

# Gardening: More Than Just Food



## LESSON ONE

### What's Ahead

In Lesson 1 of the Smart Garden Course, you'll learn:

- some of the many reasons why people garden;
- how plants grow and develop; and
- what plants need for good growth.

My mother started gardening with her Victory Garden during World War II to offset shortages of vegetables and fruits during the war. Patriotism may have been the driving force for Mom's early gardening activities, but it's not the reason why she has continued to garden for over 50 years.

There is more interest in gardening today than ever before, and for good reasons. Families can save some money each year growing and preserving fruits and vegetables at home. Savings depend on the size of your family, the size of your garden and your skills as a gardener and food processor.

But saving money isn't the only reason for gardening. People garden for many reasons, some of which are:

- For personal satisfaction, as a hobby or as recreation.
- For high-quality, fresh vegetables.
- Fun and education for the family.
- To control how crops are grown (for instance, organically).
- To add beauty and value to the home landscape.
- To share their harvest with neighbors and extended family.
- Because it's good for the environment; gardens can save energy (less transportation

of food), promote recycling (composting) and beautify your surroundings (more growing plants).

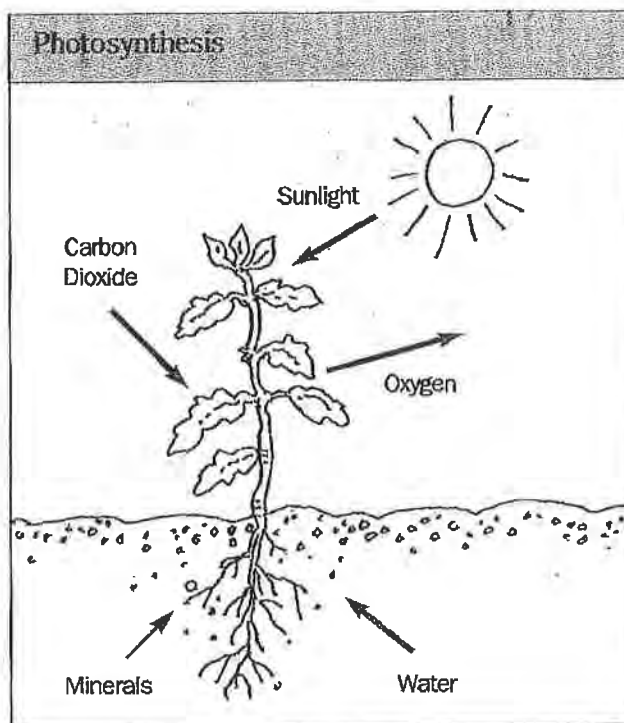
Besides, growing your own food is just plain fun!

### How Plants Grow and Develop

If you know how plants grow and develop, you'll be able to take better care of them in your garden. Three of the major functions basic to plant growth are photosynthesis, respiration and transpiration.

#### Photosynthesis: Food Production

One of the major differences between plants and animals is that the plants can make their own food (carbohydrates). To produce food for itself, a plant needs light energy (usually from



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### KEY POINT 1:

Photosynthesis is how plants make their own food using sunlight, water, carbon dioxide and chlorophyll, the pigment that gives plants their green color.

sunlight), carbon dioxide (from the air) and water (from the soil). If any of these ingredients are lacking, "photosynthesis," the food-making process, will slow down or stop. Eventually, the plant will die. Photosynthesis means "to put together with light." Photosynthesis relies on chlorophyll, a green pigment found in plants.

Photosynthesis
water + energy from the sun + carbon dioxide = carbohydrates (food) + oxygen + water

### Respiration: Using Food for Growth

The foods (sugar) made during photosynthesis become available to the plant when they are changed to energy. The plant uses this energy to build new tissues and grow.

Respiration
carbohydrates (food) + oxygen = energy to perform functions + carbon dioxide + water

### Transpiration: The Plant's Water Pump

Transpiration is the upward movement of water through a plant's roots, stem and leaves. First, water evaporates from tiny holes, called "stomates," in the plant's leaves. Then, the plant pulls water upward, all the way from the roots. Nutrients enter the roots with the water, and move to wherever they are needed.

Some of the water is used in the plant cells for processes like photosynthesis, but over 90 percent of the water that enters plant roots is ultimately lost through the stomates. This evapo-

Photosynthesis and Respiration Compared	
Photosynthesis	Respiration
1. Produces food.	1. Breaks down food for plant energy.
2. Energy is stored.	2. Energy is released.
3. Occurs in cells that contain chlorophyll.	3. Occurs in all living cells.
4. Oxygen is released.	4. Oxygen is used.
5. Carbon dioxide is used.	5. Carbon dioxide is produced.
6. Water is used.	6. Water is released.

ration process helps plants keep cool and carries nutrients throughout the plant.

Now that you have a basic understanding of how a plant grows, let's explore what plants need to grow well.

### What Plants Need for Good Growth

Vegetables come from many different plant families. We eat many parts of plants — leaves, fruit, roots, tubers and flowers. Most plants need full sun, but some can tolerate shade. Some vegetables grow well in cool weather. Others like it hot. Plants differ in hardiness. Some can stand cool temperatures, while others die at the first frost.

Despite these differences, all plants need certain things to grow, and how well a plant grows depends on the environment. Five factors influence a plant's growth. The acronym MANTLE is an easy way to remember them: Moisture, Air, Nutrients, Temperature, Light = Environment. If any factor is less than ideal, it will limit a plant's growth. A Smart Gardener manages the plant's environment so plants grow well.

### ▶ KEY POINT 3:

The acronym "MANTLE" is an easy way to remember the five environmental factors that plants need to grow: Moisture + Air + Nutrients + Temperature + Light = Environment.

### ▶ KEY POINT 2:

When plants undergo **respiration**, they're breaking down plant food into the energy they need to grow.

#### Moisture (Water)

Water is essential for plant life. It's used in photosynthesis, as it moves nutrients throughout the plant and helps control the plant's temperature. It is the major part of living cells.

#### Air

Air is made up of many kinds of gases, including nitrogen, oxygen and carbon dioxide. Plants need carbon dioxide for photosynthesis. In a tightly closed greenhouse, lack of carbon dioxide can limit plant growth. Oxygen, necessary for respiration, is rarely a limiting factor. Plants usually give off more oxygen than they use.

#### Nutrients

Many people confuse plant nutrition (what a plant needs to grow) with plant fertilization (adding materials to the soil for better plant growth). Plant nutrition refers to the need for and uses of basic chemical elements in the plant. Plant fertilization means adding these materials to the soil around the plant. A lot must happen before a chemical element, supplied in a fertilizer, can be taken up and used by the plant.

Plants need at least 16 elements for normal growth. The first three — carbon, hydrogen and oxygen — are drawn from the air and water.

Nitrogen, phosphorous, potassium, calcium, magnesium, and sulfur are found in the soil. These six nutrients are used in large amounts by the plant. That's why we call them "macronutrients."

There are seven other nutrients used in much smaller amounts, which we call "micronutrients." These elements are found in the soil: iron, zinc, molybdenum, manganese, boron, copper and chlorine.

Ninety-eight percent of the nutrients that a plant needs must be dissolved in water so that the plant can take them in by the roots. Under normal growing conditions, plants get most of these nutrients from the soil. Sometimes, a plant can get some nutrients through its leaves, if a dilute solution is sprayed on them. This is called foliar feeding. Foliar feeding is usually not an efficient way to fertilize plants.

#### Temperature

Plants have a comfort zone, much like people. Extreme temperatures — both hot and cold — stunt growth, resulting in poor quality plants. "Hardiness" refers to a plant's ability to withstand low temperatures. Some plants have adapted so they are more hardy.

#### Light

Light, both quantity and quality, has a major effect on plant growth. **Light quantity** refers to the amount of sunlight. Of course, this varies with the seasons of the year. The more sunlight a plant receives, up to a point, the more food it can make grow. **Light quality** refers to the color or wavelength of the light that reaches the plant surface. It affects growth and the forming of a flower. **Photoperiod**, the length of day and night, affects flowering and other events in some plants.

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### KEY POINT 4:

The six nutrients plants need in large amounts for growth are: nitrogen, phosphorus, potassium, calcium, magnesium and sulfur.

### Environment

A plant's growth is limited by Moisture, Air, Nutrients, Temperatures and Light, which all together create the plant's environment.

### Summary

In this lesson, you've learned about how plants grow and what they need to grow well. Now try to answer the **Study Questions**. They will help you remember what you've learned. The **Study Activities** will help you put into action what you've learned. In the next lesson, Lesson 2, we'll learn about soil — what's in it and how you can improve it for a spectacular garden.

### Study Questions

1. Name the five environmental factors that plants need to grow.
2. What is the difference between plant nutrition and plant fertilization?
3. Compare photosynthesis with respiration.
4. List the six macronutrients plants need to grow.

(See answers on bottom of page.)

### Study Activities

#### Plant Diary

Select a houseplant and keep a 30-day record of how you care for it. Note how much moisture, air, nutrients, temperature and light it receives. Try varying one of these factors and see if the plant's growth changes.

#### Transpiration Twins

Take two plants of the same type and size. Put one in a warm, well-lit place, and the other in a cool, dimly lit place. Keep a 30-day record of how much water the two plants need.

### Other Resources

These materials are available through your county Extension office:

Bulletin #2242, Plant Hardiness Zone Map of Maine

Bulletin #7029, The Forest Nutrient Cycle

### Study Question Answers:

1. Moisture, air, nutrients, temperature and light. Remember the acronym "MANTLE."
2. Plant nutrition refers to the need for and uses of basic chemical elements in the plant. Plant fertilization means adding these materials to the soil around the plant.
3. Photosynthesis is how plants make their own food using sunlight, water, carbon dioxide and chlorophyll. Photosynthesis means "put together with light." Respiration is how plants break down stored sugars into the energy they need to grow.
4. Nitrogen, phosphorus, potassium, calcium, magnesium and sulfur.