So you got a soil test… now what?

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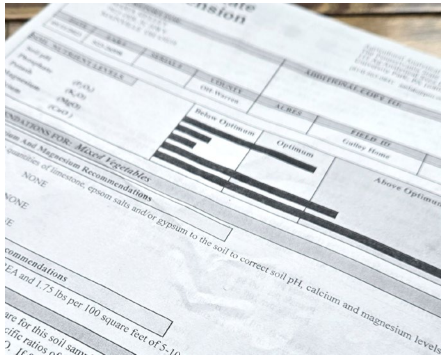
You did the thing.

You took a soil sample, following the directions to a T.

You submitted your sample properly to a reputable lab.



They sent your report to you a few weeks later.

Now what?

How do you take the information from your soil test results and translate that into products to buy and how much to use?

From the report to the garden

What you learn from a soil test

A review of why to get a soil test and what it can and can't tell you

How to translate the test for your site

Your recommendations come in pounds per 1,000 square feet. What does that actually mean for you?

How to take that translation to the store

Once you know pounds of nutrients, how do you find the right product and the right amount?

What you learn from a soil test

- Levels and recommendations for some nutrients
  - Potassium and phosphorus as macronutrients
  - Calcium and magnesium as higher need micronutrients

- Soil pH and recommendations for amendment

- Optional: organic matter percentage, cation exchange capacity

- You will not get nitrogen levels
  - Nitrogen is highly mobile in soil, so a point in time measurement isn’t very useful
  - Soil tests will still include a nitrogen recommendation for application based on what you are wanting to grow

Figuring out quantities of nutrients

1. Find out the area in square feet of the space you want to fertilize
2. Find the place on your soil test report where they tell you the amounts of nutrients as well as the unit of space the recommendation is for (Ex: 0.25 lbs nitrogen per 100 square feet, or 1.5 lbs potassium per 1,000 square feet)
3. Set up a ratio that compares the recommendation to your area

$$\frac{\text{recommended nutrient amount}}{\text{recommended square feet}} = \frac{\text{your nutrient needs (unknown)}}{\text{your garden square feet}}$$

4. Multiply your garden area by the recommended nutrient amount, then divide by the report square feet to get the amount you need for your space

$$\frac{\text{recommended nutrient amount}}{\text{recommended square feet}} = \frac{\text{your nutrient needs (unknown)}}{\text{your garden square feet}}$$

Figuring out quantities: Example

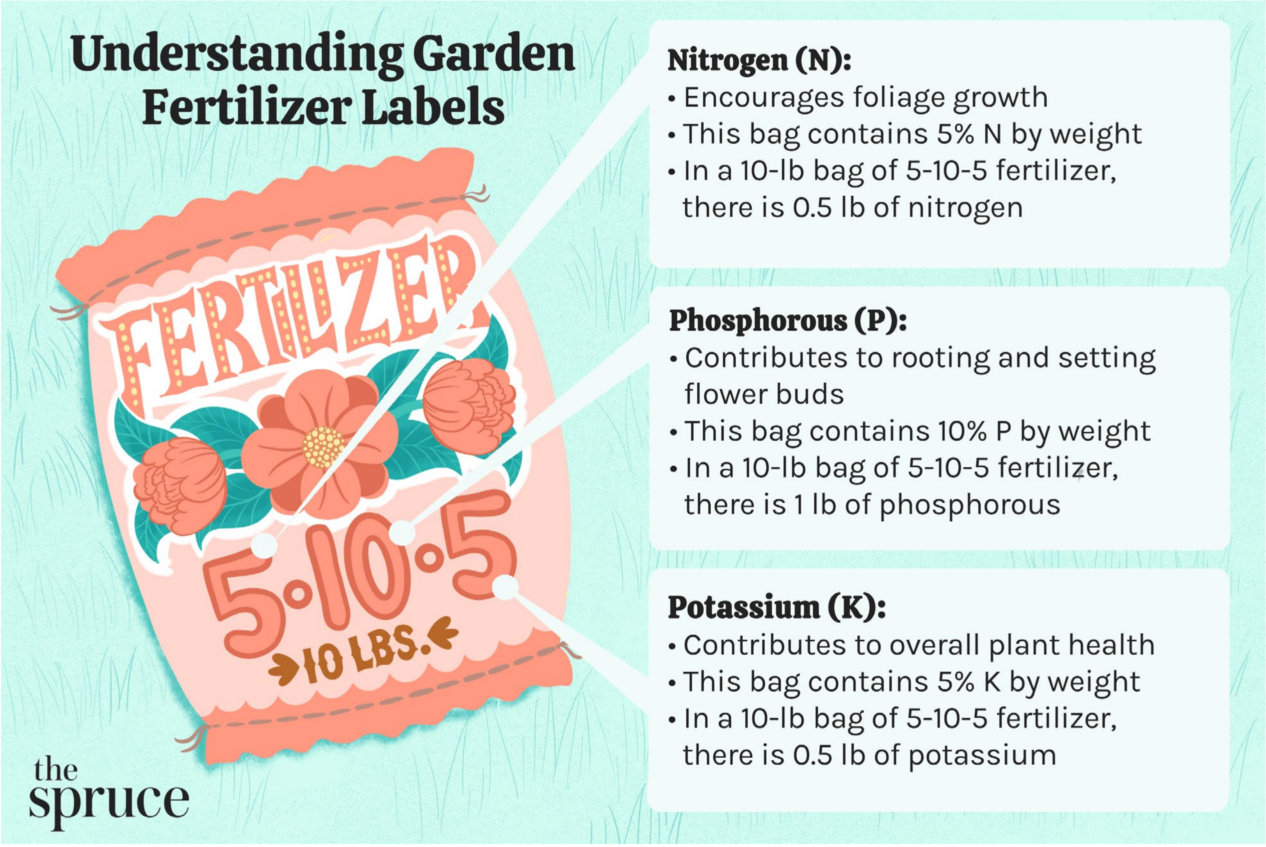
1. Your garden is 250 square feet.
2. The soil test report recommends 1.5 lbs potassium per 100 square feet
3. Set up your ratio

$$\frac{\text{rec. nutrient amount}}{\text{rec. square feet}} = \frac{\text{your nutrient needs}}{\text{garden square feet}} \qquad \frac{\text{1.5 lbs potassium}}{\text{100 square feet}} = \frac{\text{?? potassium needed}}{\text{250 square feet}}$$

4. Multiply your garden area by the recommended nutrient amount then divide by the report square feet to get the amount you need for your space

$$\frac{\text{1.5 lbs potassium}}{\text{100 square feet}} = \frac{\text{?? potassium needed}}{\text{250 square feet}} \qquad 250 \times 1.5 \div 100 = 3.75 \text{ lbs potassium}$$

Shopping based on your needs: Reading a fertilizer label



- All fertilizers will have a nutrient analysis referred to as NPK
- Nitrogen (N), Phosphorus (P), and Potassium (K) are macronutrients plants gain through the soil
- On a fertilizer label you will find three numbers in a row with dashes in between. Those are the percentages of N, P, and K by weight in that product.

Shopping based on your needs: Reading a fertilizer label


NET WEIGHT 4 LBS. (1.81kg)

Plant-tone

All Purpose Plant Food

5-3-3

GUARANTEED ANALYSIS

Total Nitrogen (N)......................................5.0%
0.4% .... Ammoniacal Nitrogen
1.6% .... Other Water Soluble Nitrogen
3.0% .... Water Insoluble Nitrogen*
Available Phosphate (P_2O_5)..............................3.0%
Soluble Potash (K_2O) 3.0%
Calcium (Ca) 3.0%
Magnesium (Mg) 1.0%
0.6% .... Water Soluble Magnesium (Mg)
Sulfur (S) 1.0%

Derived from: Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, Alfalfa Meal, Greensand, Humates, Sulfate of Potash, and Sulfate of Potash Magnesia.

*Contains 3.0% Slow Release Nitrogen from Hydrolyzed Feather Meal, Pasteurized Poultry Manure, Cocoa Meal, Bone Meal, and Alfalfa Meal. F1381

ALSO CONTAINS NON PLANT FOOD INGREDIENTS

Contains a total of 895 Colony Forming Units (CFU) per gram of the following species:

Acidovorax facilis	21 CFU per gram
Bacillus licheniformis	208 CFU per gram
Bacillus megaterium	208 CFU per gram
Bacillus pumilus	208 CFU per gram
Bacillus subtilis	208 CFU per gram
Cellulomonas flavigena	21 CFU per gram
Paenibacillus polymyxa	21 CFU per gram

Shopping based on your needs

- It is unlikely that you will be able to find a fertilizer that exactly meets your needs, so now we understand how to get close enough to go shopping
- Some soil tests, such as Penn State, do these next several steps for you and recommend a specific nutrient analysis to look for

Nitrogen, Phosphate And Potash Recommendations

Apply 0.25 lbs per 100 square feet of UREA and 1.75 lbs per 100 square feet of 5-10-10.

- But you will likely come across soil tests that do not provide this level of detailed recommendation
- In those cases you will first need to find a ratio of N, P, and K you're looking for, and then you will need to know how much wiggle room you have, or whether you need to combine fertilizers.

Shopping based on your needs: Ratios

- Our first step to finding out what you will want to buy is by finding a ratio in whole numbers for the nutrients you need
- We want to find the smallest whole numbers that will maintain the ratio between the amounts you need of the three nutrients
- Start with the recommended amounts on your soil test for N, P, and K. For this example, we will use 3 lbs N, 2.5 lbs N, and 1.75 lbs K.
- Round your numbers to the nearest .25 so that all three numbers are whole numbers or end in .25, .5, or .75
- Double each number until all three are whole numbers
  - In our example, doubling once gets us 6-5-3.5, so we'll need to double again
  - Doubling twice gets us to 12-5-7, so we stop here

Shopping based on your needs: Ranges

- Sometimes you will end up with a ratio that is easy to shop for
  - ex: 5-5-5, or a balanced fertilizer, which will mean you can buy any product where all three numbers match
- Other times, you will need to know how much you can get away with adjusting a number up or down to find a fertilizer that is close enough
  - In our example, it is unlikely that you will find a 12-5-7 fertilizer
  - Will a 10-5-5 or a 10-5-10 fertilizer be a better match?
- Knowing what each nutrient does and knowing common NPK values for fertilizers will help you figure out what is best for you

Shopping based on your needs: Nutrients

- High nitrogen relative to other nutrients promotes leaf and stem growth
  - If you are fertilizing a mature lawn or growing herbs, nudging N higher is a safe bet
  - If you are growing vegetables, nudging N lower is better
- Phosphorus serves many functions in plant development
  - Most soils have adequate phosphorus, and phosphorus runoff can cause serious water quality problems. Err on the side of reducing phosphorus.
- Potassium promotes root growth and overall plant health
  - If you are fertilizing a new lawn or growing flowers or vegetables from seed, bumping potassium higher can be good
- In our example of 12-5-7
  - Closer to 10-5-10 for vegetables and new lawns
  - Closer 10-5-5 for spring lawn fertilization or summer herbs

Shopping based on your needs: Common products

- Balanced fertilizers
    - 10-10-10, or 1-1-1, or 5-5-5, etc.
- Boosting just one nutrient
    - Urea: 46-0-0 (may not be easily available for home use)
    - Potassium sulfate: 0-0-50
    - Super phosphate: 0-20-0
- Common non-synthetic products
    - Compost: 0.5-0.5-0.5 to 1-1-1 (nutrient analysis may not be on label)
    - Bone meal: 3-15-0
    - Blood meal: 12-0-0

Shopping based on your needs: Selection

- When possible, your best route is to choose a fertilizer that fits your ratio well enough to suit your needs
- Don’t limit yourself to just looking at vegetable fertilizers if you’re growing tomatoes: if you have low potassium, a fall lawn fertilizer could be perfect
  - Note: when using lawn fertilizers on anything but a lawn, do not use a “weed and feed” product, which will include herbicides that harm other plants
- If you can’t find something that is a close fit for all three nutrients, aim to find something that fits two of your numbers well while not giving you enough of the third. You can add in some of another fertilizer that specifically boosts that last nutrient.

Measuring just one product

- Next we need to calculate the amount of product you need to use
- If your product NPK ratio doesn't match your needed ratio exactly, you will calculate the amount of product you need based on whichever number in the fertilizer is lower than your target number
    - Ex: if we bought a 10-5-5 fertilizer for our 12-5-7 needs, we will be doing math based on getting our needed amount of nitrogen since 12 < 10
- If it is an exact fit, pick whichever number you like for the next step
- For our example, we will be figuring out how much of the product we need to meet our nitrogen needs

Measuring just one product

1. Find the number we calculated at the beginning when we figured out how much of each nutrient was needed for the area

   your garden square feet x recommended nutrient amount ÷ recommended square feet = nutrient needs

2. Set up an equation to find our missing number. Our known side is the fertilizer bag since NPK numbers are # of lbs N, P, or K in 100 lbs of product. On the other side is the needed amount of N over the unknown amount of fertilizer.

$$\frac{\text{N number on bag}}{100} = \frac{\text{lbs of N needed}}{\text{?? lbs fertilizer needed}}$$

3. Cross-multiply and divide again to find the missing number

$$\frac{\text{N number on bag}}{100} = \frac{\text{lbs of N needed}}{\text{?? lbs fertilizer needed}}$$

lbs of N needed x 100 ÷ N number on bag = lbs fertilizer

Measuring just one product

1. Find the number we calculated at the beginning when we figured out how much of each nutrient was needed for the area

   200 square feet x 1.5 lbs nitrogen ÷ 100 square feet = 3 lbs nitrogen

2. Set up an equation to find our missing number. Our known side is the fertilizer bag which tells us that we have 10 lbs N per 100 lbs of product. On the other side is the needed amount of N over the unknown amount of fertilizer.

$$\frac{\text{10 lbs N}}{\text{100 lbs fertilizer}} = \frac{\text{3 lbs N needed}}{\text{?? lbs fertilizer needed}}$$

3. Cross-multiply and divide again to find the missing number

$$\frac{\text{10 lbs N}}{\text{100 lbs fertilizer}} = \frac{\text{3 lbs N needed}}{\text{?? lbs fertilizer needed}}$$

3 lbs N needed x 100 ÷ 10 = 30 lbs fertilizer needed

Measuring two products

- If you decided that the best way to meet your nutrient needs was to combine two products, you have to go through the process we just walked through twice
  - First find out how much of your fertilizer to use to meet your lower nutrient needs
  - Then find out how much more of the higher nutrient you need, and how much of the second product to use
- For this example, we will be using this example garden
  - Soil test recommended 4 lbs N, 2 lbs P, and 2 lbs K per 100 square feet
  - Your garden is 300 square feet
  - You chose a balanced 10-10-10 fertilizer to meet your P and K needs
  - You chose blood meal with a 14-0-0 analysis to boost N

Measuring first product

1. Find the number we calculated at the beginning when we figured out how much of each nutrient was needed for the area

   300 square feet x 2 lbs phosphorus ÷ 100 square feet = 6 lbs phosphorus

2. Cross-multiply and divide to find the amount of fertilizer to use to meet your P and K needs

   $$\frac{\text{10 lbs P}}{\text{100 lbs fertilizer}} = \frac{\text{6 lbs P needed}}{\text{?? lbs fertilizer needed}}$$

   6 lbs P needed x 100 ÷ 10 = 60 lbs fertilizer needed

3. 60 lbs of the first fertilizer will get you 6 lbs each of N, P, and K (or by the ratio, knocks you from a 4-2-2 need to a 2-0-0 need). Now we get the rest of the N.

Measuring second product

4. Find your total nitrogen needs from the area equation (in this case it's 12 lbs), and subtract the amount provided by the first fertilizer (in this case it's 6 lbs)

   12 lbs N needed total – 6 lbs N from first fertilizer = 6 more lbs N needed

5. Cross-multiply and divide using your remaining needed nitrogen and the numbers from your second fertilizer

$$\frac{\text{14 lbs N}}{\text{100 lbs fertilizer}} = \frac{\text{6 lbs N needed}}{\text{?? lbs fertilizer needed}}$$

6 lbs N needed x 100 ÷ 14 = 42.9 lbs fertilizer needed

6. 60 lbs of the first fertilizer plus about 40 lbs of the second (approximate is okay) will get you your full fertilizer needs.

Example scenario: calculating needs

- You have gotten a soil test for your vegetable garden
- Your vegetable garden is 50 square feet, and the soil test recommends 1 lb N, 1.5 lbs P, and 1 lb K per 100 square feet
- Calculating needed amounts of each nutrient
  - Nitrogen: $\frac{\text{1 lb nitrogen}}{\text{100 square feet}} = \frac{\text{?? nitrogen needed}}{\text{50 square feet}}$ 50 sf x 1 lb N ÷ 100 sf = 0.5 lb N
  - Phosphorus: $\frac{\text{1.5 lbs phos}}{\text{100 square feet}} = \frac{\text{?? phos needed}}{\text{50 square feet}}$ 50 sf x 1.5 lbs P ÷ 100 sf = 0.75 lb P
  - Potassium $\frac{\text{1 lb potassium}}{\text{100 square feet}} = \frac{\text{?? potassium needed}}{\text{50 square feet}}$ 50 sf x 1 lb K ÷ 100 sf = 0.5 lb K

Example scenario: choosing products

- Finding your ratio
  - Needed amounts based on soil test: 0.5 N, 0.75 P, 0.5 K
  - The numbers are already in 0.25 increments, so start multiplying by 2
  - Round 1: 1 N, 1.5 P, 1 K
  - Round 2: 2 N, 3 P, 2 K
  - Our goal ratio is 2-3-2
- You decide that you want to use non-synthetic products
  - Compost: 1-1-1
  - Bone meal: 3-15-0
  - This will mean you have some excess nitrogen, but nitrogen is highly mobile in soil, and the plant will not be harmed by extra nitrogen

Example scenario: fertilizer amounts

- Compost
  - Analysis is 1-1-1
  - Needs are 0.5-0.75-0.5
  - Calculate compost amounts based on N or K needs

$$\frac{\text{1 lb N}}{\text{100 lbs compost}} = \frac{\text{0.5 lb N needed}}{\text{?? lbs compost needed}}$$

0.5 lb N needed x 100 ÷ 1 = 50 lbs compost

- Bone meal
  - Analysis is 3-15-0
  - Remaining P need is 0.25 lbs
  - Calculate bone meal amount based on P need

$$\frac{\text{15 lb P}}{\text{100 lbs bone meal}} = \frac{\text{0.25 lb P needed}}{\text{?? lbs bone meal needed}}$$

0.25 lb P needed x 100 ÷ 15 = 1.67 lbs bone meal

Questions?