

N-P-K, Soil pH, Soil Amendments, and More

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When it comes to growing a healthy and productive garden, **soil preparation** is key! Here are some tips for preparing your soil for planting.

Why Does Having Good Soil Matter?

There's a lot more to soil than just dirt and rocks! Soil is full of minerals, microbes, and other microscopic things that plants need to survive. Plants don't root into soil simply as a means to stay upright; soil is a plant's primary source of nutrients and water, so having high-quality soil is important for healthy plant growth.

All vegetables need soil that's rich in nutrients, but some soil needs a helping hand. Here are key things to keep in mind when building healthy soil:

Take a Soil Test

Before adding anything to your garden soil, test it to see what's already there. This will allow you to tailor your amendments or fertilizers based on what your soil actually needs, and prevent you from overloading it with any particular nutrient.

- Test results should reveal the soil's pH, phosphorus, calcium, potassium, soluble salts, soil texture, and more. However, a general soil test will not reveal insects, diseases, or chemical residues.
- There are a few ways to get a soil test. First, you could buy an inexpensive soil test kit at your local garden store. Or, you could contact your [local cooperative extension service office](#) for a free (or fairly cheap) soil test. For more reading, see this gardening blog about a resource that provides [soil types around the country](#).

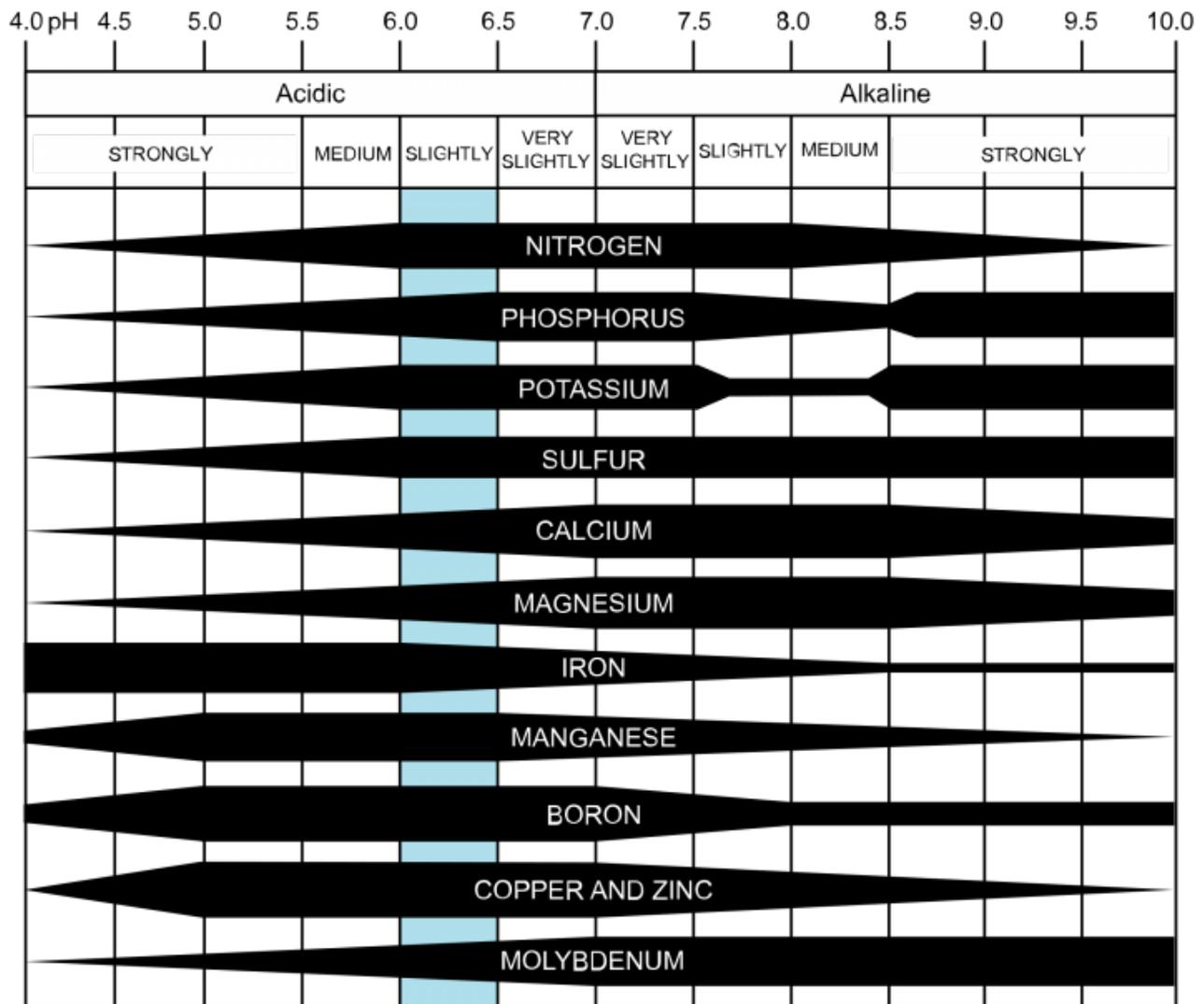
Adjust the Soil pH

Soil pH affects the availability of nutrients and minerals in the soil, as well as how well a plant can absorb and regulate these materials. A very high or very low soil pH may result in nutrient deficiency or toxicity, leading to poor plant growth—or worse!

- The standard pH scale ranges from 0 to 14, with 7 being “neutral,” 0 being “extremely acidic,” and 14 being “extremely alkaline” (or “basic”). Generally, soil pH doesn't reach the upper and lower limits of the pH scale; most garden soils will fall somewhere between 5 and 9 on the scale.
- **For most plants, the ideal pH range is between 6.0 and 6.5 (slightly acidic)** . Microbial activity is greatest and plant roots access nutrients best when the soil pH is within this range (see chart, below). However, different plants are able to tolerate different pH

ranges. [Find a list of common garden plants and their pH preferences here.](#)

Availability of Nutrients at Varying pH Values



This chart shows the availability of nutrients at different pH levels. Slightly acidic soil (6.0–6.5 pH) is best for most plants. Image by CoolKoom/Wikimedia.

How to Adjust Soil pH

After testing your soil, you may find that the soil pH isn't within the ideal range of 6.0–6.5. To get it into this range, you'll need to add "soil amendments" that raise or lower the pH. (Follow instructions on product packaging to know how much to use.)

- To **raise soil pH**, add **lime (pulverized limestone) or wood ash**.
- To **lower soil pH**, add **sulfur, peat, or organic materials (such as compost)**.

Know Your N-P-K

Plants' primary nutrients are nitrogen (N), phosphorus (P), and potassium (K). These are available in chemical/synthetic (non-organic) fertilizers or in the organic additives suggested here. On the package of a fertilizer, you'll see these three values separated by dashes (N-P-K); the numbers of each nutrient indicate the percentage of net weight contained.

- **Nitrogen (N)** promotes strong leaf and stem growth and a dark green color, such as desired in broccoli, cabbage, greens and lettuce, and herbs. Add aged manure to the soil and apply alfalfa meal or seaweed, fish, or blood meal to increase available nitrogen.
- **Phosphorus (P)** promotes root and early plant growth, including setting blossoms and developing fruit, and seed formation; it's important for cucumbers, peppers, squash, tomatoes—any edible that develops after a flower has been pollinated. Add (fast-acting) bonemeal or (slow-release) rock phosphate to increase phosphorus.
- **Potassium (K)** promotes plant root vigor, disease and stress resistance, and enhances flavor; it's vital for carrots, radishes, turnips, and onions and garlic. Add greensand, wood ashes, gypsum, or kelp to increase potassium.

Learn more about [NPK Ratio: What Do Those Numbers Mean?](#)

Avoid applying excess chemical/synthetic fertilizer. It can damage roots and/or reduce the availability of other elements. Because organic fertilizers release their benefits more slowly, they are less likely to burn plants, although some, such as fresh manure, can do so. Once the nutrients are in the soil in an available form, plants cannot distinguish between synthetic and organic fertilizers. Organic fertilizers, however, tend to also improve soil structure and encourage earthworms and microorganisms that improve overall soil health.

When is a good time to fertilize your vegetables? [See our Growing Vegetables Guide.](#)

Soil Structure and Drainage

The structure and consistency of your soil plays a big factor in the success of your garden, too. Soil that hold too much water can promote fungal infections such as root rot, while soil that holds too little water can lead to malnourished and dehydrated plants.

- If you have **clay soil**, add coarse sand (not fine beach sand), compost, and peat moss to add texture and drainage to the soil.
- If you have **sandy soil**, add humus or aged manure, peat moss, or sawdust with some extra nitrogen. Heavy, clay-rich soil can also be added to improve the soil.
- If you have **silt soil**, add coarse sand (not fine beach sand), pea gravel and compost, or well-rotted horse manure mixed with fresh straw.

Common Soil Amendments

These soil amendments are commonly used to adjust the consistency and content of garden soil:

- **Bark, ground:** made from various tree barks. Improves soil structure.
- **Compost:** excellent soil conditioner that adds nutrients. May also lower soil pH.
- **Leaf mold:** decomposed leaves that add nutrients and structure to soil.
- **Lime:** raises the pH of acidic soil and helps to loosen clay soil.
- **Manure:** best if composted. Good conditioner.
- **Peat moss:** conditioner that helps soil retain water and can lower soil pH.
- **Sand:** improves drainage in clay soil.
- **Topsoil:** usually used with another amendment. Replaces existing soil.

If you are starting from scratch with a small field or large garden that is either over-spent or neglected, [see our article about reclaiming your garden soil](#).

Now that you know the importance of high-quality soil, you're ready to grow your best garden yet. Happy gardening!