things plants need

There are certain things that every plant needs in order to grow. If any one of these things is missing, the plant will grow slowly or not at all. Or, if there is too much of something, the plant's growth can also be harmed.

WATER & AIR

If they have nothing else, plants must have water. You can grow plants at least for a short time with nothing but water, since seeds contain stored food; for example, sprouts will grow on water alone (see Extra Projects in the Vegetable Seeds project), but plants will not grow on just fertilizer or just air.

Even desert plants, like cacti, will dry up eventually if they have no water at all - they have just learned to conserve every little bit of water they get, and will last much longer than other plants under dry conditions.

Other plants grow well while standing in water. They have developed ways (adapted) to get air to their roots when water is filling up all the space in the soil. For example, a type of cypress tree has "knees," or special roots which come up for air.

Those are extremes, though. Most plants like to have a good balance of water and air around their roots. Even most water plants grow in moving streams where the water movement causes air bubbles in the water, which the plant can use. Plants grown in water, "hydroponically," (see Extra Projects in the Container Garden project) also have to have air added to the water somehow.

Soil is made up of particles of minerals and organic matter, and between the particles are spaces, or pores. Soils with large particles, like sand, have large spaces between them, while soils with small particles, like clay (you can't see the particles, they are so small) have very tiny pores. See the illustration on page 2.
Since water tends to drain out of the large spaces and is held in the small pores, you can see why clay stays wetter longer than sand. This may also tell you why roots will die for lack of air in heavy clay soil that is too wet. What most plants like, then, is soil with about half air and half water spaces.

**LIGHT**

Another important element in the life of most plants is light. (Can you think of some plants that don't need light to grow? Hint: they usually aren't green and you've probably been told not to eat them unless they come from a store. If you still don't know, read the first page of the Kitchen Garden project.)

Light is the energy source (usually solar energy) that a plant uses to make its food. A pigment (coloring) called chlorophyll, which gives leaves their green color, is used to collect this solar energy. Some plants, like red cabbage, have leaves of another color, but if you look closely you will see green mixed in with other colors.

When light strikes the chlorophyll, it causes reactions in the plant cells which allow the plant to make sugars and starches out of carbon dioxide and water. This is called photosynthesis (photo = light; synthesis = forming). The sugars and starches are food for the plant's growth. They are also stored in different parts of the plant; for example, starch in potato tubers (underground stems) and sugars in fruits.

Plants need plenty of light in order to grow properly. If they do not get enough, they will be weak and spindly, have small leaves, and usually very few leaves on the lower part of the plant. Too much light, however, can burn or scorch leaves and fruits.
SOIL, NUTRIENTS, & ORGANIC MATTER

Plants cannot grow on air, water and light alone, however. They must have nutrients to make everything work right in their bodies. These nutrients are to plants like vitamins and minerals are to you. They must be present for photosynthesis and other processes, and if they are not available to the plant, it will not grow well.

As we said before, plants do not have to have soil to grow, since they can grow in water, but in hydroponics (water or soil-less culture) all the nutrients, or fertilizers, must be added regularly. Many nutrients are already in garden soil, but some have been used by plants and others are leached out (washed away) by rainfall, so fertilizers have to be added.

Nutrients found naturally in garden soil come from the breakdown of minerals and of plant and animal material (organic matter). Organic materials tend to hold fertilizers and water well and keep soil from becoming hard and tight, so it is important to add organic matter in the form of manures, mulches, or compost whenever possible. If you add organic matter to clay soil, it makes it looser and allows plant roots to get air. If you add organic matter to sandy soil, it helps to hold water and fertilizers in. Read the "Plants and Nutrition" and "Fertilizing" HELP sheets for more information.

RIGHT TEMPERATURE

Different plants require different temperatures to grow, but most vegetables grown in Virginia like fairly warm temperatures. Some plants are called cool-weather plants because they grow poorly when it is hot or because they flower when the weather is warm. A plant which flowers when we don't want it to (like lettuce) is said to "bolt" or "go to seed." Other plants will not grow well at all when the weather is cool. A lot of food plants that we eat originated in hot climates.

PROTECTION

When you put a plant outdoors, you expose it to many things. It can be attacked by a disease or pest, or it can suffer from the effects of the weather (too hot, too cold, too wet, too dry, hail, strong winds, etc.). By knowing the needs of each plant you can protect it as much as possible. There is not much you can do about hailstones except cover the plants with boxes or baskets if you have time, and strong winds can be difficult to control. But you can keep plants indoors until it is warm enough for them to grow outside, and you can protect them from summer heat by growing them in a shady area if they dislike strong sunlight.

One practice which gives plants many kinds of protection is mulching. A mulch is a material which is put on top of the soil around plants; it can be inorganic, such as black plastic, or organic material which will break down and become part of the organic matter in the soil. Some common mulches are: grass clippings, leaves, sawdust, newspapers, compost, and straw.
Mulches protect plants by keeping the ground and the air around the plant warm in cool weather; however, during early spring it is a good idea to pull the mulch away from the plants to let the sun warm the ground during the day. Mulches also keep soil temperatures cool and even during hot summer days and reduce the amount of moisture lost. Mulches also help control weeds by smothering them before they get large. Since the soil stays moist under the mulch, the weeds that get through are easy to pull up. See Guide for the Beginning Gardener for more about mulching.

Finally, you're the doctor when it comes to protecting your plants from insects, diseases and too many weeds. Keep your eyes open for signs that something is wrong. It is up to you to find out what to do for sick plants. The Garden Pests and Problems project will help you learn what to do.

**POLLINATION**

One factor that is often forgotten when listing the needs of plants is pollination. Many plants cannot make their fruits or vegetables without insects to pollinate them. The honeybee is one of the most important pollinators for your garden, and you can protect honeybees by using only those insecticides that are least harmful to bees and by spraying insecticide at night if you have to spray. Read the insecticide label to find out if it is dangerous to bees. Also, you can attract honeybees to your garden by planting things they like – borage (an herb) is one of their favorites.

Wind is important in pollinating some plants, like tomatoes and corn. If you're growing tomatoes inside, you may have to shake the flowers occasionally (and gently!) to help pollinate them.

**New Words**

- **bolting**: production of a seed stalk by vegetable plants
- **chlorophyll**: pigment which gives plants their green color and has a vital role in photosynthesis
- **hydroponics**: plant culture without soil
- **mineral**: the non-organic part of soil; usually from weathered rock
- **mulch**: material applied to the soil surface around plants
- **organic matter**: the part of soil made from decayed plant and animal tissues and wastes
- **photosynthesis**: production of carbohydrates from carbon dioxide and water, using light energy and releasing oxygen