J&L Garden Center

The All Season Gift and Garden Center

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'Falling Leaves'

Every fall deciduous trees and shrubs go through a transition period where their leaves turn from green to beautiful shades of yellow, red, orange, crimson and other colors. These fabulous fall colors look even more beautiful when set against or amongst the dark green foliage of pine and spruce. To most people, this is just the ***'Changing of the Fall Leaves Season'*** and there are just a couple of colorful weeks left before *'Old Man Winter'* sets in. But, what really causes these leaves to turn color and then drop off the trees is very fascinating. *Mother Nature* knows what she is doing and she helps her plants survive the cold winter weather in a number of ways.

Why do leaves fall?
Where do leaf colors come from?
Why do leaves change color?
Why do some trees turn yellow and others red?
How do leaves change color?
Do leaves change color because of weather?
Why is fall color better some years than others?

Why do leaves fall?

The process of leaves changing color and falling off a tree is an actual growth process that all deciduous plants must complete each fall. The plant actually uses energy to complete the process. A healthy plant drops its leaves; a dead or dying tree doesn't lose its leaves unless they are physically removed by wind, snow, or shaking. A tree's roots, branches and twigs can endure freezing temperatures, but most leaves are not so tough. A deciduous tree, such as a maple or a birch, have thin leaves, made up of cells filled with watery-sap, which will freeze in winter. Any plant tissue unable to live through the winter must be sealed off and shed to ensure the plant's survival.

As sunlight decreases in autumn, the veins that carry sap in and out of a leaf gradually close. A layer of cells, called the separation layer, forms at the base of the leaf stem. When this layer is complete, the leaf is separated from the tissue that connected it to the branch, and it falls. Oak, beech, and sycamore tree leaves are the exception. The separation layer never fully detaches the dead leaves on these trees, and they remain on the tree through winter.

Evergreens such as juniper, pine, spruce, cedar, fir, laurel, euonymus, and holly plants don't lose their leaves (or their needles) in winter. The leaves and needles are covered with a wax coating and the fluids inside the cells contain ingredients that resist freezing. Evergreen needles and leaves live for several years before they fall.

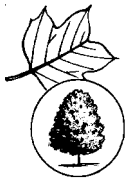
Where do leaf colors come from?

Leaves contain four types of pigments which influence their colors in both summer and fall.

* **Chlorophyll.** Leaves are green because of a group of pigments known as chlorophyll. Chlorophyll is vital to the plant's food-making process, called photosynthesis. Leaves manufacture simple sugars from water and carbon dioxide, using energy captured from the sun by chlorophyll. A bi-product of this process releases oxygen into the atmosphere. These sugars are the source of the carbohydrates needed for the plant's growth and development.

In the food-making process, chlorophyll molecules break down and are continually "used-up". However, the plant replenishes them all through the growing season. As long as replacement remains high, the leaves stay green because chlorophyll is the most dominant pigment and masks most other pigments.

* **Carotenoids.** This pigment produces yellow colors in plants. Orange colors are produced by a combination of both carotenoid and anthocyanins. Carotenoids produce the brilliant yellow leaves in birch,



ginkgo and norway maple leaves. Corn, carrots, daffodils, and buttercups also have a lot of carotenoids.

* **Tannins.** This pigment turns leaves brown. English oak, beech, walnut, and sycamore trees are trees that contain a large quantity of tannin. This pigment also turns the yellow, orange, or red leaves brown after they drop to the ground.

* **Anthocyanins.** This pigment produces pink, red, and purple colors in leaves. Not all leaves contain this pigment and this pigment is more finicky. The amount of light, and the acidity of the soil, determines how much anthocyanins a plant will produce. The more sunlight, the redder the leaves will be. The more acid the soil, the redder the leaves, and the more alkaline the soil, the more purple the leaves will be. Red apples, concord grapes, blueberries, cherries, strawberries and plums contain anthocyanins. Anthocyanins also produce the red leaves in red maples, burning bush, oak, and sumac.

Unlike the carotenoids, these pigments are not present in the leaf all season. They develop in late-summer within the sap of the leaf cells. Their formation depends on the breakdown of sugars in the presence of bright light, and the lowering of phosphate in the leaf. The phosphate level in leaves is high during the growing season, but in autumn it moves out of the leaf and into the stem of the plant. When this happens, the sugar breakdown process changes, leading to the production of anthocyanin pigments. The brighter the light, the more anthocyanins are produced and the more brilliant the color.

Why do leaves change color?

During the growing season, leaves appear green because the plant is producing abundant quantities of chlorophyll. As the amount of daylight decreases in autumn, chlorophyll production slows down and then stops completely, enabling the carotenoids and anthocyanin pigments to appear. Moisture and temperature can also influence how fast the color changes and how brilliant the change will be. The soil pH has a big impact on how bright the reds and purples will be in some plants. For example, a burning bush growing in a soil with a high pH (alkaline) will not always produce the brilliant red colors that the same plant would have produced with a different soil condition (more acidic). If your soil is alkaline, try mixing a cup of vinegar in 5 gallons of water and pouring the solution around your plants (not on your plants) once or twice in the summer to change the soil pH. It may help improve the red fall colors in that plant.

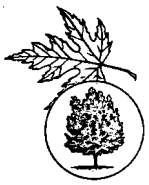
Colors are their brightest when warm fall days are accompanied with very cool nights (below 45 degrees but above freezing). An early fall, with adequate moisture conditions, stimulates brilliant red and purple color changes. The yellow and brown colors will always be brilliant no matter what the weather is, but the reds and purples will vary from year to year. Watch the mountains, some years the colors are brilliant, other years they are not so spectacular. The temperature and moisture also determines how long the colors stay vivid. The cooler and wetter, the longer the colors remain brilliant.

How do leaves change color?

Color change happens because of a combination of naturally occurring chemical changes in the plants, and the plant's environment. These chemical substances, known as plant hormones, regulate the plants growth and development and they regulate when the plant is to grow and when the plant is not to grow. There are five groups of these hormones, three of which promote plant growth and two of which inhibit plant growth. The three growth promoters are auxins, gibberellins and cytokinins. The two growth inhibitors are ethylene and abscisic acid. When the levels of growth promoters are higher than the levels of growth inhibitors, the plant is actively growing. When levels of growth inhibitors are higher than levels of growth promoting hormones, growth of the plant slows and stops.

Day length and temperature regulate when these hormones are active in the plant. In the spring, as the day length becomes longer and the temperatures begin to warm, growth promoters reach higher levels in the plant - which starts the plant actively growing. In autumn, the day length becomes shorter and the temperatures cooler, causing the growth inhibitors to reach higher levels than growth promoters in the plant. Ethylene and abscisic acid reach levels that override the growth promoters, causing the plant to go dormant.

Once the growth inhibitors reach higher levels than growth promoters, chlorophyll, the green pigment in plants, is lost. Other pigments then become more obvious in the leaves color.



The levels of ethylene and abscisic acid continue to build up as the days

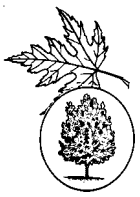
shorten and temperatures get cooler. At the base of the leaves petiole (leaf stalk) which is fastened to the twig or stem of the tree, a bump or thicker part of the petiole develops due to the build up of ethylene and absicsic acid. This bump is known as the abscission layer. Abscisic acid was named because of its association with leaf, flower and fruit abscission (to cut or fall off) of plants. You may notice this bump on the end of an apple stalk and other fruit also. As the chemicals build up in this abscission layer, the cells become softened and the leaf or fruit finally breaks away and falls to the ground. Immediately after leaf fall, a corky tissue develops, closing the wound on the stem side of the abscission layer. This healing layer of corky tissue forms the leaf scar on the twig. This leaf scar is located at a node, directly below a leaf bud.

If you look closely at the twigs on your trees and shrubs after the leaves have fallen, you will notice that next spring's leaf and flower buds have all ready developed. The smaller buds are the leaf buds and the larger buds are the flower buds. These tiny, highly compressed leaf and flower buds are covered with scale-like structures called bud scales. These overlapping bud scales protect the delicate leaves and flower buds from the harsh winter climate, they are called dormant buds. These leaf and flower buds grow very quickly in the spring because they have all ready been formed. This is why lilacs and forsythia can have such beautiful large flowers so early in the spring.

Do leaves change because of weather?

Perhaps you've noticed that in some years, the red fall colors seem brighter and more spectacular than in other years. The temperature and cloud cover can make a big difference in a tree's red colors from year to year.

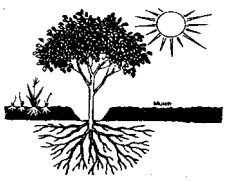
When a number of warm, sunny autumn days accompany cool, but not freezing nights, it's going to be a good year for reds! In the daytime, the leaves can produce lots of sugar, but the cool night temperatures prevent the sugar sap from flowing through the leaf veins and down into the branches and trunk. The extra sugar sap and sunlight increase the production of the anthocyanin pigments in the leaves. When the chlorophyll is finally gone, these leaves will turn bright, brilliant shades of red, purple and crimson.



The yellow, gold and orange colors created by carotenoid remain fairly constant from year to year, however. That's because carotenoid are always present in leaves, and the amount does not change in response to weather.

The amount of rain in a year also affects autumn leaf color. A severe drought can delay the arrival of fall colors by a few weeks. A warm, wet period during fall will lower the intensity, or brightness, of autumn colors. A severe frost will kill the leaves, turning them brown and causing them to drop early. The best autumn colors come when there's been a warm, wet spring, a summer that's not too hot or dry, and a fall with plenty of warm sunny days and cool nights.

Fall color starts in September with poison ivy and sumac and ends in November with the weeping willows, with a lot of color changes in between. Frost and freezing temperatures will stop the coloration process in progress and blacken the leaves quickly.



Why is fall color better some years than others?

There is no formula to predict fall color for a given year. The intensity of fall color and time of peak color vary and are determined by complex environmental factors, as well as the genetic makeup of the plants themselves. These factors vary from plant to plant and from region to region.

The *'best'* fall color for an area occurs during the shortening days of autumn when days are bright, sunny and cool, when nights are cool but not below freezing, and when there has been sufficient rainfall. In addition, the plant should have the proper soil pH and nutrients, and be free of diseases and pests.

As a general rule, plants growing in shade do not produce the brilliant colors that plants of the same species produce in full sunlight. Leaves on the top and south side of a tree will begin to change color first. Trees along the edge of a woodland, and tall trees that make up the forest canopy usually will change color first. Leaves on smaller saplings and more shaded trees stay green until the leaves of the taller, more exposed trees have changed color and fallen. This explains the two-tone effect on green ash, which exhibits yellow on leaves inside the tree and purple on the outside leaves where they are exposed to sunlight. It also explains why the flowering pear may have red leaves on top branches and yellow leaves on the

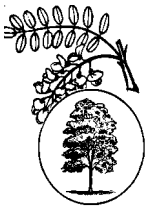
bottom and inner branches.

Also, plants that are in poor health, or are stressed, usually change color earlier than their healthy, unstressed neighbors. Leaf color change is a complicated interaction involving pigments, sunlight, moisture, chemicals, hormones, temperatures, length of daylight, site, and genetic traits that make for a perfect autumn color display.

Hot and dry fall weather will shorten, and sometimes even eliminate, the pretty fall color changes.

What Causes Premature Leaf Color?

Each year we look forward to trees and shrubs turning color and standing out in the yard with their impressive display of colorful leaves. However, if the plant changes color too early it could be a warning sign that the plant is under unusual stress. A closer look at the plant might be warranted especially if your plant started changing colors in August or early-September.



Weather conditions are a big factor that contributes to stress in plants. During a hot and dry summer many trees and shrubs, especially those near streets, driveways and parking lots can become overly *'stressed-out'*. Leaf scorch is a very noticeable symptom of plant stress and can cause some trees to turn color prematurely.

Early fall color can also be caused by root or trunk problems. Root problems can include cultivating too close to the plant, covering the drip line with too much extra soil, too much fertilizer or other chemicals in the soil, and the most common problem - too much or too little water. Trunk problems can include damage from lawnmowers or string trimmers, mouse or gopher damage, splitting bark from previous injuries, or even a string or wire tied around the trunk for a clothesline or to hold the burlap on the rootball when it was first planted.

A common problem for both burning bush and lilac plants that make them turn color prematurely is blight diseases. Both of these plants are troubled by this type of disease and may actually die from this problem if it is not properly treated.

Grasses

One of the more popular types of plants that add to the fall color landscape are the perennial ornamental grasses. They add a distinct appearance to the garden. The tall green leaves often turn golden yellow or brown in the fall. They move gracefully in the fall breezes. Grasses can be useful in many ways so don't cut down the dead blades of grass until early next spring. Grasses attract and feed winter wildlife. The birds, as well as squirrels, mice and other rodents, love the abundant seeds they produce. Birds also like to hide in the cover tall grasses afford in the yard. You can enjoy the added beauty of ornamental grasses in your yard this winter.

Pine Tree Needle Color

Contrary to the name *'evergreen'*, pine trees do not keep their needles indefinitely. Pine trees only keep an individual needle for two or three years. After that time period, the tree stops feeding the oldest needles. Each fall the needles die. They turn yellow or brown and drop off the tree. That is why the older pine trees are always bare in their center, and why homeowners are always upset with the needles making a mess on the ground around their trees.

Every spring, a pine tree grows a new set of needles. Every fall, the pine tree sheds its oldest set of needles. Some years a pine tree may shed two sets of old needles, making the fall needle drop even more apparent.

Needle drop in newly planted trees, and in trees under stress, is more noticeable than in the older and larger trees. However, all pine trees (Austrian Pine, Scotch Pine, Mugho Pine, Blue Spruce, Alberta Spruce, Junipers, Cedars, Cypress, and Yews), lose their oldest set of needles each fall, even the healthy trees.

Broadleaf Evergreen Leaves

Broadleaf evergreen plants also drop their oldest set of leaves. However, most broadleaf evergreens shed their old leaves in the spring, as soon as the plant produces new leaves. ***Leaf drop*** in the spring doesn't seem to be as noticeable as ***needle drop*** in the fall. Broadleaf evergreen plants, just like pine trees, do not keep their leaves indefinitely. They only keep individual leaves for one or two years before they shed them. Boxwood, euonymus, holly, rhododendron, and laurels are just a few of the broadleaf evergreens.

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