



Why do leaves change color?

As I was leaving the garden club meeting yesterday, I noticed a green tree is no longer green. Yes, I know, and I don't know why I didn't ask this question. My only defense is I did ask the question and have forgotten that I did. So, why do leaves change color in the fall.

I have come up with several conclusions and some are more fun to think about than others.

The fun one that come to mind is an old campfire talk from our beloved Native Americans. I truly don't remember the source. Many years ago, as Mother earth was just developing her children, she heard arguments between different groups about other groups. Plants, trees, animals, insects, worms, and I was very surprised but even humans. Mother earth decided that she needed to have a meeting with all parties in attendance. She created a language that everyone could speak and understand. As expected, humans spoke up first and loudly "we have done nothing wrong". This was before the problem was even discussed. Finally, some started talking about why they had issues. A lot of the issues were against humans and disrespect to everyone else. This was a very long list only good for a book. Short list Several animals fish and reptiles complained they were killed and eaten. Some plants jumped in and said they were eaten also. Last a couple of worms complained they were tired of being stepped on and a couple of times while hiding behind a tree they were pooped

on. Oh my. The humans that were present apologized and explained they had to eat to live. The deer understood that as they had to eat also. The humans who now understood said they would like to become stewards of all things. If they took a life or plant for food, they would respect and give thanks for that sacrifice. Reluctantly the issue was closed. Now finally the reason leaves change color. It was because of winter. Winter was cold and food was scarce. Several groups said they lost members during winter and were asking what could be done. We all know that sometimes we need to be told the solution and Mother earth, being smart gave out instructions. She explained each session and why we had it. The problem was winter came without warning. She addressed the lack of food first. Her command was trees and shrubs would change color in fall. Changing leaf color would tell everyone to store food for the winter. Cold was one of the other complaints. Certain trees and shrubs would drop the leaves and then they could be used as blankets or insulation. Bears said, "we will eat and take a long winter nap". They did ask that the skunk cabbage be available when they woke up. The party continued for days. Weeks, maybe it is still going on in someone's dreams. So, Denise, that is a long story. Why leaf's change color.

The nerdier story. Why do leaves change color.

(This information is from the USDA Forest Service. "Science of Fall Colors").

There are three factors that influence autumn leaf color change.

- Leaf pigments
- Length of night
- Weather

A color palette needs pigments, and there are three types that are involved in autumn color:

- **Carotenoids:** Produces yellow, orange, and brown colors in such things as corn, carrots, and daffodils, as well as rutabagas, buttercups, and bananas.
- **Anthocyanin:** Gives color to such familiar things as cranberries, red apples, concord grapes, blueberries, cherries, strawberries, and plums. They are water soluble and appear in the watery liquid of leaf cells.
- **Chlorophyll:** Gives leaves a basic green color. It is necessary for photosynthesis, the chemical reaction that enables plants to use sunlight to manufacture sugars for food.

Trees in the temperate zones store these sugars for the winter dormant period.

Both chlorophyll and carotenoids are present in the chloroplasts of leaf cells throughout the growing season. Most anthocyanins are produced in the autumn, in response to bright light and excess plant sugars within leaf cells.

During the growing season, chlorophyll is continually being produced and broken down and leaves appear green. As night length increases in the autumn, chlorophyll production slows down and then stops and eventually all the chlorophyll is destroyed. The carotenoids and anthocyanin that are present in the leaf are then unmasked and show their colors.

Length of Night

In early autumn, in response to the shortening days and declining intensity of sunlight, leaves begin the processes leading up to their fall. The veins that carry fluids into and out of the leaf gradually close off as a layer of cells forms at the base of each leaf. These clogged veins trap sugars in the leaf and promote production of anthocyanin. Once this separation layer is complete and the connecting tissues are sealed off, the leaf is ready to fall.

How does weather affect autumn color?

The amount and brilliance of the colors that develop in any particular autumn season are related to weather conditions that occur before and during the time the chlorophyll in the leaves is dwindling. Temperature and moisture are the main influences.

A succession of warm, sunny days and cool, crisp but not freezing nights seems to bring about the most spectacular color displays. During these days, lots of sugars are produced in the leaf but the cool nights and the gradual closing of veins going into the leaf prevent these sugars from moving out. These

conditions – lots of sugar and light – spur production of the brilliant anthocyanin pigments, which tint reds, purples, and crimson. Because carotenoids are always present in leaves, the yellow and gold colors remain constant from year to year.

The amount of moisture in the soil also affects autumn colors. Like the weather, soil moisture varies greatly from year to year. The countless combinations of these two highly variable factors assure that no two autumns can be exactly alike. A late spring, or a severe summer drought, can delay the onset of fall color by a few weeks. A warm period during fall will also lower the intensity of autumn colors. A warm wet spring, favorable summer weather, and warm sunny fall days with cool nights should produce the most brilliant autumn colors.

What does all this do for the tree?

Winter is a certainty that all vegetation in the temperate zones must face each year. Perennial plants, including trees, must have some sort of protection to survive freezing temperatures and other harsh wintertime influences. Stems, twigs, and buds are equipped to survive extreme cold so that they can reawaken when spring heralds the start of another growing season. Tender leaf tissues, however, would freeze in winter, so plants must either toughen up and protect their leaves or dispose of them.

- **Evergreens:** pines, spruces, cedars, firs, and so on are able to survive winter because they have toughened up. Their needle-like or scale-like foliage is covered with a heavy wax coating and the fluid inside their cells contains substances that resist freezing. Thus, the foliage of evergreens can safely withstand all but the severest winter conditions, such as those in the Arctic. Evergreen needles survive for some years but eventually fall because of old age.
- **Broad-leaved trees:** These are trees that do not have needles or scale-like leaves. They are tender and vulnerable to damage, are typically broad and thin and are not protected by any thick coverings. The fluid in the cells of these leaves is usually a thin, watery sap that freezes readily, which makes them vulnerable in the winter when temperatures fall below freezing. Tissues unable to overwinter must be sealed off and shed to ensure the plant's continued survival.

What happens to all those fallen leaves?

Needles and leaves that fall are not wasted. They decompose and restock the soil with nutrients and make up part of the spongy humus layer of the forest floor that absorbs and holds rainfall. Fallen leaves also become food for numerous soil organisms vital to the forest ecosystem.

It is quite easy to see the benefit to the tree of its annual leaf fall, but the advantage to the entire forest is more subtle. It could well be that the forest could no longer survive without its annual replenishment from leaves than the individual tree could survive without shedding these leaves. The many beautiful interrelationships in the forest community leave us with myriad fascinating puzzles still to solve.

Thank you for sharing my path and listening to my drummer. Rusty O'Neal