

**PLANT NUTRIENTS ARE DIVIDED INTO 3 GROUPS:**

- **Macronutrients** (Plants need fairly large amounts of these.)
- **Secondary Nutrients** (Plants need about the same amounts of micronutrients as macronutrients however, most soils less likely to be deficient in micronutrients so they are referred to as secondary.)
- **Micronutrients** (Plants need these in small quantities.)

**MACRONUTRIENTS: NUTRIENTS THAT PLANTS NEED IN LARGE QUANTITIES.**

1. **CARBON, HYDROGEN AND OXYGEN** are macronutrients found in air and water. During photosynthesis, plants take up carbon and oxygen from the carbon dioxide ( $CO_2$ ) present in the atmosphere. Plants then use this carbon to produce other carbon-containing molecules (sugars and starch), which provide energy for the plant. Oxygen is then released and recycled into the atmosphere during plant respiration.

2. **NITROGEN** is a macronutrient obtained by nitrogen fixing organisms (bacteria) and by dead and decaying plant matter in the soil. Nitrogen is an essential element involved in the synthesis of proteins such as chlorophyll and enzymes. Plant cells require nitrogen in order to thrive and reproduce. Nitrogen tends to be the nutrient that is most likely to be lacking in garden soils.

Plants deficient in nitrogen begin to turn yellow from the bottom upward. Leaves begin to yellow from the tips toward the stem. Plant growth is stunted.

3. **PHOSPHORUS** promotes strong root growth, flowering, fruiting and helps transfer energy from one part of a plant to another.

Plants deficient in phosphorus exhibit stunted growth, fruit reduction, and sometimes the undersides of leaves will turn a purplish color.

4. **POTASSIUM** regulates protein and starch synthesis which helps make plants sturdy. Potassium helps increase hardiness, which means resistance to cold, heat, and disease.

Plants deficient in potassium exhibit reduction in flower and fruit production, spotted or curled leaves, and weak stems and roots.

**FERTILIZER:** Any natural (organic material) or manufactured material added to the soil in order to supply one or more plant nutrients. Fertilizers can be obtained as separate plant nutrients, but usually sold as a mixture of nitrogen, phosphorus and potassium. Example: a fertilizer marked as a 5-10-5 formula means that the contents are guaranteed to contain 5% nitrogen, 10% phosphorus, and 5% potassium.

**SOIL pH**

The pH of soil is the key to enabling plants to consume (take in) fertilizer and plant nutrients such as Nitrogen, Phosphorus, and Potassium. The pH of the soil is the numerical measure of ACIDITY or ALKALINITY levels in soil.

**THE pH SCALE RANGES FROM 1-14**


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1    2    3    4    5    6    7    8    9    10    11    12    13    14

- pH levels between 1 and 6 indicates an **ACIDIC SOIL**
- pH level of 7 means the soil is **NEUTRAL**
- 8-14 indicates an **ALKALINE SOIL**

When pH is at its proper level, nourishment available in the soil is "unlocked", ready to give the plant the necessary vitality it needs in order to grow, reproduce, and resist disease. If the pH is too high or too low, this nourishment is locked out and fertilizer or compost applications are wasted. While some plants thrive only in acidic soils, others can survive in alkaline soils. Overall, most garden and field crops do best when the pH ranges from 5.8 - 6.6, just below neutral, on the acidic side. For example, nitrogen has a special relationship to pH. Nitrogen must be broken down by soil bacteria before it can be absorbed by plants. These soil bacteria do their best work between a pH of 5.8 and 6.6. Therefore in high acid alkalinity soils there is very little breakdown of nitrogen. So, plants can starve even if large quantities of fertilizer have been applied. Lime is generally used to raise pH; gypsum, iron sulfate and sulfur are used to lower pH.