

**Linda Chalker-Scott, Ph.D., Extension Horticulturist and Associate Professor,
Puyallup Research and Extension Center, Washington State University**

The Myth of Red Leaves

“If plants develop red leaves, it means they are phosphorus deficient”

The Myth

The ability of some leaves to turn from green to red, or from red to green, has intrigued people for centuries. Right now, you will be seeing new leaves emerging from buds on deciduous shrubs and trees; many of these buds and young leaves are red. Similarly, leaf reddening will occur in a variety of plant species throughout the year.

Last fall, a Sunday comic strip gag line attributed the phenomenon of red leaves to fairies painting them. I almost wish more people would believe this rather than the popular, yet erroneous, alternative explanation: red leaves are a sign of phosphorus deficiency. As I've discussed in previous B&B columns, the overuse of phosphate in non-agricultural landscapes is dangerous to soil, plant, and ecosystem health.

The Reality

Leaf reddening is caused by production and accumulation of anthocyanins, which are water-soluble pigments that may impart a red, blue or purple coloration to vegetative tissues (and flowers as well). There are a number of reasons these pigments are produced in leaves, including:

- **Normal juvenile reddening.** Many plants, including *Photinia*, produce young red leaves. These leaves turn green upon reaching full size. This is a natural phenomenon.
- **Normal red leaf morphology.** Other plants, including some *Acer* species, produce red leaves that maintain their redness even on maturity. These are often desirable cultivars because of the distinctive coloration of the leaves.
- **Drought.** Lack of sufficient water in plant leaves commonly induces anthocyanin production. While the exact mechanism is unclear, it is likely that these water-soluble pigments help conserve the remaining leaf water.
- **Salt stress.** Like drought, the presence of salt in soil, water, or the atmosphere will cause a dehydration of leaf tissues and a resultant formation of anthocyanins.
- **Nutrient deficiency or toxicity.** Many essential nutrients and non-necessary minerals can cause leaf reddening if they are deficient or in excess. Phosphate deficiency is one of the least likely deficiencies in non-agricultural situations.
- **Cold temperature.** Cold temperatures can decrease water uptake, leading to low water conditions in leaves. Furthermore, freezing events inside the leaves will decrease the amount of water available in a liquid form and cause a freeze-induced dehydration.
- **Anoxia.** This is probably common in urban areas, where compacted and poorly drained soils contain too little oxygen for root systems. Without functional roots, water uptake decreases and leaf water deficit occurs.
- **Wounding.** Wounding by animals, people, or vehicles can induce a localized reddening response.
- **Pathogens.** Exposure to many bacteria and fungi will induce anthocyanin formation.
- **Herbicides.** Inadvertent exposure to herbicides can also cause leaves to synthesize anthocyanins.

From this brief outline, it should be apparent that many environmental factors can induce leaf reddening. It is highly unlikely in ornamental landscapes that this reddening will be caused by phosphate deficiency.

How do anthocyanins alleviate environmental stress in leaves? There is no one answer, but evidence points towards a trio of functions – reduction of water loss, solar protection, and antioxidant behavior.

The Bottom Line

- There is no single reason why leaves turn red.
- The young leaves in many species, and especially cultivated ornamental plants, are naturally red.
- Many environmental factors can induce leaf reddening.
- In non-agricultural landscapes, phosphate deficiency is not likely to occur and therefore will generally not be a cause of leaf reddening.
- Before adding phosphate fertilizer, have a soil test performed to assess phosphorus availability.

For more information, please visit Dr. Chalker-Scott's web page at <http://www.theinformedgardener.com>.