International Society of Arboriculture

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Press Release.

I.S.A. Explains The Fact & Fantasy of Autumn Colours!

Autumn colours have been celebrated in literature, legends, songs, and works of art since ancient times. Legends include the mythical Jack Frost who supposedly brings reds and purples to the forest by pinching the leaves with his icy fingers. The hues of yellow, gold, and brown are mixed on his paint palette and applied with quick broad strokes of his brush as he silently moves among the trees to decorate them.

Although we still tell these fictional stories today, we are able to logically explain the how and why of autumn colour. The explanation involves the geographic distribution and growth habit of trees, physics of light and colour, plant pigments, the physiology and anatomy of leaves, and the influence of weather conditions as the seasons change.

Geographic Distribution And Tree Growth Patterns

Only a few places in the world have the combination of tree species and climatic conditions necessary for vivid autumn foliage. It is our deciduous forests and trees with their many broad leaves which change colour almost in unison, that display the most noticeable autumn colour. Evergreen species also develop autumn coloration, but the colour changes are slow and gradual. Many homeowners become unnecessarily alarmed in the autumn when the interior needles of their pines, spruces, and firs turn colour. They mistakenly interpret this as a disease problem, not realising that even evergreens seasonally shed older leaves. The introductions of exotic species to urban landscapes in areas where the trees are adapted, as well as the development of cultivars noted for their autumn coloration, have increased the opportunities to see one of nature's greatest treats.

Leaf Pigments And Physiological Changes

The various leaf colours we see are due to the physics of sunlight striking pigments in the leaves. For an explanation of autumn colour, four broad categories of pigments are recognised. Chlorophylls, carotenoids, anthocyanins, and tannins. It is these same pigments that also account for the array of colour in flowers. During spring and summer, the leaves serve as the principal site for the photosynthetic process in which carbon dioxide and water are transformed the carbohydrates necessary for tree growth. This food making process takes place in the leaf in numerous cells containing the pigment chlorophyll, which gives the leaf its green colour. As the days get shorter

and temperatures get cooler in the autumn, there is a decline in synthesis of new chlorophyll. The green colour disappears and the rate of photosynthesis declines. The trees become very frugal and even more efficient by pulling nutrients such as nitrogen and phosphorus into twigs and branches to be stored for the winter, further enhancing the loss of chlorophyll.

Along with chlorophyll, leaves also contain yellow or orange carotenoid pigments. This is the same pigment, which gives the carrot its familiar colour and also lends colour to eyes, feathers, and scales of certain animals. Most of the year these yellowish colours are masked in leaves by the greater amount of green chlorophyll. It is the unmasking of the carotenoids that account for the yellow and golden colour of Norway Maple, Horse Chestnut, Yellow Poplar, Sycamore, Birches, Walnuts, Ashes, and many other species of trees. The golden yellow produced in some leaves such as those of Beeches, results from the presence of tannins along with the yellow carotenoid pigments.

The anthocyanin pigments responsible for the pink, red and purple leaves of Sugar Maple, Sumac, Red Oak, Mespilus, Spindle, Viburnum and many other woody plants are formed by reactions between various sugars and complex compounds called anthocyanidins. A mixture of red anthocyanin pigment with yellow carotene often gives a bright orange colour as seen in some species of maples. Good soil fertility can enhance the intensity of red colour by affecting carbohydrate production during the growing season. For instance, Pin Oaks, which have received heavy applications of nitrogenous fertilisers, will have a much deeper red colour than those grown in poor soils without fertiliser. Among the most important environmental factors that influence the intensity of colour due to anthocyanins are light intensity, temperature, and water supply. Bright light favours red colour, and anthocyanin pigments usually develop only in leaves that are exposed to the light. If one leaf is shaded by another, the lower leaf usually does not form the red pigments at all. The degree of colour can vary from tree to tree as well, since trees exposed to the sun may turn red while others in the shade may be yellow. A single tree may have branches with different coloured leaves.

The Best Weather Conditions

In some year’s autumn colour is more pronounced than in others. The shades of yellow and brown always appear, but it is the brilliant reds and purples mixed with the yellows that impart the awesome beauty autumn landscapes.

Autumn weather conditions favouring formation of bright red autumn colour are warm sunny days followed by cool nights with temperatures below 45 degrees Fahrenheit, but not freezing. Some photosynthesis still occurs in the leaves during the daytime even while the chlorophyll content is declining. Rainy or cloudy days without much light occurring near the time of peak coloration will actually decrease the intensity of autumn colours by limiting photosynthesis. There is an old wives tale that says rainy days wash the colour out of leaves. While that is not true, these conditions reduce light intensity, and heavy rains and high winds can sweep the leaves off the

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trees early. Freezing temperatures and heavy frost can greatly reduce the brilliance of autumn leaf colour by killing or severely injuring the leaves before the pigments reach their maximum development. In the U.S., the New England states are noted for their spectacular autumn colours. This is generally true because the maritime climate in the northeast moderates the temperature, reducing the incidence of killing frost during peak colour periods. Warm, sunny days and cool but not freezing nights needed for brilliant colour changes are more predictable in New England. In our country with its warm autumn nights and cloudy days, the autumn trees are usually muted and dull. It is little wonder that in early colonial times before communications were better, painters were accused by Europeans of exaggerating the bright colours of forest landscapes in the New World. Even so, Arboretums such as Westonbirt in Gloucester organise guided walks to show off the more spectacular trees.

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With more than 14,500 members worldwide, The International Society of Arboriculture (ISA) is the largest professional association of those dedicated to the proper care and preservation of trees. Our membership includes commercial Arborist, municipal Arborist and urban foresters, utility Arborist as well as educators and researchers. ISA also has the only International Certification program for Arborist to help consumers make a choice when purchasing tree care services. The mission of ISA is to foster research and education that promotes the care and benefits of trees.