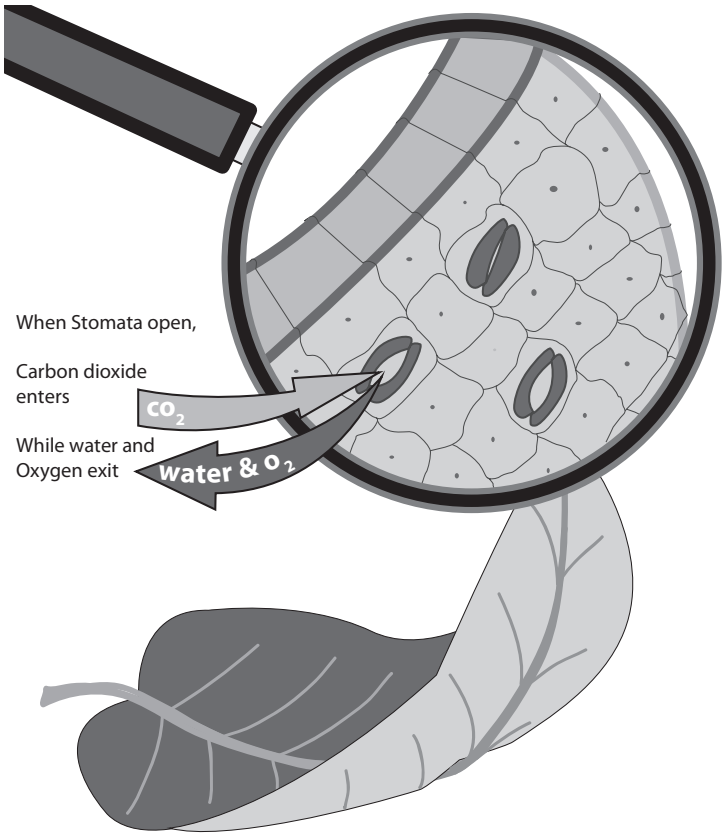
What's in a Plant?

Imagine that you are floating around on an inner tube in a mountain lake, breathing in fresh air on a warm summer day. Every once in a while you get off your inner tube and wiggle your toes in the sand. This is so relaxing you feel like staying here all day, but you are getting hungry and you didn't bring any food with you. Unfortunately, you have to go home for lunch. As you are pedaling your bike home under the canopy of tall trees you think about how cool it would be to make your own food like plants do.

Plants are unique living things. They have the ability to photosynthesize; "photo" means light and "synthesize" means to put together. Through photosynthesis, plants capture the sun's energy to make their food. Plants take water and nutrients from the soil, along with carbon dioxide from the air, and convert them into the food they need to grow and be healthy. Sunlight is needed for this process to take place.

We all depend on plants for survival, without them there would be no life on Earth! All the food we eat and the oxygen we breathe can be traced back to plants.

Think of leaves as the plant's kitchen. This is where sunlight is captured to give the plant the energy to mix carbon dioxide and water together to make the food the plant needs to grow and carry on life processes.



Plants absorb carbon dioxide through pores on their leaves called stomata (stomata means mouth in Greek). Guard cells surround the pore or stoma to regulate the opening, which allows the passage of carbon dioxide into the leaf and oxygen out of the leaf. Water vapor will also exit the open stomata through the process of transpiration. Sometimes stomata absorb other things too, like water molecules and nutrients. Most of the time, water and nutrients are absorbed through the root hairs of plants.

Like any living thing, plants need certain minerals and nutrients to stay healthy. Here are some of the nutrients required by plants:

Nitrogen

The element nitrogen (N) is required by all living things, including humans and plants. Nitrogen is needed to make the trunks, stalks, vines, flowers—basically every part of the plant.

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Nitrogen is found in chlorophyll, the green pigment that allows plants to capture energy from the sun to make food through photosynthesis. Nitrogen, sometimes called "the builder," is also the basic element of plant and animal proteins, including the genetic material DNA and RNA, and is important in periods of rapid plant growth. Nitrogen gas makes up about 78% of Earth's atmosphere, but this form of nitrogen must be converted into a type of nitrogen that can be used by plants. This is done by chemical processes or by nitrogen-fixing bacteria in the soil.

Legumes, such as beans and alfalfa, are great nitrogen fixers because they grow specialized nodules on their roots. Nitrogen-fixing bacteria called Rhizobium live in these root nodules and convert atmospheric nitrogen into nitrogen plants can use. Farmers take advantage of this unique symbiotic relationship by periodically growing legumes in nitrogen-deficient soil to boost nutrient levels.

Potassium

Potassium (K) is another nutrient that plants require. Potassium helps the plants open and close the guard cells that surround the stomata. This is important in efficient water use, especially during times of drought. Potassium is often called "the regulator" since it is involved in more than 60 different enzyme systems in plants. It helps plants resist disease, aids in the production of starches, and controls root growth. Most potassium is mined from underground deposits while some comes from the evaporation of water from natural salt lakes.

Phosphorus

Phosphorus (P) is often referred to as the "energizer" since it helps store and transfer energy during photosynthesis. It is also part of the genetic material of all cells: DNA and RNA. Plants require phosphorus during periods of rapid growth.

Legumes also require plentiful amounts of phosphorous. Established plants such as trees, shrubs, and vines—especially those grown in warm climates—require the least amount of phosphorus. In the soil, phosphorus is often found in chemical forms that cannot be absorbed by plants, so farmers often need to apply a phosphorus fertilizer.

Nitrogen, phosphorus, and potassium are known as primary nutrients since they are used by plants in relatively large amounts and are often deficient in the soil. In all, 17 chemical elements are known to be important for plant growth. Three of them, carbon, hydrogen, and oxygen, are taken in from the air and water. The other 14 elements are absorbed by plant roots from the soil.

Calcium, magnesium, and sulfur are less frequently deficient in the soil and are classified as secondary nutrients. Micronutrients are also essential to plants, but are only used in very small amounts. Micronutrients are: zinc, iron, manganese, copper, boron, molybdenum, chlorine, and nickel.

In the readings #1–4, you will learn how farmers make sure their crops get the essential nutrients so we can all have enough food to eat.