

# Herbaceous Plants and How They Grow



The word "herbaceous" is derived from "herb", and simply means "herb-like". When a stem (or plant) is herblike, what is implied is the lack of a woody stem.

As we already know, a woody plant forms true wood in its stem, accumulating with age, and the vascular cambium remains alive year-round.

Herbaceous plants have a stem above the ground surface that fails to keep its cambium alive beyond a single growing season, the stem ultimately dying to the roots or ground surface and the whole process of growth starting anew.

There are complications to the simple definition of "herbaceous plants do not have stems alive above ground year-round".

**The variation of plants in nature will never totally conform to our attempts to generalize everything.**

There are **annual** plants (herbaceous always) which live only during one growing season, and die completely after fruiting, including the roots (example corn, beans, sunflowers). There are **winter annuals**, which bloom, fruit and die completely in spring, but its stems have been alive above ground all winter. There are **biennials**, which last for 2 seasons or 2 years before death (these are also considered herbaceous). And there are **perennials**, surviving 3 or more years; some of these with above-ground stems that die back to the roots annually, some with underground stems that live on and send only leaves into the air each year, and there are **sub-woody or suffruticose perennials**. These suffruticose plants have the lower part of their stems woody, but send up herbaceous stems annually.

And to further muddle the ideas of order, there are plants which have small, herbaceous-like stems above the ground which do remain alive for several years, but do not grow secondary xylem (ex. Pachysandra, Chimaphila), or true wood.

And some plants may be woody in one part of their range, and herbaceous in another (usually to the north). Regardless of all the variations on lifespan and ability of the stems to live above the ground for one year or one season, a more definitive difference between herbaceous stems and woody stems can be seen in their anatomy, and this requires a view by microscope or strong lens.

**A truly herbaceous stem will have no vascular cambium formed to provide secondary growth (girth increase) of xylem tissue.**

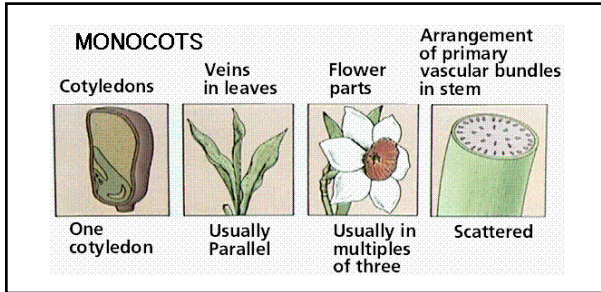
This means no true wood is present, as seen in the anatomy of a tree. The vascular cambium of woody stems is the active cell layer between wood (xylem) and inner bark (phloem) tissues, which together are the vascular system of woody plants. In herbaceous stems, the vascular tissue occurs in bundles spaced within a mass of parenchyma (thin-walled storage cells). These bundles were initially formed when the stem first grew upward, the apical meristem being the source of all new (primary) tissues.

Think of a leaf stalk as a herbaceous stem (which it is) the vascular bundles running through it are a link to the vascular system branching from the main stem. Look closely at a cut leaf-stalk, and you will see the vascular bundles- they appear different from wood, where the xylem and phloem are separate. These vascular bundles leave a scar within the leaf scar of a twig in winter, and the number or arrangement of the bundles can be important in identification of many plants.

Herbaceous stems have vascular bundles which contain xylem (large pores transporting mostly water) and phloem (smaller pores which transport food reserve concentrations made by leaves). There are usually some different sizes of each tissue involved in one vascular bundle, and some bundles are larger than others. Juicy parenchyma cells, including pith, surround the bundles, and most of the bundles occur near the outer

parts of the stem. Look closely at the celery stalk provided, to see all these parts. Pick any old dead "weed" stem and you can see the hollow or pithy center, and vascular bundles clustered near the outer rind.

**But if you pick a monocot stem, things will be a little different!**



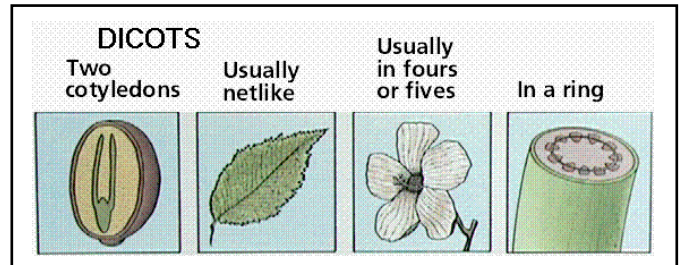
The monocots are those plants with only one cotyledon per seed (visualize a corn kernel), flower parts in 3's or 6's, and leaves usually with parallel venation. Examples include grasses, sorghum, sedges, lilies, cattails, greenbriars, trilliums, irises, orchids, asparagus. The dicots have two cotyledons in each seed (visualize a bean), flower parts in 4's or 5's, and netted leaf venation. Dicots are essentially "everything that grows" out there, that is not a monocot (but not ferns or mosses). The celery stem is a herbaceous dicot stem. The asparagus stem is a herbaceous monocot stem. Looking at the asparagus stem, notice the vascular bundles are smaller, and scattered essentially throughout the stem, even to the pith. Ever eaten a green corn stem or sugarcane stem and noticed how fibrous and stringy it gets when chewed? After all the juicy parenchyma cells are squashed and the sap drained from them, the tough vascular bundles are all that remain.

Some interesting things happen with monocot stems when they last longer than one year, as in the woody monocots like bamboo, yucca, palms, banana, or greenbriars. The fibrous inner anatomy of their stems is still evident, from the scattered vascular bundles. But, small diameter increases in palms or large yuccas can come about from a partial cambium being formed near the growing top, and from the stretching or expansion of many tiny vascular bundles that were previously formed by the apical meristem. You may notice that palms have very slow or nearly negligible trunk diameter increases with age, or bamboo or greenbriar stop in diameter increases after the period of expansion following rapid tip growth. They have either no way, or a limited way, to add large amounts of new vascular tissue, away from the growing tip. Palm wood is, nevertheless, noted in tropical countries for its hardness- the multitudes of closely packed vascular bundles become lignified with hardened chemical deposits as in "true" wood cells.

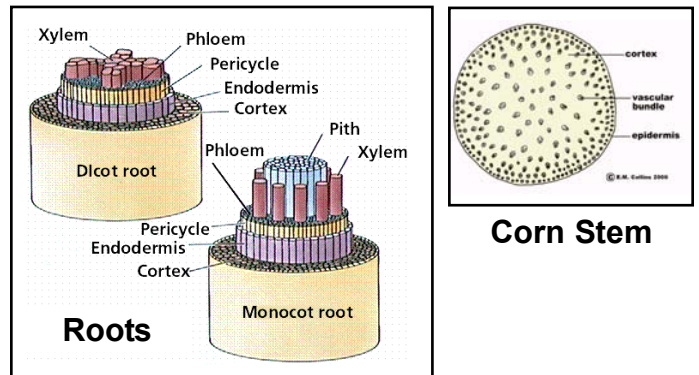
Bamboo, cane, and greenbriar stems do most of their growing initially from the apical meristem, with some "fattening -up" of pre-formed vascular bundles and parenchyma. No buds for further growth occur on bamboo- underground stems do have buds, however. Greenbriar stems have a lim-

ited number of buds.

Cacti are another odd arrangement. These dicots have a vascular system which may form a partially woody (lignified) frame, just outside a pith. In cacti which continue to grow tall, the frame may thicken and its interlacing pattern hints at the incomplete cambial area that is present on the "ridges" of the network. Most of the cactus stem, inside and outside of the vascular area, is composed of parenchyma cells that store water.



True roots have other anatomical differences from stems, mainly in the arrangement of the vascular bundles. A cortex protects the central root region, which is where the vascular system is found- this central "stele" is most sweet in the carrot since that is where much of the sugars are contained in the phloem & xylem. The outer protective cortex is made up of mostly parenchyma tissue.



**Some other words related to stems:**

**Rhizome** - an underground stem

**Stolon** - a specialized rhizome or above-ground stem which elongates away from the main plant to take root at the tip.

**Bulb** - an enlarged underground stem with fleshy enlargement of associated leaves.

**Corm** - a thickened underground stem, with membranous scales

**Tuber** - an enlarged portion of a rhizome or stem having buds ("eyes")

**Adventitious roots** - roots originating without a specific pattern, from rhizomes or above-ground stems.

**Tendrils** - a twining appendage of stems, used to aid climbing.