Botany of a Grass Plant

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There are two major categories of grasses. The Festucoideae or cool season grasses include the fescues, bluegrasses, brome, and quack grass, all of which utilize C3 photosynthesis. These are found in the northern part of the continent at higher elevations. The other is the Panicoideae or warm season grasses (C4 photosynthesis), relatively rare in the northern part of the continent and rare at higher elevations. They dominant warmer, hotter areas of North America and the Third World. Included in this family are corn, sugarcane, sorghum, rice, and crabgrass. In this article, I will outline the major features of typical grass plants.

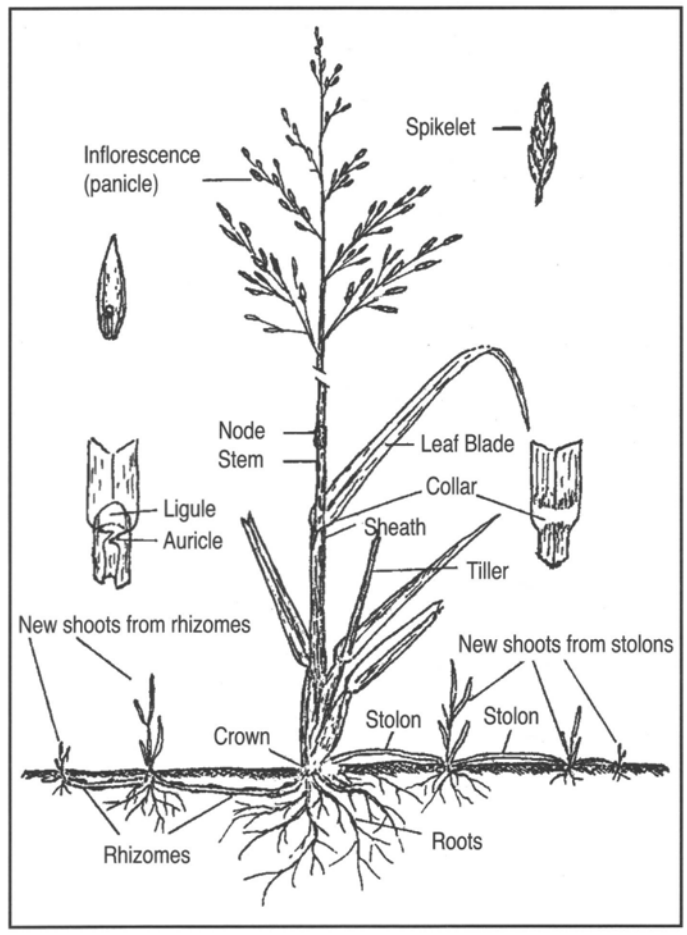
The Baby Plant

What is a seed? A baby plant with a lunch bucket! The baby plant or embryo consists of a root portion or radicle, a stem portion or epicotyl, and a single cotyledon called the scutellum. At germination, the cotyledon absorbs nutrients from the endosperm (its lunch bucket), the radicle expands downward to become the short-lived primary root, and the epicotyl with its apical meristem (the growing point for stem and leaves) which is protected inside the coleoptile or sheath, grows upward, and the first true leaf emerges. Adventitious roots are soon produced as the seedling establishes itself from the first few nodes at the base of the stem to become the fibrous root system that characterizes all grasses.

Root Growth

Root growth is affected by soil moisture, temperature, structure, depth, fertility, and chemical reaction (whether it grows in a basic or acidic soil), as well as by genetic and cultural factors. A minimum of moisture is required for growth as roots will not enter dry soil "in search of water"— a common belief shared by many people! Depth of root penetration is roughly correlated with the height of top growth which is calculated as 2 feet for short grasses, 4-5 ft. for intermediate, and 7-9 ft. for tall grasses. Almost as much of the grass plant lives in the soil as above ground. In an acre of bluegrass sod, there may be over 3 tons of roots, of which 2% consists of nitrogen. Some 23% to 57% of the root mass of a perennial grass dies and must be replaced with new growth each year. This means that they become important builders of soil and reservoirs of nutrients—that is why grasses contribute so much to soil fertility.

The amount of annual root growth is subject to the same soil, genetic, and cultural factors that were mentioned earlier. A cultural factor one must consider is the amount of mowing that occurs. For example, in moderately growing grass, removal of 50% of the top growth of leaves and stems has little or no effect on root growth, but removal of 70% may cause 50% of the roots to stop growth for 17 days. With the removal of 90% of the top growth, *all* root growth may cease for 17 days. Often a surprise to many people are the root to shoot ratios, which by weight range from 0.7:1 to as high as 4:1. This means that for every 1 lb of shoot material (stems and leaves), there could be from 0.7 to 4 lb of roots.



The Stem, Leaf, and Inflorescence

If we look at the stem or culm of a grass plant, it consists of a series of nodes (usually solid and swollen) and internodes (usually hollow). A leaf is produced at the node that comes off the sheath and forms a blade. At the tip of the embryonic stem in the embryo is an apical meristem whose continued growth produces stem, leaves, and an inflorescence (the flowering part of a plant).

Intercalary meristems just above each node may produce additional lengthwise growth of stems. Branches arise from axilliary buds at nodes just between the leaf sheath and stem. Stolons are stems that spread horizontally along the ground, whereas rhizomes (stems complete with nodes, internodes, and scale-like leaves) grow more or less horizontally beneath the soil surface. Stolons and rhizomes both root at nodes and produce additional upright shoots from those nodes.

Leaves produced at the nodes mentioned earlier typically consist of three parts, a leaf sheath that pretty well surrounds the

stem, a leaf blade that extends away from the stem, and a collar at the junction of the blade and sheath. The leaf base, the junction of the leaf sheath and the leaf blade, is a very important portion of the grass leaf.

The ligule is a little portion of tissue that arises from the inside of the leaf sheath and is present in all grasses as an upward extension of tissue (either as a membrane or a row of hairs from the inner surface of the sheath). All of the stomata, which allow for gas exchange and moisture release, are located on the inside of the leaf, not on the outer surface. The reason being that in a drought situation, certain cells shrink, the leaf closes up, and there is practically no moisture loss from the inside of the leaf. Auricles are present in some grasses as small hook-like structures that extend from the lowermost edges of the leaf blade and clasp the stem and collar. Features of the leaf base are very important in the identification of grasses in the vegetative stage.

Identification and Classification

Technical identification and classification of grasses are almost exclusively based on features of the inflorescence. The basic unit is a spikelet. These are arranged in branching panicles, in spike-like panicles, or in spikes. Each spikelet contains one or more flowers (3 stamens and a pistil) enclosed by tiny bracts called glumes and lemmas. ♦