick release of nutrients.	Works really well in edible container gardens.
Composted Chicken Manure	Work into soil 4–6 inches or spread it on the surface.	Slow to moderate release of nutrients.	Use only fully composted manure from a reputable source.



Did you know? Commercial rapid release phosphorous (P) fertilizers are now regulated in Washington state, and are limited to one-time starter applications. This is because P is the main culprit of algae in our lakes and streams. Slow release P fertilizer is still allowed in the forms listed above, and is better for the environment.

Potassium (K)



Potassium plays an active role in the production of plant proteins and helps regulate the flow of water through the plant. It is essential for overall plant health.

Amendment	How to Apply	Nutrient Release Rate	Notes
Compost	Mix 2–3 inches into topsoil.	Slow release of nutrients.	Provides the best and most even infusion of potassium into your soil. Compost with fruit and vegetable waste works especially well.
Wood Ash	Work into soil 4–6 inches. Use 1 pound/10 square feet.	Very slow release of nutrients.	Also raises the pH of your soil. Do not use ash from treated/painted wood or wood pellets.
Kelp Meal or Seaweed	Work into soil or spray soil with a liquid seaweed spray.	Very slow release of nutrients.	Comes in different forms. These include ground powder and liquids.
Greensand	Work into soil 4–6 inches.	Very slow release of nutrients.	Long term soil conditioner. May be added to your compost pile to improve the potassium content of your compost.



Calculating Amounts of Recommended Fertilizer

The soil testing company will provide fertilizer recommendations based upon your results. When looking at a package of fertilizer, pay attention to the three numbers shown. From left to right they stand for nitrogen (N), phosphorus (P), and potassium (K) by percentage (%) of weight in the package.

How much of each nutrient is in a package of fertilizer? Let's take a look at the pictured box of soybean meal. In order to calculate the amount of each nutrient in the box, take the weight of the box (in this instance 6 lb), multiply it by the amount of the nutrient (either 7, 1, or 2, depending on nutrient you are interested in), and divide it by 100. This will give you the pounds per box of the nutrient in question. We walk you through each equation and show you the pounds per box of each nutrient below.

$$\frac{6 \text{ lb} \times 7}{100} = 0.42 \text{ lb N per box}$$

Nitrogen (N) = 7

$$\frac{6 \text{ lb} \times 1}{100} = 0.06 \text{ lb P per box}$$

Phosphorus (P) = 1

$$\frac{6 \text{ lb} \times 2}{100} = 0.12 \text{ lb K per box}$$

Potassium (K) = 2



How much fertilizer do I need to use? Say the soil testing company recommends that you apply 1 lb of nitrogen per 1,000 square feet (ft²). You look at the amendments that help increase nitrogen, on page 5, and decide to use soybean meal. You know that you will get 0.42 lb of nitrogen in a 6 lb box of fertilizer with a ratio of 7-1-2, so you would need to use about 2 boxes of this fertilizer per 1,000 ft² to follow the suggested recommendations.

What if the area I need to fertilize isn't 1,000 ft²? The soil testing company will always provide your application recommendation per 1,000 ft². So, if the area you need to fertilize is smaller or larger than 1,000 ft², scale the application rate up or down. If in doubt, it's better to use less than more and if you have any questions, give us a call.



You can measure the size of your sample area without a measuring tape!

- Measure the length (in feet) of your normal stride and write it down.
- Divide your sample area that will be fertilized into rectangles if you have an odd-shaped lot.
- Pace off each rectangle, measuring their width and length based on the length of your stride.
- Calculate the square footage (width x length) of each rectangle.
- Add up the square footage of all rectangles in the area to be fertilized.

How to Apply Soil Amendments

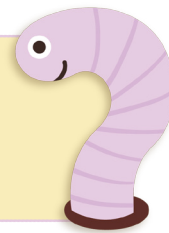
Fertilizer application is not a complicated process. There are a number of ways to apply fertilizers, safely, depending upon the amount needed and the size of the area. For most scenarios, you can mix amendments. The exception is if you are significantly trying to change your pH. Do that as a separate first step, wait several weeks, then work in your other amendments.



Safety

- Read fertilizer labels carefully.
- Store fertilizers out of the reach of children and pets. Keep the materials in a locked cabinet in the garage or a shed.
- Wear gloves when handling fertilizers.
- Pay attention to how long to keep children and pets away from application areas.

What is weed-and-feed? A popular type of fertilizer, weed and feed combines herbicide with rapid release fertilizer. However it can harm the environment AND get tracked into our homes.



Applying Fertilizer

- **Pre-plant application:** Scatter fertilizer over the entire area and till it into the soil using a hoe or rake.
- **Broadcast pre-plant application:** Suitable for larger areas. Use a calibrated spreader and till into the soil using a hoe or rake.
- **Dilution application:** Dilute fertilizer in a bucket or watering can and use that solution to water your plants. Follow instructions- some amendments like compost tea can be applied to leaves, others should be applied just to soil and roots.
- **Side dressing:** Walk down the row of plants with fertilizer in a dry bucket and spread a small amount around each plant, tilling in slightly.
- **Check the weather:** Apply when it is unlikely to rain more than $\frac{1}{4}$ inch within a day.





About Snohomish Conservation District

Each year Snohomish Conservation District works with thousands of landowners from apartment dwellers to commercial farms and everything in between. We are proud to provide technical, educational, and financial assistance on a voluntary basis to these folks who are creating better ground in the communities where they work, live, and play.

District boundaries include Camano Island and most of Snohomish County. We operate with a diverse staff ranging from engineers, resource planners, community conservation staff, restoration specialists, and a field crew.



Our Services

(Within Snohomish County and Camano Island)

- On-site Consultations
- Backyard Habitat
- Stormwater Solutions
- Low Cost Rain Barrels
- Sound Horsekeeping
- Youth Education
- Habitat & Stream Restoration
- Farm and Rural Property Planning
- Forestry and Firewise
- Cost-Share Opportunities
- Manure & Seed Spreader Program
- Annual Conservation Plant Sale

Program Highlight: Lawns to Lettuce

Are you tired of the maintenance of a lawn? Do you want to learn how to grow food? The Lawns to Lettuce program may be for you! This program encourages landowners to convert a portion of their lawn to grow edibles in a way that builds healthy soil, protects pollinators, minimizes pesticide use, reduces runoff and conserves water.

Get Involved!

- Join us at one of our Lawns to Lettuce workshops.
- Send us photos of your projects! If you've replaced a portion (or all) of your lawn with edibles, your example can help encourage others.
- Cost-share opportunities are available to qualified individuals and organizations that are working towards community-based urban agriculture in Snohomish County and Camano Island. Cost-share projects can include building materials for raised beds, seeds, soil, compost, rain catchment systems, and more!

Learn more at:

www.snohomishcd.org/lawns-to-lettuce
 Email lawnstolettuce@snohomishcd.org or call
 425-335-5634



Resources

Many gardening resources exist to help you enjoy your garden. Learn, experiment, and most importantly, have fun! Gardening allows us to reap what we've sown, provides a total-body workout, and provides opportunities to reconnect with nature and our loved ones. So grab a shovel and some compost and get out there!

*www.snohomishcd.org/lawns-to-lettuce
www.betterground.org*

*www.tilthalliance.org
www.growsmartgrowsafe.org*

Remember, every garden is different.

This booklet is your introduction to soil testing and using amendments to build healthy soil. Experiment with your garden, keep a journal, and observe over time which practices work and which ones do not.

Good luck and happy experimenting!

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