NEP-251

Growing Your Own
A beginner's guide to gardening

Soil Testing

Every time you grow something, the plant takes nutrients from the soil. Testing a soil sample before planting your garden can help you know what nutrients or other chemicals are present in your soil. The results recommend what fertilizers you may need to add for a successful crop. Healthy soil leads to healthy plants.

How and when should I collect a soil sample?

Test your soil at least once a year. It can take several weeks to get your soil sample results back. Do a soil test one to two months before you will plant your garden.

You can bring soil samples to your local Cooperative Extension office for free or low-cost testing. They will submit your samples to the lab.

You will need to collect two cups of dry soil from your garden area. To take a sample, insert a shovel or trowel about six inches into the soil. Try to dig out a slice of soil that is a full six inches deep. Remove any grass or mulch and place the soil in a clean bucket. Repeat this in four to six spots around your garden area. Mix all the soil together, then bring the sample to your Extension office.

You may grow plants in a variety of areas, such as flower beds or lawns. Submit a separate sample for each area that you want to fertilize. For raised beds, submit one sample that combines soil from all raised beds. If one raised bed is showing problems, submit a separate sample for that bed. If you are growing plants like blueberries or asparagus, they require a different soil pH (see the graphic on soil pH levels for garden plants). Submit a separate sample for each of these crops.

Be sure to label each sample before you turn it in. Record where each sample was taken so you can remember when you get the results.

Cooperative Extension Service

SNAP Putting Healthy Food Within Reach
USDA Supplemental Nutrition Assistance Program

This institution is an equal opportunity provider.

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EFNEP Expanded Food and Nutrition Education Program

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What does a soil test check?

Your soil sample will be tested for levels of basic nutrients and important qualities like pH. Your test results can only tell you what the levels were at the time of sampling. Fertilizers and other soil conditioners can change these levels to help plants grow stronger. Remember to wait for your test results before adding anything to your garden.

Soil pH

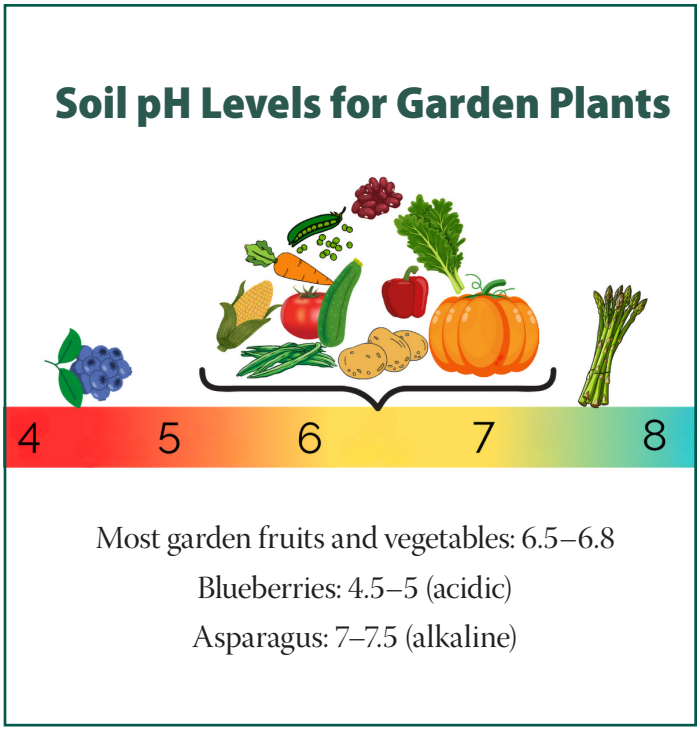
The soil pH tells you how acidic or alkaline your soil is at the time of sampling. The pH scale ranges from 1 to 14. Neutral is 7. Acidic is below 7, and basic or alkaline is above 7.

The test results will tell you if you need to adjust your soil pH. Soil pH can only be adjusted by a limited amount each year. If pH is a problem, test soil each year and continue to adjust.

Soil nutrients

Most nutrients that plants need come from the soil. Plants use larger amounts of these three nutrients: nitrogen (N), phosphorus (P) and potassium (K). Fertilizer packages will list this as the N–P–K ratio.

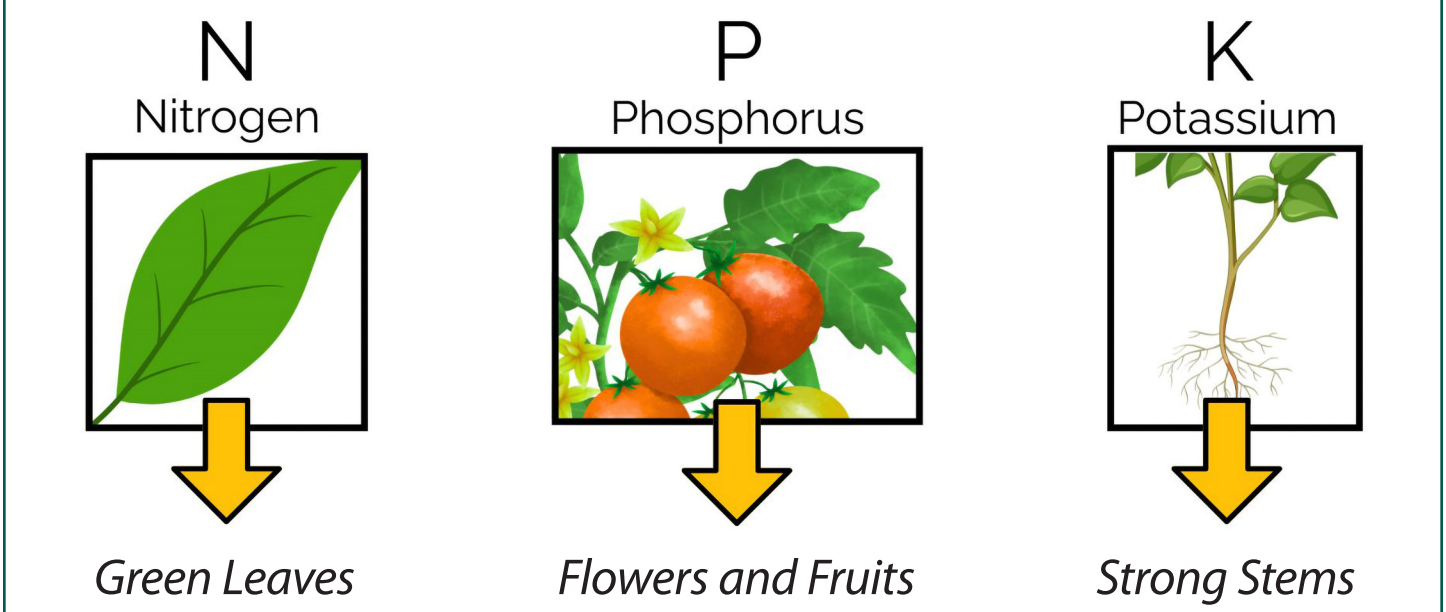
- *Nitrogen* makes plants green and helps them grow. Expect to add nitrogen regularly, either with compost or fertilizer. The soil test results will recommend how much nitrogen to add, depending on what you plan to grow.
- *Phosphorus* helps plants grow flowers and fruits. In Kentucky, our soils often have plenty of phosphorus. Only add more if your soil test says you need to.



- *Potassium* helps the plant move water from the roots to the leaves and makes plant stems strong. Potassium is sometimes needed. Check your soil test results.

Lead and toxins in soil

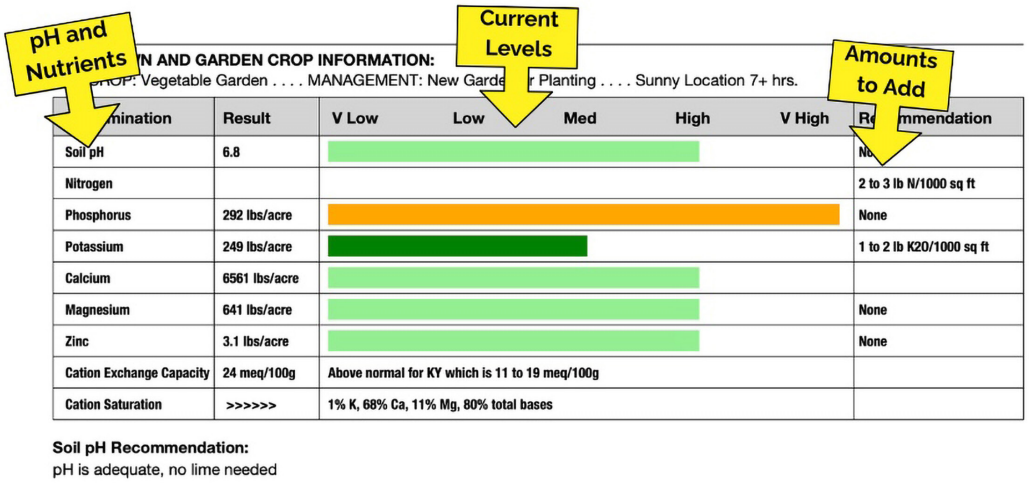
Soil samples can also test for lead and other toxins. If you are concerned about lead or other toxins in your soil, talk to your local Extension office. The county office may recommend other tests to check for these toxins. There may be an additional cost. Your county Extension agent can help with this process.



Nitrogen, phosphorus, and potassium are important nutrients that each support plant growth in different ways.

What is on the soil test report?

Your soil test report includes a pH and nutrient levels table and agent recommendations to help you interpret and apply the test results.



An example of a vegetable garden soil test table. This report shows that pH for the sample needs no change and the phosphorus is high. It recommends adding two to three pounds of nitrogen (N) and one to two pounds of potassium (P) per 1,000 square feet.

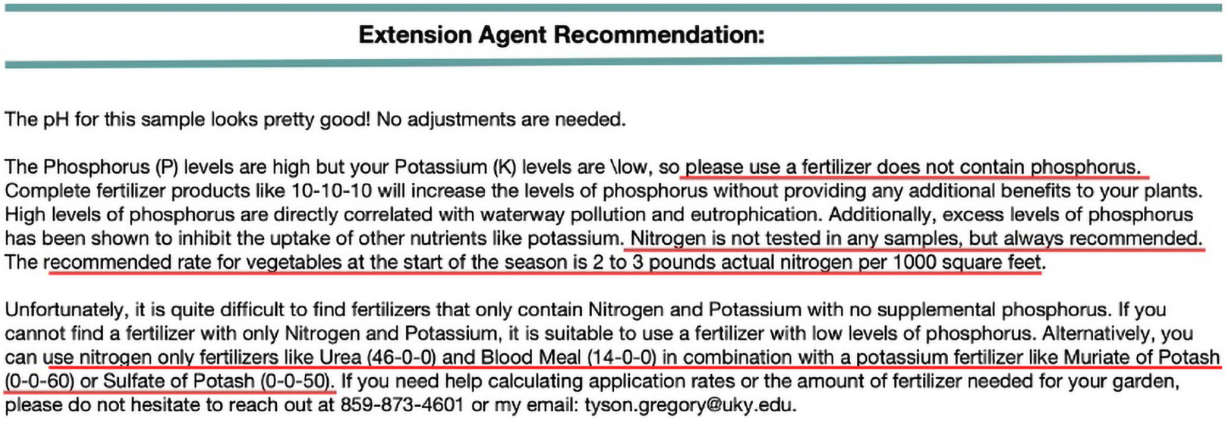
Levels table

The table shows your soil's pH and nutrient levels at the time the sample was taken. The column on the right shows the amounts of additional nutrients recommended per 1,000 square feet.

Agent recommendations

The second page of your soil test report shows agent recommendations. This section gives advice on what nutrients to add and how to adjust the soil pH, if needed. Important information you should note is underlined in red in the Extension Agent Recommendations example.

- **Check the pH.** Your agent will recommend if you should add anything to adjust the pH.
- **Don't add phosphorus**. Most Kentucky soil is high in phosphorus. Using a balanced fertilizer (10–10–10) will only add excess phosphorus, which can pollute waterways.
- **Do add nitrogen.** Nitrogen is the most important nutrient to add for Kentucky soils. Your report will tell you how much to add.



Extension Agent Recommendation:

The pH for this sample looks pretty good! No adjustments are needed.

The Phosphorus (P) levels are high but your Potassium (K) levels are \low, so please use a fertilizer does not contain phosphorus. Complete fertilizer products like 10-10-10 will increase the levels of phosphorus without providing any additional benefits to your plants. High levels of phosphorus are directly correlated with waterway pollution and eutrophication. Additionally, excess levels of phosphorus has been shown to inhibit the uptake of other nutrients like potassium. Nitrogen is not tested in any samples, but always recommended. The recommended rate for vegetables at the start of the season is 2 to 3 pounds actual nitrogen per 1000 square feet.

Unfortunately, it is quite difficult to find fertilizers that only contain Nitrogen and Potassium with no supplemental phosphorus. If you cannot find a fertilizer with only Nitrogen and Potassium, it is suitable to use a fertilizer with low levels of phosphorus. Alternatively, you can use nitrogen only fertilizers like Urea (46-0-0) and Blood Meal (14-0-0) in combination with a potassium fertilizer like Muriate of Potash (0-0-60) or Sulfate of Potash (0-0-50). If you need help calculating application rates or the amount of fertilizer needed for your garden, please do not hesitate to reach out at 859-873-4601 or my email: tyson.gregory@uky.edu.

The agent recommendation section of the soil test report explains the table and gives options for amending your soil. This section provides key information that should be noted (underlined in red above).

The Garden Area = Length x Width

Find your garden's area by multiplying length times width. A 10-foot-by-10-foot garden has an area of 100 square feet, and a four-foot-by-eight-foot raised bed has an area of 32 square feet.

How do I use the results to improve my soil?

The soil test report will tell you how much of each nutrient to add. The rate will be given per 1,000 square feet, which is quite large. You will need to find the area of your garden to determine how much is needed for your own growing spaces.

Find your garden area

Your garden area equals the length times the width. See the example shown for a 10-foot-by-10-foot garden or a four-foot-by-eight-foot raised bed. Once you know your garden area, you can apply the soil test report recommendations to your garden. *See the Soil Nutrient Worksheet in this publication for more information.*

How Much Does This Garden Need?

To find out how much of a nutrient you need to apply to your garden bed, use this formula:

Garden Area X Report Recommendation ÷ 1,000 = Amount Needed

The following table shows how the formula would be applied for example measurements shown in this publication.

Garden area (sq ft)	Report recommendation (3 lb N/1,000 sq ft)[1]	Per-square-foot adjustment[2]	Amount needed (lb N)
32 (raised bed[3])	Multiply by 3	Divide by 1,000	0.096
100 (garden[4])	Multiply by 3	Divide by 1,000	0.3

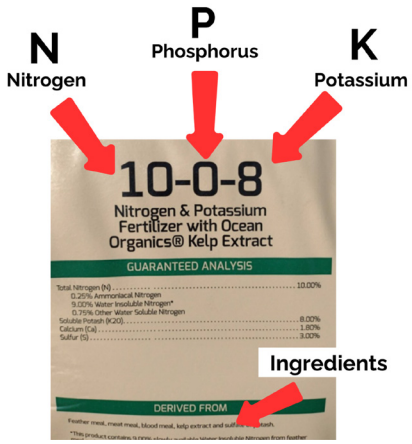
[1] The soil report recommendation in the levels table example calls for applying three pounds of nitrogen per 1,000 square feet (3 lb N/1,000 sq ft), so the garden area is multiplied by three.
[2] Dividing by 1,000 adjusts the report recommendation amount per 1,000 square feet to a per-square-foot rate.
[3] Area for 4-foot-by-8-foot raised bed example
[4] Area for 10-foot-by-10-foot garden example
See the Soil Nutrient Worksheet in this publication to apply your soil report recommendations to your garden space.

Using Fertilizer

Your fertilizer's label lists an N–P–K value. This tells you how much of each nutrient (nitrogen, phosphorus, and potassium) is in the product by weight. For example, a 10–10–10 fertilizer is 10% nitrogen, 10% phosphorus, and 10% potassium.

If you do nothing else, almost every garden will benefit from an application of nitrogen at a rate of two to three pounds per 1,000 square feet. Three common sources of nitrogen are:

- Compost (0.5–0.5–0.5 on average, but analysis varies). Make your own or buy compost. Compost is often sold in one-cubic-foot bags, which usually weigh 40 to 50 pounds.
- Bloodmeal (14–0–0). It is sold as powdered granules in a bag. One pound typically equals three cups.
- Natural lawn fertilizer (10–0–2). Although not sold for use on vegetable gardens, there are many plant-based "natural" lawn fertilizers that are safe and easy to spread on your garden. Be sure to buy a product that does not include any herbicide or other materials.



Fertilizer labels will list their "N–P–K" ratio. The numbers tell you how much nitrogen (N), phosphorus (P), and potassium (K) are in the product (in percentage by weight).

If you want to calculate exact amounts to use of specific fertilizers, check the Extension Fertilizer Calculator at https://www.rs.uky.edu/soil/calculators/one_fert.php. You can also ask your Extension agent for help .

Adding Nitrogen to a Garden

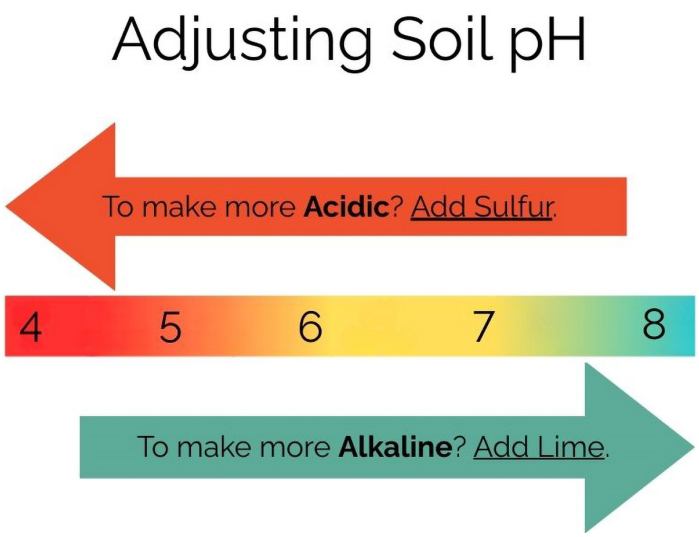
Example Garden	Nitrogen Source		
	Compost (0.5–0.5–0.5)	**Bloodmeal** (14–0–0)	**Natural Lawn Fertilizer** (10–0–2)
Raised bed (32 sq ft)	20 lb	2/3 lb (2 cups)	1 lb (2 cups)
Garden (100 sq ft)	60 lb	2 lb (6 cups)	3 lb (6 cups)

This table shows how to add the basic amount of nitrogen (2-3 lb/1,000 square feet) using three common fertilizers: compost, bloodmeal, and natural lawn fertilizer. The examples given are for a four-foot-by-eight-foot raised bed or a 10-foot-by-10-foot garden.

Adjusting pH

The pH number on your soil report will tell you how acidic or alkaline your soil is and how to adjust it. If your soil pH is between 6.5 and 6.8, you won't need to adjust it for a vegetable garden. Some crops have specific pH needs.

Usually, you add sulfur to lower the number and make soil more acidic. You can add lime to make the soil more alkaline and raise the number. The soil pH recommendations will tell you how much, if any, of each mineral to add. Sulfur and lime are both sold as bagged powder or pellets to mix into your soil. Follow the product instructions for how much to apply. Ask your Extension agent if you have further questions.



Soil Nutrient Worksheet

1. Measure your garden to determine the length and the width in feet.

    a. Length:_____ft. Width:_____ft.

2. Use the measurements from step 1 to calculate the square footage of your garden.

    a. _____ ft. length X _____ ft. width = _____ square feet

3. Look at the recommendations for nitrogen (N), phosphorus (P), and potassium (K) listed on your soil sample report.

    a. The recommended amount of nitrogen (N) is _____ lb.

    b. The recommended amount of phosphorus (P) is _____lb.

    c. The recommended amount of potassium (K) is _____ lb.

4. Multiply the recommended amounts of N, P, and K listed in step 3 (above) by the area of your garden in square feet (step 2).

    a. _____ lb of N recommended X _____ ft^2 garden area = _____ lb N

    b. _____ lb of P recommended X _____ ft^2 garden area = _____ lb P

    c. _____ lb of K recommended X _____ ft^2 garden area = _____ lb K

5. Divide the answers from step 4 by 1,000 to determine your amounts needed. *(We do this because the soil recommendations are per 1,000 square feet.)*

    a. _____ lb N ÷ 1,000 square feet = _____ lb N for your garden area

    b. _____ lb P ÷ 1,000 square feet = _____ lb P for your garden area

    c. _____ lb K ÷ 1,000 square feet = _____ lb K for your garden area

6. Use these recommendations when searching for fertilizers and amendments for your garden. Contact your Extension agent if you want more help.

Summary

How and when should I collect a sample?

Test your soil once a year, two to three months before you will plant. Take your soil samples to the Extension office for testing.

What does a soil test check?

A soil test will check the pH and nutrient levels in your soil. Talk to your Extension agent if you also want testing for lead and other toxins.

What is on the soil test report?

The soil test report with include a levels table and specific agent recommendations explaining what adjustments you should make. In most cases, they will recommend you don't add phosphorus. You can usually add nitrogen. Check your pH recommendations.

How do I use the results to improve my soil?

The soil test recommendations are given for a 1,000 square foot area. Find your garden area to calculate how much to add to your own garden. Compost, bloodmeal, and natural lawn fertilizer are all simple ways to add nitrogen to your garden areas. Use the soil nutrient worksheet to calculate the exact amounts for your garden.

Adjusting pH

Your soil test report will say if you need to adjust the soil pH. You can add sulfur to lower the pH or lime to raise the pH.

If you want to calculate exact amounts for your garden using specific fertilizers, you can use the Extension Fertilizer Calculator at https://www.rs.uky.edu/soil/calculators/one_fert.php. Ask your Extension agent for more help.

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