BASIC WOODY PLANT BIOLOGY – *Part 2*

Tree of Knowledge

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How Plants Increase in Size

Plants increase in size by a combination of cell division and cell enlargement. If the plant has enough water and the temperature is warm enough, cells formed by division in the apical meristems enlarge until they reach their mature size. This cell enlargement is responsible for the growth of stems and branches between budbreaks in the spring and the cessation of growth in summer or fall. Root elongation occurs in the same way whenever the soil temperature is high enough and there is enough moisture in the soil to allow growth.

Increase in stem diameter is from the enlargement of cells produced by the vascular cambium. The cambium forms a cylinder under the bark that is only a few cells thick. It increases in diameter each year, however, producing a layer of phloem to the outside and xylem toward the center of the tree. A nail driven into a tree trunk will never move farther from the ground, but it may be covered by xylem tissue as the tree increases in diameter. A piece of wire wrapped around a tree trunk will eventually girdle it, possibly killing the entire tree.

The amount of shoot and trunk growth produced in a given year is often a good indicator of the general health of a plant. If a year's growth is significantly less than that in previous seasons, begin looking for underlying causes for the decreased growth.

The Stem

In woody plants, the stem is made primarily of xylem cells with very thick cell walls containing lignin. Cells toward the center of the stem are no longer living and make up the heartwood (Figure 2). Because an individual tree ring shows the xylem tissue formed during a single year, rings can be used to estimate the age of a tree. Living, tubelike xylem cells near the cambium function to carry water and dissolved minerals from the roots to the leaves. Xylem production is strongly influenced by environmental conditions. For example, wind movement of the trunk tends to stimulate thickening of xylem cell walls, leading to increased trunk diameter. For that reason, trees that are staked rigidly for several years sometimes fall over when the stakes are removed. Periods of stress often show up in a trunk cross section as narrow growth rings.

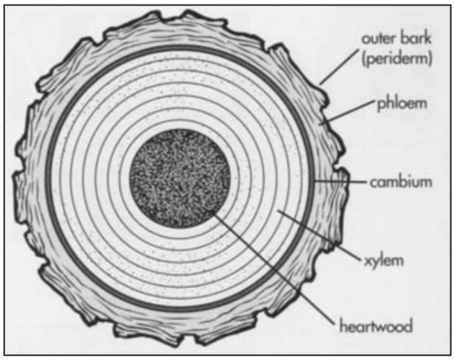

Figure 2. Cross section of a woody plant stem.

Just outside the cambium is a thin layer of phloem tissue that functions to transport sugars produced by photosynthesis in the leaves downward in the plant. The phloem does not form rings like the xylem does. Phloem produced in previous years simply dies and sloughs off. When a tree is girdled, the xylem may still be functional, but the flow of sugars toward the roots through the phloem is interrupted, resulting in a gradual root starvation. As a result, it may take several years for a tree to die after it is girdled.

Outside the phloem is the outer bark, or periderm, consisting of corky cells produced by a tissue called the phellogen. The periderm increases in diameter each year, forming a protective covering over the trunk. The outermost layers, however, cannot keep up with the expansion of the trunk and develop cracks and plates, giving the bark the appearance characteristic of the tree species.

The outer bark of a woody plant is an effective barrier to the entry of insects, bacteria and fungal organisms into the stem. Mechanical bark damage caused by lawn mowers, string-type trimmers or vehicle bumping creates a direct opening for pathogens to enter the stem and cause decay. Seemingly minor bark damage is often the initial step leading to the decline and death of a tree.

Continued in next issue

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