Garden Mastery Tips
from Clark County Master Gardeners

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Why Leaves Turn Red

Forests, particularly those in the northern hemisphere, erupt in spectacular colors each fall. Most of us are content to simply enjoy the vivid yellows and reds – soaking up the “eye candy” for those few fleeting weeks. Scientists on the other hand, see it as a mystery waiting to be solved. The study of leaves turning red started more than a century ago. Today, scientists are closer to understanding the phenomenon, but questions still remain. Don’t panic; this article will not delve into scientific detail. If so inclined, you may refer to the references for more analysis.

Yellow leaves are easy to understand. Yellow carotenoid pigments are present all summer long but are masked by green pigments. In fall, trees break down the green chlorophyll in the leaves, leaving the yellow pigments behind.

Red pigments in a leaf are called anthocyanins, named by a German botanist Ludwig Marquart in 1835. Trees do not start producing anthocyanins until fall. So why would a tree put the energy into building new red molecules just when it is extremely busy storing nutrients for winter? Plants only produce things that benefit them, so red leaves must be of some help to the tree.

An early hypothesis was that anthocyanins protected the leaves from ultraviolet damage, but this has been disproved with modern instrumentation. Instead, scientists now believe that the anthocyanins provide a sunscreen function. Trees absorb energy through photosynthesis, but the combination of bright sunlight and cold temperatures damages the leaf cells that absorb light energy. Green leaves can be damaged beyond repair. Red pigments protect the leaf from cell damage, and enable it to continue absorbing energy.

Another hypothesis, which has emerged from studying blueberry plants, is that anthocyanins act as antioxidants. Leaves have high concentrations of oxygen and therefore are susceptible to damage when bitten by an insect or burned by sunlight and cold. The presence of antioxidants in the red leaves helps the plant resist this damage. Antioxidants are good for people and it is now believed they are also good for plants.

Both the sunscreen and antioxidant benefits may turn out to be true. Both benefit the long-term health of the tree by allowing it to absorb more energy and protect other functions before going dormant.

Several other suggestions have been made recently for the function of anthocyanin production. One is that the red pigments help regulate water movement, allowing the leaf to absorb more water and therefore withstand frosty nights without freezing. Others believe that the red color discourages insect damage and the growth of some fungi. Obviously, much research will continue, perhaps for another century.

Until trees talk, we may not know with certainty the real reason for the production of red leaves. However, because of the research that has been done, we know that red leaves do provide some benefit to the tree and are not just a frivolous redecoration project before winter sets in.

The issue that continues to baffle scientists is that if the red pigmented leaves are of great benefit to the plant, then why don't all leaves turn red? While they worry about this, the rest of us can sit back and enjoy the show each fall.

References

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