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Volume 23

What Causes the Brilliant Leaf Colors of Fall?

By Linnea West, TN Urban Forestry Council



In early autumn, longer nights prompt cells between leaf petiole and twig to begin dividing rapidly, producing a thin corky layer.

This corky layer of cells gradually blocks the flow of water and minerals coming up from the roots to the leaves and, also, blocks the transport of glucose, manufactured in the leaves, back to the woody parts of the tree.

The green color we see in leaves during the growing season comes from chlorophyll. Sunlight is absorbed by the chlorophyll in leaf cells and photosynthesis begins.

Photosynthesis is the process by which plants use the **energy of sunlight** plus **water** and **carbon dioxide** to produce **glucose** and **oxygen**.

Throughout the growing season of spring and summer, trees make their own food through photosynthesis, and provide additional glucose and oxygen vital to the web of life*.

As lengthening nights cause the corky layer of abscission cells to block the flow of liquid between leaf and woody twig, chlorophyll production slows, then stops... and the leaf colors that were hidden by green chlorophyll are revealed:

orange *carotenoids*, yellow *xanthophylls*, brown *tannins*, red and purple *anthocyanins*. (Additional anthocyanins are created during cool weather from sugars trapped in the barricaded leaf.)

Eventually, the corky abscission cells dry up, the petiole breaks off from the branch, and the leaf drifts to the ground. Within the loose leaf, the yellow, orange, red and purple colors gradually fade, leaving only brown tannins. The fallen leaves decompose on the ground to nourish the tree in future years.

Unique chemical compositions of different species of trees determine their potential range of colors. Location and weather conditions affect the expression and intensity of colors each fall. Ideal weather conditions for a colorful display would be a summer growing season with plenty of rain, followed by an autumn of sunny warm days and cool, but frost-free, nights.

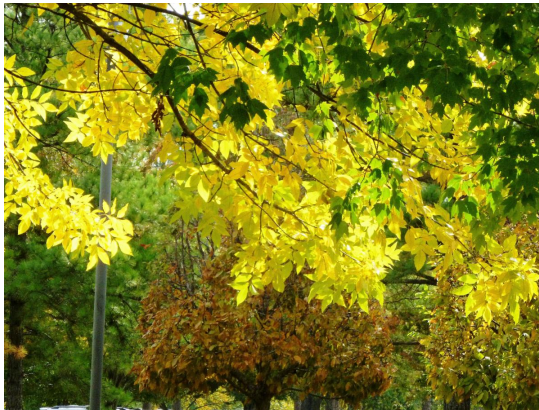
Why lose leaves at all as cold weather approaches? Survival! Tender leaf tissue would freeze in winter, so trees must either have leaves that are tough and waxy like needle evergreens, hollies, and our *Magnolia grandiflora* – or pull back their sap and discard their leaves, entering a dormant state for winter.

Winter survival preparation for the trees, glorious show of color for us!

*It is not just animals who need oxygen. Trees and all other plants require oxygen for breaking down glucose to release metabolic energy.

Planting Trees in the Fall: Laying the Foundation for a Lifetime of Growth

By Bo Kelley, MBG Arborist



In temperate regions of the world, plant life has been required to adapt to a multitude of environmental factors that change with the seasons. Temperature, precipitation, wind, soil conditions, and even animal activity have influenced the strategies that plants utilize to ensure their survival. Perennial plants, such as trees, often showcase a timed order of life cycle events as a result of evolving in habitats that experience such drastic change. We can think of the blooming of flowering trees, the formation of pollen producing cones in conifers, or the change of leaf color in deciduous trees as events that occur at specific times of the year. In addition to these dramatic changes above ground, one event is paramount for the tree's survival: root growth.

Roots, like flowers and fruits, do not grow at the same rate throughout the year. They grow during the spring, but most trees exhibit a secondary phase of root growth in the fall, before winter frosts returns. We can take advantage of this event when planting, because the tree is able to focus its energy on root growth, without shuttling resources towards expensive processes of leaf, flower, or fruit growth, as it would during the spring. Trees planted in the spring can survive, but the energy they have stored is split between growth above ground and establishment below ground, and they might require extra care, attention, and chemical intervention on your part. Often, if a tree is planted too late in the spring, the energy stored in the roots is shuttled upwards to produce leaves and elongate shoots, without being replenished through the unestablished root system. Trees will appear to grow but will then wither as the temperature increases into summer.

If planted in the fall, the tree will have a period of dedicated root development to enable it to survive the winter. The following spring, the tree will be established in the soil (both physically and symbiotically with bacteria and fungi) and energy expended on root growth will lead to increased nutrient absorption, ensuring a successful spring production of leaves and flowers along with sufficient water

Root growth is a process that allows a tree to establish itself within its habitat. The importance of the root system cannot be understated as it not only secures the tree in place; it also serves as the interface between the plant and the soil, creating the opportunity for the development of beneficial, symbiotic relationships with bacteria and fungi, generating an avenue for nutrient absorption.

When planting trees, root establishment is critical for the tree's survival, especially in its first year.

absorption to survive our hot summers. It may appear contradictory (most "big box" stores will have dramatically smaller supply and diversity of trees in the fall, possibly perpetuating this contradiction) but planting trees at this time of the year increases the tree's survivability in its first year. Check your local nurseries, which should have adequate selections of native trees for you to plant during the fall. Planted trees are capable of living for many years. We can ensure they do so by giving them the best possible start.

DID YOU KNOW?

- That the **Tennessee Urban Forestry Council** has a very strong chapter that meets in Memphis (901-636-4128 for more information on meeting dates and times).
- That the Tennessee Urban Forestry Council has an **Arboretum** Program that certifies tree collections and encourages community education.
- That the Tennessee Urban Forestry Council offers a 5-week **Urban Forestry Advisor's Class** every fall (901-636-4128 to get on next year's waiting list).
- That Memphis has been recognized as a **Tree City USA** and has a tree board that promotes tree education and proper care of existing trees.
- That the Memphis Botanic Garden offers **Tree ID Classes** both on-grounds and at other arboreta in the community. The next class is on fall color/mast on Oct. 30th. 901-636-4128 for more information or to register.
- That **Under the Oaks** newsletters are archived on our web site.



All photos by Jan Castillo, TN Urban Forestry Council

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