2009 09 30 Alamosa Trees
Seeing Red? Or Yellow or Orange?
By Marilyn Loser

Fall colors. This time of the year green tree leaves turn red, yellow, gold and orange. OK, there aren't too many red leaves around here, but there are some.

What causes this brilliant display? If you cast your mind back to high school biology, you'll remember that tree leaves contain the photosynthetic pigment, chlorophyll, which captures the sun's energy to make food for trees. Leaves also contain the pigment carotene which is familiar to most people as the coloring agent in carrots. In spring and fall, chlorophyll is the more abundant pigment and gives leaves their green hue.

The cooler and shorter days of fall trigger a chemical reaction in trees that cuts off the circulation of water, nutrients and sugar to the leaves. When this happens, chlorophyll disintegrates rapidly letting carotene shine through and giving brilliant yellow hues in cottonwoods, aspens, and ashes.

Where does the red come from? Scientists used to believe that leaves also contained the pigment anthocyanin all season and that it too shone through in the fall, giving some leaves a red or orange color. However, scientists recently discovered that red autumn leaves result from a different process. Trees and shrubs actually create the red pigments just as they are about to shed their leaves. Around the valley you see our native current shrubs turning red and the occasional stand of red aspens.

Scientists agree on what happens, but there are a number of competing theories as to why a tree that is trying to store energy at the end of the season would expend energy to turn leaves red. Why does an aspen turn red one year and yellow the next? Are cold nights a trigger? Does the red color deter insect pests or protect leaves from sunlight? Could soil composition be part of the equation?

Researchers in Vermont ran tubes of chilled antifreeze to selected twigs to keep them colder than surrounding branches. The chilled limbs responded by producing brilliant red leaves while the remainder of the tree displayed yellow leaves. A follow-up study is exploring the possibility that anthocyanin may allow trees to keep absorbing sugars and nutrients from leaves later into the fall — an obvious advantage for a sugar maple living on a cold mountainside with a short growing season.

A North Carolina study showed that in places where the soil was relatively low in nitrogen and other essential elements, red maples produced more anthocyanin. The next step is to conduct a wider analysis of satellite data showing tree color and comparing it to geological maps showing the types of soils in the study area.

Other studies have shown that when there's less sun, anthocyanin isn't as chemically active and leaves are more orange or yellow than red. One proposal is that anthocyanin acts as a sunscreen. A Montana State University researcher found that if he genetically

blocked anthocyanin production in red-leafed plants, their leaves were unusually vulnerable to fall sunlight, and so sent less nutrients to the plant roots for winter storage.

Other explanations suggest that the red pigment is produced as part of the tree's strategy for protecting itself against insects that thrive on the flow of amino acids. Insects tend to suck the amino acids from the leaves in the fall season, and later lay their eggs, to the detriment of the trees. Aphids are attracted to yellow leaves more than red ones. Trees that expend the energy to color their leaves red may benefit from fewer aphids.

I've dreamt of bicycling through New England to see the brilliant, red foliage displays that adorn calendars the world over. Do you wonder why you don't see similar European images? European trees don't produce as many red leaves.

University of Haifa researchers propose the European difference has to do with the layout of mountain ranges and ice ages. Who knew? Mountain ranges in North America tend to run north and south, allowing trees and their associated insects to migrate with the advance and retreat of the ice according to climatic fluctuations. In Europe, the Alps and their lateral branches run east to west. Many trees species weren't able to migrate with climatic changes since the mountain ranges interfered. Hence, the trees and their pests did not survive the severe cold.

The Haifa scientists suggest that at the end of the repeated ice ages, most tree species that had survived in Europe had no need to cope with insects that had become extinct, so they no longer had to expend energy to produce red warning leaves.

For a list of sources, please visit http://www.AlamosaTrees.net.

"*I have reached illusion's end in this grove of falling leaves. Each leaf a signal of past joy, drifting here within my heart.*" Mu Dan