

Why Do Leaves Change Color?

Folk tales about the cause of fall leaf colors are entertaining, but the scientific explanation is almost as interesting.

Autumn leaf colors are the result of a chemical change in the leaves. The trigger is the onset of cooler temperatures and reduction in day length.

During the growing season, green leaves are green because of the large amounts of chlorophyll they contain. Chlorophyll is the key component in photosynthesis, the process by which leaves use sunlight and carbon dioxide to make the sugars and starches the tree uses for food. As long as they are growing, trees continually replenish their leaves' supply of chlorophyll. As the days get shorter and cooler, however, growth slows and the tree produces less chlorophyll. As chlorophyll in the leaves breaks down, it isn't replaced, and the other pigments that have been there along, masked by the green, become apparent.

The yellows, oranges and browns commonly seen in birch, hickory, aspen and some maples come from a group of pigments called carotenoids. These are the same pigments responsible for the colors in carrots, bananas and field corn.

Red and purple coloration in leaves of trees such as oak, sweetgum, dogwood and some maples is caused by anthocyanins, the same pigments that color cherries, grapes, blueberries and apples. In trees with green leaves, carotenoids are present in leaves all summer, but anthocyanins are produced in late summer and early fall in response to environmental cues.

Both kinds can occur in the same leaves and can combine to produce the fiery reds, oranges and bronzes seen in dogwoods, sumacs, oaks and maples. A wide range of colors is possible, though the basic color varies from species to species and cultivar to cultivar.

The intensity of color varies from year to year, depending on the weather. The conditions most favorable for brilliant reds are bright, sunny, warm days and cool nights. The leaves produce more sugar on warm days, and night temperatures below 45 degrees keep those sugars in the leaves. Pigments are formed in those sugars, so the more sugars, the more color.

