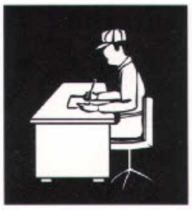

Tree Leaves

By Monroe S. Miller

A while back I filled this space with some thoughts, experiences and reading about lightning.

As happens so often, thinking and writing about one subject that concerns a golf course superintendent leads to questions about some other subject.

This time the subject of lightning led to critical trees on a course and how some golf course superintendents provide those trees with some lightning protection.

That subject of trees and lightning led to a search for some information about which trees were more vulnerable to lightning damage, and why.

Before I knew it I was reading botanical literature about moisture content of wood, bark texture of various tree species and some very interesting things about tree leaves. In fact, the reading about tree leaves was almost spellbinding.

It's pretty difficult to be a course manager and not have at least some interest in tree leaves. Our northern golf courses don't really look like they should until their trees are fully leafed out in the springtime. The leaves themselves are as much of the hazard a tree offers as the wood skeleton.

Around here there isn't a superintendent who isn't well award of how much it costs to keep a golf course playable and to clean up the annual leaf drop at season's end.

For me, once a year tree leaves describe what I do, along with hundreds of thousands of others who vacation in New England. We are called leaf-peekers and spend most of a vacation immersed in the beauty offered by the tree leaves of that little corner of the world. There is nothing prettier in any landscape anywhere.

The studies that caught my interest concerned the response of tree leaves in the rain. Frankly, I've never paid any attention. The times I'm on the course and rain begins, I usually head in for the shop, with my eyes down, watching for standing water. My inattentiveness has cause me to miss one of nature's small scale spectaculars.

Many plants in warmer regions than Wisconsin use their leaves as rain collectors. Leaves in climates like ours, where moisture availability seldom limits tree growth, have evolved not to collect water but rather to drain it from their surfaces.

In fact, if the rain didn't run off, the leaves would become less efficient collectors of sunlight. Additionally, leaves and limbs would be more prone to damage because of the weight of the collected water.

Ask any golf course superintendent who lived through Wisconsin's great ice storm of March 4, 1976. It took weeks to clean up all the wood brought down because of the weight of the ice. Areas went without power for up to a week.

That damage came despite the lack of leaves. I once was caught in the mountains of New England when an early autumn snowstorm came through, dumping a foot and a half of snow. The weight of the snow held by leaves and limbs was tremendous; so was the damage to the trees. Usually, the damage to evergreens is greatest, for obvious reasons — needles.

In fact, one of my big worries with all the rain we had at our course last winter between Christmas and January 4th was tree damage.

The impact of thousands of pounds of water (or ice) can, as many veteran golf course superintendents can testify, dramatically bring entire trees crashing to the ground.

It should come as little surprise, then, that leaves on our trees have evolved to shed the rain that falls on them. These adaptations are largely intended to overcome surface tension — the attraction between water molecules that gives water drops their cohesiveness. Surface tensions allows drops of water to stick to surfaces like leaves. Water that does drain to the edge of a leaf will hang there as pendulous drops, the attraction of water molecules for each other and the leaf (the forces of adhesion and cohesion are well known to Soil Science majors at the UW-Madison!) fighting against the force of gravity.

If the edge of the leaf was round and very smooth, several drops might form at different spots around the leaf. But if you look at tree leaves closely, you'll find that many come to sharply pointed tips. In our state, basswood, elm, cottonwood, birch, ironwood and many other tree and shrub leaves have very pointed tips.

Other trees, like maple, red and black and pin oaks, hickory and ash have more than one tip on each leaf. When it rains, water droplets accumulate at these tips, gradually forming large drops that fall more quickly and easier than would several smaller drops. Thus, the leaf tips help trees shed water.

The way leaves respond to rain affects what we experience when we run beneath a tree for shelter. Because the drops from leaf tips must be heavy enough to overcome surface tension, we find fewer but larger drops falling under trees during a prolonged rain than in the open.

When wind blows through the tree, it breaks loose drops that aren't large enough to fall on their own, producing a shower to passing golfers or crew members. And, as you'd expect, trees continue to drop water for some time after a rain stops as water drops gradually make their way to leaf tips and the breezes shake them free from the tree.

Interestingly, not all of a given leaf surface slopes toward the tip. Some leaves form a shallow arc with areas far from the base sloping toward the tip and areas near the base sloping down to the petiole. Drops of water therefore also accumulate where the leaf joins the petiole and when surface tension is overcome by gravity this water runs down the petiole, branch and eventually down the trunk. This forms what hydrologists call stemflow.

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On a smooth trunk tree, stemflow can be quite significant. A study from Germany that I read about found that 15 to 18 percent of the rain falling on a beech forest reached the ground by flowing down the trunk! Try this some time for proof: during a rainstorm place one of your fingers against the trunk of a birch or young linden. You will see a small puddle of water form above your finger quite quickly.

On trees with a coarse and rough bark, more water is needed to wet the bark before stemflow can occur. Once it does begin you will often see water dripping off of the rough areas and surface bumps.

Despite these various mechanisms for moving water off their leaves, trees still catch a lot of the water falling on them. Somewhere between 15 and 25 percent of the annual precipitation falling on a mixed forest of hardwoods and evergreens will remain on the leaves and needles, eventually evaporating into the atmosphere.

From this discussion it is pretty obvious that trees are important in efficient use of rainfall. The interaction between trees and rain slows the water coming from far above. It first reaches tree tops, drops to lower limbs and branches and makes its way to the ground. On our courses, the turf under the trees further reduces the droplet force and that decreases erosion and runoff even more while it increases percolation into the soil.

Contrast this with water drops hitting bare soil from thousands of feet up. The sudden splash created can mobilize soil particles, making them available for erosion.

The difference between dripping to the ground from a mile high cloud and from the leaf of a grass plant speaks volumes to the value of trees and turf in the urban landscape.

Tree leaves and their interaction with rain is yet another of nearly limitless wonders of nature golf course superintendents can observe and appreciate.

All we have to do is look up when it is raining!

Don't Miss It!

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