AGRICULTURAL

MU Guide

PUBLISHED BY MU EXTENSION, UNIVERSITY OF MISSOURI-COLUMBIA muextension.missouri.edu/xplor/

Autumn Colors

Julie L. Rhoads
School of Natural Resources

The spectacular parade of colors associated with the "Indian Summer" days of autumn is created by a complicated series of interactions involving pigments, sunlight, moisture, chemicals, hormones, temperature, length of daylight, growing location and genetic traits. A precise clockwork within the leaf cells sets the forests of Missouri ablaze when early fall days are bright and cool, and nights are chilly but not freezing.

Several central Missouri highways have reputations for being particularly beautiful autumn drives: Highway 19 between I-70 and Hermann, Highway 94 north of the Missouri River between Jefferson City and Hermann, and Highway 100 south of the Missouri River between Hermann and Washington.

A favorite route for fall foliage watching in eastern Missouri is Highway 79 along the Mississippi River between Winfield and Hannibal. Good colors can also be found on the bluffs along the Missouri River Trail in the central part of the state around Columbia and the piedmont area around Ironton.

The leaves of the growing season are green because of the formation of chlorophyll, a pigment found in minute leaf structures called plastids. Chlorophyll is the change agent for food making in green plants. These green pigments use energy from sunlight, carbon dioxide from air, and water from the tree itself to produce simple sugars that feed the tree in a delicate process known as photosynthesis.

Yellow and orange pigments called carotenoids are also present in the leaves during the warm weather of the growing season but are masked by the greater amounts of the green pigments. Autumn's dropping temperatures and shorter periods of daylight stop the production of new green pigments and cause existing chlorophyll to degrade at an accelerated rate. The yellow pigments are then "unmasked" as the green pigments disappear, accounting for the brilliant coloration of Missouri hardwood species such as hickories, birches, cottonwood, sassafras, poplars and hackberry.

These autumn environmental stimuli also cause the leaves to form abscisic acid, a hormone that induces the plant to form weak layers of new cells at the base of the leaf stem. These "abscission zones" eventually break apart from wind or other physical disturbances, often causing the leaf to fall before the yellow and red pigments have deteriorated.

The pigments responsible for the vivid red and purple autumn colors of persimmons, dogwoods, maples, sumacs, sweetgums and ashes come from another group of cell pigments called anthocyanins. Anthocyanins develop in the sap of leaf cells in late summer and are stimulated by lowering temperatures and high light levels. If the tree's sap is acidic, the leaves become red; alkaline sap causes purple coloration. Anthocyanin formation in the leaf depends on a simultaneous increase of sugars in the presence of bright light and a decreasing level of phosphate caused by the chemical moving out of the leaf into the stem. Mild drought conditions also stimulate production of the red pigments.

Carotenoids and anthocyanins often combine in leaves to give the deep oranges, fiery reds, and bronzes typical of many hardwood species. Brown autumn leaf color of oaks and beech is due to the presence of the brownish tannin compounds in combination with the carotenoids.

Several environmental factors can diminish the

colors of fall foliage. Very warm weather encourages late-season chlorophyll production and vegetative growth, which discourages initiation of autumn colors. If an early frost occurs before abscission, leaves die before the pigments fully develop, and then simply shrivel and fall to the ground. Long periods of wet, cloudy weather in the fall produce a drab coloration because of low light intensity.

Necessary conditions for the brightest fall colors are cool but not freezing temperatures, mild late-season drought and sunny days. Table 1 shows the fall colors of various native trees in Missouri woodlands.

Table 1. Fall colors for common native Missouri deciduous trees.

Tree	Color
Ash, green (Fraxinus pennsylvanica)	yellow
Ash, white (Fraxinus americana)	orange/purple
Basswood, American (Tilia americana)	brown/yellow
Birch, river (Betula nigra)	yellow
Bladdernut, American (Staphylea trifolice)	yellow
Buckeye, Ohio (Aesculus glabra)	yellow
Cherry, black (Prunus serotina)	yellow
Dogwood (Cornus florida)	red/purple
Elm, American (Ulmus americana)	yellow
Hackberry (Celtis occidentalis)	yellow
Hawthorn, downy (Crataegus mollis)	red
Hazelnut (Corylus americana)	yellow
Hickory, bitternut (Carya cordiformis)	yellow
Hickory, shagbark (Carya ovata)	orange/yellow
Honeylocust (Gleditsia triacanthas)	yellow
Ironwood (Ostrya virginiana)	yellow/red
Maple, black (Acer nigrum)	yellow/orange
Maple, red (Acer rubrum)	yellow/orange/red
Maple, silver (Acer saccharinum)	yellow
Maple, sugar (Acer saccharum)	yellow/orange/red
Musclewood (Carpinus caroliniana)	yellow/orange/red
Oak, post (Quercus stellata)	brown/red
Oak, northern red (Quercus rubra)	red
Oak, white (Quercus alba)	brown/red
Persimmon (Diospyros virginiana)	orange/yellow/red
Poplar (Populus deltoides)	yellow
Redbud, eastern (Cercis canadensis)	yellow
Sassafras (Sassafras albidum)	orange/yellow/red/purple
Serviceberry, downy (Amelanchier arborea)	yellow/orange/red
Sumac, smooth (Rhus glabra)	red
Sycamore, American (Platanus occidentalis)	brown/yellow
Walnut, black (Juglans nigra)	yellow

OUTREACH & EXTENSION
UNIVERSITY OF MISSOURI
COLUMBIA

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Ronald J. Turner, Director, Cooperative Extension, University of Missouri and Lincoln University, Columbia, MO 65211. ■ University Outreach and Extension does not discriminate on the basis of race, color, national origin, sex, religion, age, disability or status as a Vietnam era veteran in employment or programs. ■ If you have special needs as addressed by the Americans with Disabilities Act and need this publication in an alternative format, write ADA Officer, Extension and Agricultural Information, 1-98 Agriculture Building, Columbia, MO 65211, or call (573) 882-7216. Reasonable efforts will be made to accommodate your special needs.