

What Makes the Leaves Change Color?

We are in the middle of the “peak color” season, and people frequently ask, “What causes the leaves to change color?” It turns out it is a really complicated sequence of events that cause deciduous trees and shrubs to turn from various shades of green to yellow, orange, and/or red, or just brown.

Throughout most of the spring, summer and early fall, most leaves have high amounts of a group of chemical compounds called chlorophyll. All of this group of compounds are green which gives the leaves their color. The general structures of chlorophyll molecules are somewhat similar to the hemoglobin molecule except hemoglobin contains iron while the chlorophyll has magnesium in its place.

Chlorophyll is the compound that allows green plants to manufacture sugars, starches and cellulose, all of which are carbohydrates, from the carbon dioxide in the air and water from the roots. In the process, chlorophyll is altered chemically to a colorless substance, but more chlorophyll is also continually manufactured by the leaves so the leaves stay green.

In the fall, as the length of daylight decreases and nighttime increases, something in the leaves of plants (See next week’s column) causes the photosynthesis and the manufacture of chlorophyll to slow down and to eventually stop. (I find it amazing that a plant, without a brain, can actually make physiological changes to itself in response to seasonal changes.)

As the green color fades, the color of another group of compounds, called the carotenoids, which have been in the leaves all the time, become visible, and these compounds are yellow or orange. These are the pigments that make corn and bananas yellow and carrots orange.

As the chlorophyll production declines, it triggers the production of another group of compounds, called the anthocyanins. These compounds are various shades of red, and are what gives color to red apples, strawberries and cherries.

So, to greatly oversimplify the whole process of fall color change, as the hours of nighttime increase, it signals to the leaves it is time to start shutting down photosynthesis and chlorophyll production and increasing the production of anthocyanins. This changes the color of the leaves from green to some mixture or combination of yellow, orange and red, and the relative amounts of these other colored pigments determine the exact shade of a leaf.

It is a common belief that weather, freeze dates, and/or rainfall determine the time of fall color. In fact, the predominant determinant of the timing of both fall color and of leaf

drop is the length of daylight and darkness. Temperature and rainfall can have a secondary effect on timing and on the exact balance of the fall color pigments, and thus cause slightly different colors in different years. Also, different species of trees and shrubs have different relative amounts of these pigments, and also react slightly differently to increasing nighttime hours.

So in a woodland with different species of trees, you can expect to see different colors on any given day and perhaps a few days later see another collection of different colors. Bright sunny fall days with cool nights tend to give rise to more vivid colors. Also, there is always a slight variation among individual trees in terms of both timing and color.

Because day length is a function of latitude, the days get shorter in the north earlier than they do here, (This time of year we have over an hour more daylight than Minnesota) which is the main reason leaves turn colors earlier in the north.

As the process of shutting down photosynthesis and chlorophyll production continues in the leaves, the veins of the leaves begin closing off, and at some time the structure at the base of the leaf petiole (stem that attaches the leaf to the twig) dries up and that is what causes the leaves to fall. As the pigments fade, the leaves turn brown which is the color of the cell membrane of the leaves when there are no pigments to give color.

One thing to note, Mother Nature does not rake leaves! Having the leaf litter remain under trees allows the nutrients in the leaves to be recycled into the soil to help the trees grow more leaves next year. It also insulates the soil and keeps moisture from evaporating, so the feeder roots and micro-organisms can stay moist. In other words, Mother Nature knows best!

Happy Thanksgiving!

Until next time...

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