



# Notes with Answers for Soils Module

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## Soil Formation

Identify the five factors in soil formation that give soil its characteristics.

1. *Parent Material*
2. *Geologic Time*
3. *Climate*
4. *Biological Activity*
5. *Relief or Topography*

## Physical Properties of Soil

Define the following physical properties of soil.

Texture: *The size of the soil particles (sand, silt and clay) and the percent of each that compose a soil.*

Soil Structure: *The arrangement of the particles in the soil. It provides spaces in the soil for oxygen and water. It is dynamic (constantly changing) and can be destroyed by tillage, heavy equipment, or anything that leads to compaction.*

Soil Color: *Influenced by organic matter, parent material, topography, and mineral composition.*

Soil profile: *Based on the physical characteristics of the soil, broken in horizons, and contains information about the parent material*



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## Chemical Properties of Soil

For each of the primary plant nutrients, describe the function they support in the plant.

Nitrogen: - *Necessary part in all proteins, enzymes and metabolic processes in plants; required for photosynthesis; promotes vegetative growth.*

Phosphorus: *Required for photosynthesis; required in formation of oils, starches, and sugars; encourages flowering and root formation.*

Potassium: *Required in many processes including photosynthesis and building proteins*

## Soil Fertility

Define the Cation Exchange Capacity.

*The number of negative charge sites in a soil. The more negative charge sites (exchange sites), the higher the ability to hold cations, which translates to better ability to hold and retain nutrients.*

## Organic Matter

How does organic matter improve sandy soils?

*Improves water holding capacity because the organic matter retains moisture.*

How does organic matter improve clay soils?

*Organic matter in clay soils means better able to resist compaction and won't break down easily when wet. Clay soils with organic matter drain better and aerate the roots.*



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## Acidity

Define soil pH.

*It is a measurement of the soil's acidity.*

How does soil pH influence plant growth?

*pH affects the availability of nutrients in the soil for the plants.*

## Soil Sampling

This is an example of how to calculate lime and fertilizer application rates based on the soil test result from the manual for B. A. Gardener.

We will assume B.A. Gardener's vegetable garden is 10x15. To find the square footage of his garden, you multiply the width and length.

$$10 \times 15 = 150 \text{ ft}^2$$

B.A. Gardener's soil test result recommends adding 13.6 lbs of lime per 100 ft<sup>2</sup>. His garden is 150 ft<sup>2</sup>. How much lime should he apply? There are two ways to solve this problem.

Since B.A. Gardener's garden is 150 ft<sup>2</sup>, we can divide 13.6 lbs of lime per 100 ft<sup>2</sup> in half.

$$\frac{13.6 \text{ lbs of lime per } 100 \text{ ft}^2}{2} = 6.8 \text{ lbs of lime per } 50 \text{ ft}^2$$

This will give us the amount of lime to apply to 50 ft<sup>2</sup>. We can then add that amount to the rate at 100 ft<sup>2</sup>.



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6.8 lbs of lime per 50 ft<sup>2</sup>

**+** 13.6 lbs of lime per 100 ft<sup>2</sup>

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20.4 lbs of lime per 150 ft<sup>2</sup>

B.A. Gardener should apply 20.4 lbs of lime to his 150 ft<sup>2</sup> vegetable bed.

We can also calculate the rate using algebra. This is helpful when the square footage is a number that is not as easily divided.

$$(13.6 \text{ lbs lime}) (150 \text{ ft}^2) = X \text{ lbs } (100 \text{ ft}^2)$$

$$2040 \text{ lbs/ft}^2 = 100X \text{ lbs/ft}^2$$

$$\frac{2040 \text{ lbs/ft}^2}{100 \text{ ft}^2} = X \text{ lbs}$$

$$20.4 \text{ lbs} = X \text{ lbs}$$

Using algebra, we get the same rate, 20.4 lbs of lime per 150 ft<sup>2</sup>.

Next let's tackle the fertilizer application rate. From the soil test results:

Nitrogen: Needed nitrogen will be supplied with the phosphate and/or potash recommendations below.

Phosphate: No phosphate fertilizer needed.

Potash: Apply 2.5 lbs of winterizer turf fertilizer per 100 ft<sup>2</sup> annually for 2 years.



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Let's assume B.A. Gardener would like to use an organic source of potash, kelp meal.

How many pounds will he need to apply to his 150 ft<sup>2</sup> vegetable garden? We will use the following formula to calculate the amount of potash he needs to add.

$$\text{Pounds of Product to Apply} = \frac{\text{Nutrient Need}}{\text{Percent Nutrient in the fertilizer as a decimal}}$$
$$\text{Pounds of Poseidon's Yields Kelp Meal} = \frac{1.0 \text{ lbs potash}}{0.02}$$

Pounds of Poseidon's Yields Kelp Meal = 50 lbs per 100 ft<sup>2</sup>.

Since B.A. Gardener's vegetable bed is 150 ft<sup>2</sup>, he'll need to add 75lbs of Poseidon's Yields Kelp Meal.

Note: the soil test recommendation of a traditional turf winterizer fertilizer was only 2.5 lbs per 100ft<sup>2</sup>. This is because the winterizer's recommended analysis of 10-20-30 has 30% potassium, whereas Poseidon's Yields Kelp Meal only has 2% potassium.



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## pH Adjustments

What types of materials could you use to increase your soil's pH?

*Limestone*

What types of materials could you use to lower your soil's pH?

*Iron sulfate or Aluminum sulfate*