

Why Leaves Change Color in The Fall

For kids (and some adults), not many things are better than jumping in a big pile of red, yellow, and orange leaves on a cool fall day. Others just enjoy admiring the bloom of color before the leaves fall. But how and why do these leaves go from bright green, hanging on trees to a colorful mix all over the ground in just a few weeks?

Green Leaves

To understand why leaves change color, we need to know what makes them green to begin with. Tree leaves get their green coloring from

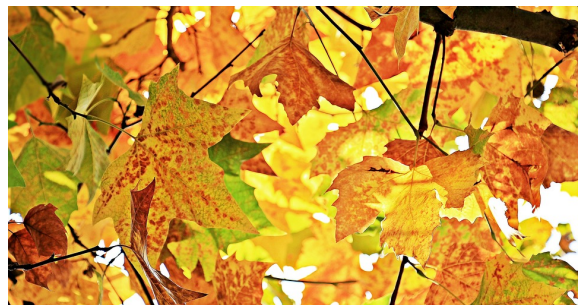


Green leaves contain chlorophyll, necessary for photosynthesis.

chlorophyll. Chlorophyll is the **pigment** in leaves that not only gives them their green color but also helps the leaf make food. This chlorophyll uses water, carbon dioxide, and energy from the Sun to generate energy and sugar within the plant. This process is called **photosynthesis**. Oxygen is released as a byproduct of photosynthesis. Thus, photosynthesis is necessary for all life on Earth as it provides not only food, in the form of plants, but the

oxygen we breathe.

Chlorophyll is not the only pigment in leaves, however. The other pigments found in leaves are **carotenoids**, which are responsible for oranges, yellows, and browns. Among the carotenoids are **carotene**, which produces orange and brown, and **xanthophyll**, which produces yellow. Carotene gives us orange carrots and pumpkins, while xanthophyll is



Carotenoids produce yellows and oranges.

found in corn and daffodils, among other plants (and even animals). The carotenoids absorb some wavelengths of light that chlorophyll has trouble absorbing, and feed the energy to chlorophyll, thus providing more light energy to the leaf. They also help in a completely opposite way, by protecting chlorophyll from being damaged by excess light. Too much light overloads the systems involved in photosynthesis and can damage the leaf. Carotenoids can take this excess energy and push it back out as heat, thus protecting chlorophyll and its essential function. When leaves are



Most people love vibrant fall leaves.

making and using lots of chlorophyll, during the sunnier months, it masks the yellows, oranges, and browns of the other pigments, making the leaves green.

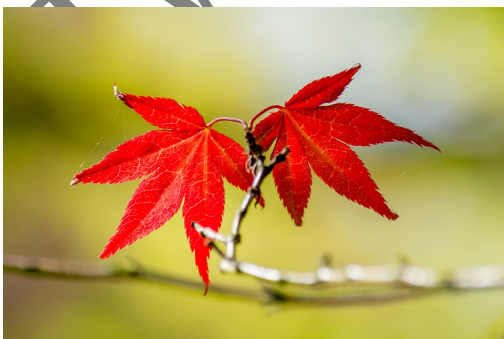
Changes in Weather and Lengths of Days

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less chlorophyll increasingly rapidly and eventually stop altogether. The chlorophyll remaining dies off and is not replaced. With no more chlorophyll in the leaves, there is nothing to make them green. The other pigments that were always there are allowed to show through, resulting in orange and yellow leaves.



Anthocyanin is responsible for leaves that turn red.

Red Leaves

A third pigment, **anthocyanin**, turns leaves red, purple, and brown. Anthocyanin is responsible for the reds of apples and the blue of blueberries. Right before leaves begin to fall, trees start making anthocyanin using the leftover sugar in the leaves. It's not entirely clear why trees

do this, but one hypothesis is that anthocyanin acts as a sunscreen. In this role, it would protect the leaves, giving them a little extra time to recoup some of the nutrients in the leaves before they fall off. However, other tree species that don't produce anthocyanin are able to recoup nutrients just as well as anthocyanin-producing trees. Other possibilities are that it helps prevent cold damage or fungal/insect attacks. It may function in several different ways. Research is ongoing.

Tree Species Differences

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Weather and soil moisture affect timing and intensity of leaf colors.

Color Intensity and Timing

The Earth tilts predictably each year, so day length changes regularly every fall. Why, then, do we see such different hues from year to year and on different trees? Temperature, of course, plays a role. In especially cold years, chlorophyll disappears more rapidly. When the fall is especially clear, allowing greater sunlight during the day, anthocyanins can be produced more quickly. If there is an early frost, however,

anthocyanins won't be produced.

Soil moisture also affects color timing and intensity. Drought can cause leaf color change to occur later in the season, while abundant soil moisture in the spring leads to more vibrant fall colors. An

autumn with cool, frostless nights following a warm, wet growing season produces the most brilliant leaf color show.

Trees That Don't Change Color

Evergreen trees, such as pines, don't exhibit leaf color changes. This is because their leaves have a protective waxy coating as well as products within the leaf to prevent freezing. Trees that lose their leaves do so to protect the rest of the tree from losing minerals to frozen, useless leaves. If the leaves don't freeze, there is no danger of mineral loss.



Evergreen leaves don't change color.

Reading Comprehension Questions:

- 1) What
- 2) What
- 3) Why does the weather become colder in the fall?
- 4) What
- 5) What other pigments are present in leaves that give them their brilliant fall colors?
- 6) Why are the

Extension Questions:

- 7) Why do you think trees grow new, green leaves each spring?
- 8) How
- 9) Using what

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TWF READING

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