Plant nutrition

Plants need seventeen basic chemical elements in order to grow.

The first three - carbon, hydrogen, and oxygen - are collected from the atmosphere and are readily available to plants as carbon dioxide and water. The remaining elements must be collected from the soil.

Soil nutrients

Soil nutrients are arranged into three categories

Symptoms of nutrient deficiency

When plants aren't getting the nutrients they need, they may show visible symptoms of deficiency (see Table 2 for leaf symptoms). Some symptoms, like stunted growth and weak stems, are the same for many types of deficiencies. Others are more specific and give clues as to which nutrient is deficient. When problems are first noticeable on the older, lower leaves, deficiencies are more likely to be nitrogen, phosphorus, potassium, or magnesium. When younger leaves are a□ected, deficiencies are more likely to be calcium or boron, or others. However, it often takes an experienced gardener to accurately diagnose deficiencies by visual symptoms alone. Several books and websites give detailed descriptions and photographs of deficiency symptoms.

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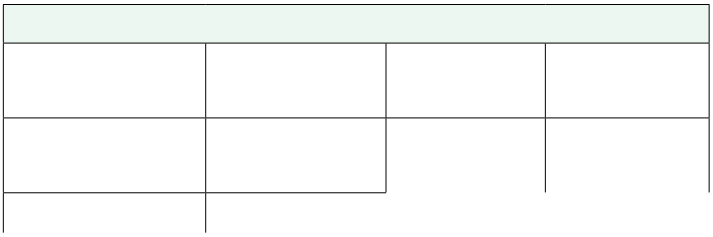
Deficiency	Symptom
Lower leaves Leaf yellowing; starts at tip and spreads up middle	Nitrogen
Purpling of leaf edges	Phosphorus
Browning of leaf edges	Potassium
Yellowing between veins	Magnesium
Leaf edges brown; fruits rot at blossom end	Calcium
Yellowing between veins	Iron, Manganese, Zinc, Copper
Death of growing points	Boron, Calcium
Leaf yellowing	Sulfur

Natural source fertilizers

Nutrients can be applied in the form of organic materials such as compost, manure, green manure, plant residues, and wood ash. Additional supplements can be purchased at garden centers and by mail-order. Some, such as rock phosphate and Sul-Po-Mag are mined from the earth. Others, like seaweed, fishmeal, and greensand, are from the ocean. And still others, such as bone meal, blood meal and feather meal, are animal byproducts.

Natural source fertilizers generally have lower concentrations of nutrients compared to synthetic fertilizers, so greater quantities are required to meet crop needs. The average nutrient content for a selection of materials are listed in Table 3. However, remember that the concentration can vary among products from di□erent sources or from batch to batch. (For example, not all sheep manure will have the same nutrient content.) Where possible, check product labels for the type and quantity of nutrients and how they are best applied.



Green manures should be mixed into the soil the previous fall or, if planted as a cover crop, incorporated early in the spring together with some well-rotted manure or compost to encourage quick decomposition. Well-aged compost can be applied shortly before planting, or as a top dressing during the growing season.

Rock phosphate should be applied in the fall or incorporated into the compost pile for more rapid decomposition. Sul-Po-Mag (sulfur, potassium, magnesium) can be applied in early spring.

Liming materials

Lime, which is normally applied to soil for pHpring.

Activity

Calculate how much of an amendment you will need.

Soil test reports make recommendations for nitrogen (N), phosphorus (P2O5), and potassium (K20) in kilograms per hectare (kg/ha). You will have to figure out how much of an amendment to apply to meet the recommendation. Let's say the soil test report recommends adding nitrogen at 36 kg/ha. Here are the calculations you will have to make:

Vegetable gardens are usually much smaller than a hectare so the first step is to figure out how much nitrogen you will need for the area of your garden. Let's say your garden is 10 m x 10 m, or 100 square meters. (Note: 1 hectare = 10 000 square meters). So,

(36 kg N/ha)/(10 000 m^2/100 m^2) = 0.36 kg N per 100 square meters

Let's say you want to use a synthetic fertilizer; 12-24-24. This fertilizer contains 12% nitrogen, 24% phosphorus (P2O5), and 24% potassium (K2O) so 1 kg of fertilizer would contain 0.12 kg nitrogen, 0.24 kg phosphorus, and 0.24 kg potassium. How much fertilizer would you need to supply 0.36 kg N for your 100 square meter garden?

(0.36 kg N/100 m^2)/(0.12 kg N/kg of fertilizer) = 3 kg fertilizer/100 square meters

Use the following worksheet and information from Table 3 and Table 4 above to calculate how much of each amendment you will need to supply nitrogen at 36 kg/ha to a 100 square meter garden. Also calculate how much phosphorus and potassium you will be adding to the soil if you apply that rate of amendment.

Amendment	Amount needed to supply nitrogen at 36 kg/ha to a 100 square meter garden	Phosphorus (P_2O_5)	Potassium (K_2O)
12-24-24 fertilizer	3 kg	0.72 kg P_2O_5 per 100 m^2 OR 72 kg P_2O_5 /ha	0.72 kg K_2O per 100 m2 OR 72 kg K_2O /ha
Calcium ammonium nitrate fertilizer			
17-17-17 fertilizer			
Cattle manure			
Compost (assume 2% N;0.75% P_2O_5; 1.5% K_2O			
Fishmeal			