Fall of the Leaf

By Susan Camp

While my husband and I were in Arizona a few weeks ago, we enjoyed the bright yellow cottonwoods, which made a striking contrast with the deep green Ponderosa pines and dusty blue-gray juniper foliage. The trees were beautiful, but I missed the varied colors of autumn in Virginia.

On the long plane ride home, I pondered three questions: Why do leaves change color in autumn? Why do they fall? Why do we have two words for the third season of the year?

In the back of my mind, I located some half-forgotten information about leaf color change from the Master Gardener and Tree Steward courses, but the memory was pretty fuzzy, so I decided to do a little reading on the topic.

The leaves of deciduous trees turn color in the fall because of chemical changes that occur to leaf pigments. The two most important pigments are chlorophyll and the carotenoids. Chlorophyll is the chemical that gives leaves their green color. Chlorophyll is necessary for photosynthesis, the chemical process by which plants use sunlight to change water and carbon dioxide into sugars to use as food. Carotenoids, including carotene and xanthophyll, produce orange, yellow, and brown colors. The dominant chlorophyll masks the carotenoids' colors in leaves most of the year. A third pigment, anthocyanin, produces red shades in fruits, flowers, and other plant parts.

As the days grow shorter and nights grow longer and the temperature decreases, chlorophyll production slows down and gradually stops. Carotenoid pigments are unmasked, and yellow, orange, and brown leaves appear. These colors remain constant from year to year. Warm, sunny days and cool nights above freezing cause the production of anthocyanin pigments, which help trees to recover and store the sugars they will need to survive the cold winter months. Anthocyanins result in a spectacular fall color show of bright reds and purples in trees like maples and dogwoods.

Soil moisture affects color, as do a late, cool spring and a period of summer drought, both of which serve to delay the onset of fall color. The ideal weather for brilliant color includes a warm, wet spring, a summer without temperature extremes, and sunny fall days and cool nights.

A tree's leaves, unlike the twigs and branches, aren't hardy enough to withstand freezing weather. The thin leaves are composed of watery, sap-filled cells, so trees have evolved a means of sealing off and shedding the leaves. As the days shorten, the leaf veins close and a layer of cells is produced at the leaf stem base to separate the leaf from the tree. Eventually, the leaf falls and the tree seals the wound with a leaf scar. The leaves of some oaks and other trees remain attached until spring. Evergreen needles or scales survive frigid temperatures because they are covered with a protective, waxy coating and their cell fluid contains chemicals that help them

resist freezing. The USDA Forest Service Northeastern Area article “Why Leaves Change Color” and the SUNY College of Environment Science and Forestry publication “Why Leaves Change Color” both offer information on the phenomenon.

We now know why tree leaves change color in autumn and why they separate from the trees after the color fades. The third pressing question is the reason why this season has two names. The first English term for the third season was *haerfest* or harvest. The word “autumn” was adopted from the French in the late 14th century. “Fall” is derived from a Germanic word meaning “to fall from a great height” and eventually came to mean “fall of the leaf.” Fall became the term of choice in the United States and Canada in the 17th century, while Britain continues to favor the use of autumn. www.slate.com and www.livescience.com offer similar explanations for word origins and usage. Whether I call it autumn or fall, it is my favorite season.

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