The Science of Fall Color

Fall color actually starts during high summer. Subtly decreasing amounts of daylight trigger the beginning of nitrogen re-absorption from the leaves back into the tree's woody tissue. We cannot see this process. It starts in July and by late September, more than half of each leaf's nitrogen (and phosphorous) has been returned to the woody tissue, where it acts as an antifreeze for the tree and will provide an infusion of nutrients for early spring growth.

Cool September nights stimulate cells at the base of each leaf stem, or petiole, to dry out. Just inside these cells a layer of tough, corky cells develops, stopping the flow of water into the leaf and stopping the export of carbohydrates and metabolic waste back to the tree.

With the flow of water staunched, the production of chlorophyll stops. Chlorophyll, the green pigment in leaves, is volatile. Sunlight destroys it. A constant supply of water up through the trunk and into each leaf is required for the tree to continue manufacturing chlorophyll. As the flow of water into each leaf is cut off, the leaves become less and less green. In a dry summer, this de-greening of leaves may be obvious much earlier than in a wet summer as trees simply run out of water to maintain full chlorophyll production.

With chlorophyll production winding down, previously unseen pigments appear. Xanthophylls, the yellow pigment in egg yolk and butter, and carotene, the orange pigment in carrots – both of which are present in varying amounts in different tree species all summer but hidden by chlorophyll – transform the leaves of American elm, quaking aspen, paper birch, and black willow to a golden yellow.

While autumn yellows are produced by subtraction, autumn reds are produced by addition – the addition of sugars and leaf waste which cannot exit through the plugged petioles. Anthocyanin yields the red of sumac, blueberry, red maple, and Virginia creeper, the purple-blue of white ash, and the purples of viburnum. If the leaf sap containing anthocyanin is acidic, leaves turn red. If the sap is alkaline, they turn blue or purple.

Anthocyanin is a sun pigment. If late September and October are overlaid with clouds, little anthocyanin is produced. Leaves go from green to yellow. Sunny days and cool nights, however, generate reds and oranges and purples. A hard frost ruptures plant cells, causing their contents to leak out and destroying their brilliant color.

Sugar maple leaves contain all three pigments – xanthophyll, carotene, and anthocyanin. Sugar maple leaves turn yellow in the shade, red in the sun, and, depending on the proportion of sun and shade, and can change hourly from yellow to red to orange.

More About Maple Leaf Colors:

Fall colors and maple trees in fall are an important staple piece in many landscapes and provide glorious displays of color year after year (usually)!

Exactly which colors predominate in autumn leaves depends on the tree species (not necessarily variety) and the local weather. **Temperature** and **light** influence the intensity and duration of autumn color. Rainy, overcast days may cause the chlorophyll to degrade more quickly, thus increasing the intensity of the yellow colors and orange colors. Low temperatures above freezing favor production of the red-pigmented anthocyanins. Early frosts degrade the reds.

Weather is the primary factor for determining color in your maple tree leaves season to season.