

Phil Busey, turf@ufl.edu
(after 5/31/2011: phil@philbusey.com)
Associate Professor of Environmental Horticulture
University of Florida – Davie, 954-579-3932
grove.ufl.edu/~turf

The Grass Family, Turfgrasses, and Weeds

Worldwide importance

Grasses are a family of flowering plants of great economic and ecological importance, occurring on all continents including Antarctica. No other family of plants is distributed as widely and in as many different habitats as grasses. Directly and indirectly, grasses are the major component of the human diet. The scientific name for the grass family is Poaceae and they have also been called Gramineae which is still correct. There are some 10,000 species of grasses.

Grasses are the only family of plants for which is named one of the world's six biomes¹, and grasses are the majority component of extensive ecological areas such as the Great Plains of North America (1.1 million square miles), the Eurasian Steppe² which extend 5,000

"The grass is rich and matted, you cannot see the soil. It holds the rain and the mist, and they seep into the ground... It is well-tended, and not too many cattle feed upon it; Not too many fires burn it, laying bare the soil." ~ Cry the Beloved Country by Alan Paton

miles from Hungary to Manchuria, the Pampas of South America, and the savannas of Africa. Grasslands support a rich diversity of wildlife and are a fundamental cause in the formation of the richest and most complex of the 12 orders of soil, specifically, the Mollisols which include the soils in the breadbaskets of the world, the Chernozem of the Ukraine and the Prairie soils of the Midwestern U.S.

Growth habit and vegetative characteristics

As monocots, grasses have parallel leaf veins and leaf blades are generally at least ten times longer than wide. In this respect grasses or Poaceae are similar to their sister family, the sedges or Cyperaceae. But unlike sedges which have somewhat triangular stems, the stems of grasses are roundish. The stems of some cool-season grasses are hollow, but most grasses have solid stems. The leaves of grasses are 2-ranked (basically alternate) while the leaves of sedges are 3-ranked, or in 3 vertical rows on the stem. The grass leaf has two parts, a clasping basal portion, the sheath, and a usually outstretched terminal portion, the blade. Unlike sedges, the leaves of grasses have a strong defining region between the sheath and blade, the collar.

Other grass leaf features include trichomes, ligules, and auricles. Grass leaves can have a variety of kinds of single-celled trichomes or hairs, such as the glandular hairs of molasses grass, the tomentose hairs of some species, as well as stiff strigose hairs. The ligule is a region on the inside of the collar

¹ The world's dozen or so biomes (e.g., Grassland, Rainforest, Tundra, Taiga, Desert, Freshwater, and Marine) are large geographic areas defined by similar ecosystems based on vegetation structure, climate, and adaptations of organisms

² The Eurasian Steppe was long inhabited by nomadic pastoral people. By the 3rd century AD, under Attila, the Huns expanded into western Europe and induced migrations of other so-called barbarian peoples greatly changing the language, culture, and politics of the region. Later nomadic expansionists included Ghenghis Khan, whose Empire conquered China and parts of Europe, and Timur who founded the Timurid Empire in India.

that can be either a ring of hairs, a membranous rim, or both hairs and membrane. The auricles are ear-like flaps that extend from the sides of the collar on some cool-season grasses.

Except for the bamboo subfamily of grasses which is often woody and tall, grasses are herbaceous and often grow near the ground. With growing points near the ground, many grasses can tolerate fire, grazing, and periodic mechanical mowing useful for maintaining grassed landscapes in urban settings. A dense and uniform carpetlike fabric of living grass, mat, and intertwined roots is called a lawn or a turf.

The knitted root system of turfgrass, often in combination with their spreading growth habit from horizontal stems, the belowground rhizomes or aboveground stolons, gives grasses the ability, with proper maintenance, to cover and protect the soil. Grasses that spread laterally are considered sod-forming which means that they have enough tensional strength to be harvested in a shallow slab or even rolled and transported to a new location. Reproduction and establishment of grasses is often through vegetative reproduction in the form of sprigs, stolons, plugs, and sod. Grasses that do not spread laterally are considered bunch grasses, but with proper maintenance they, too, can protect the soil and are useful for outdoor sports. For example, perennial ryegrass, *Lolium perenne*, is the species of choice for seeding athletic fields, often mixed with other species.

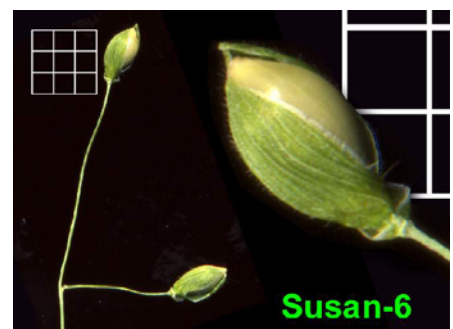
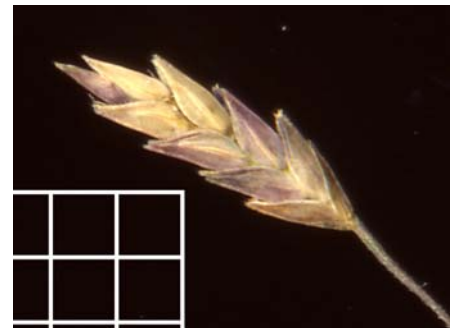
The planting of grasses is often the primary method of controlling soil erosion in naturalistic areas including restoration projects, as well as protecting infrastructures such as highway embankments, levees, and beachfronts. Properly maintained grass areas support golf, sports, and other activities involving frequent traffic such as grass parking lots. As with many other monocots, grass root systems are fibrous and renew themselves every 1- to 2-years, which may partly explain the ability of grasses to tolerate extremes of flooding and drought as well as the fineness and soil clinging ability of grass roots.

Grass flowers and fruits

Flowers of grasses are reduced in size. Lacking showy parts such as petals, grass flowers are pollinated by wind rather than insects. The basic unit of the grass inflorescence is the spikelet, which can be arranged in different types of inflorescences, or seedheads, e.g., panicle (branched and rebranched), raceme (spikelets are attached closely on two or more elongate axes which are called rachises, and spike (spikelets are attached directly to a single elongate axis called a rachis). The stalk which generally attaches the spikelet to the branches of the inflorescence is the pedicel. Because grass

leaves look very among different species, while the spikelets are distinctive, spikelets are often necessary for species identification.

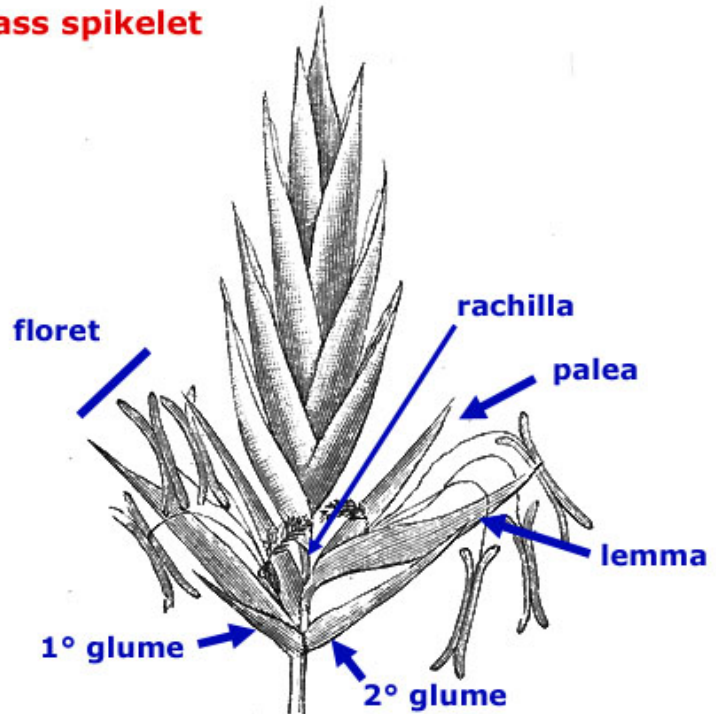
The grass spikelet, which varies greatly in shape and appearance, can be recognized because it has two usually similar looking glumes at its base. Glumes are bracts or modified leaves, often greenish, and together with other bracts, the lemma and palea (described below), they form the chaff that is removed in processing to free an edible cereal grain. In traditional agriculture the chaff is threshed free by beating with hand flails or by treading of hooved



animals such as oxen, and the chaff is removed or winnowed using wind.

The fruit of grasses is generally a dry, single-seeded indehiscent fruit called a caryopsis. The fruit wall, which is fused to the mature ovule, often contains high concentration of B-vitamins. Although this portion, the bran, can be removed in processing to produce a lighter-colored, plainer-tasting, and less gritty product, its removal is associated with the removal of vitamins. Polished white rice, which became prevalent following the introduction of machine milling to east Asia, is associated with beriberi, a nutritional disease caused by deficiency of thiamin (vitamin B1) removed with the rice bran.

Grass spikelet

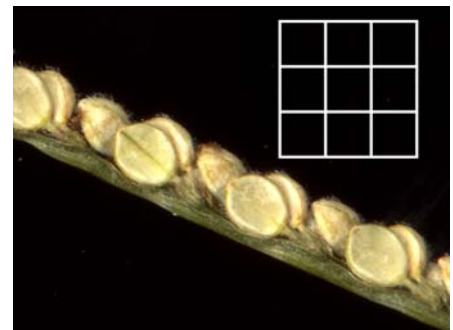


The vast majority of the interior of the grass fruit consists of a specialized starchy tissue called the endosperm. A prominent feature on the side of the caryopsis is the germ which consists of a single modified embryonic cotyledon, the scutellum, and a narrow ridge which is the embryonic axis. When the grass embryo germinates, the scutellum is believed to act as an absorbing region from which nutrients are mobilized from the endosperm and translocated to the growing grass embryo. The single leaf that emerges from the ground when grass seeds germinate is thus not the single cotyledon typical of monocots.

The spikelet

The construction of the grass spikelet is as a series of generally two or more florets emerging on alternate sides of a central axis called a rachilla which is subtended by two glumes. Each floret consists of a lemma and a palea which protect the tightly enclosed flower. The lemma, the back or convex side of which is generally away from the rachilla, is often boat-shaped, and the palea, which is more flat or rectangular in cross-section, fits tightly inside the lemma like a lid.

There are two common arrangements of florets within the grass spikelet. In one arrangement the most reduced (the smallest or least functional) floret is the most distal, farthest above the glumes. In a second arrangement there are only two florets and the most reduced floret is the one below.



The grass flower has (except for the bamboos and rice) three stamens and one ovary topped with two stigmas. The florets open, by the hinging of the lemma and the palea away from each other, often in the early morning, to permit the extension of the stamens by means of rapidly expanding filaments. The generally 4-chambered anthers rupture or dehisce longitudinally in dry air, and pollen is shed to

the wind. Grass pollen is nondescript, oblately spherical, sometimes finely tuberculate, with a single operculum or hole, and has no ornamentation as in species pollinated by animals for which ornamentation would serve to provide attachment of pollen to insect legs and hairs.

Pollen is captured by stigmas and germinates within minutes and to produce an elongate pollen tube which travels down the side of the stigma shaft and into the ovary, to reach the base of the ovule, where non-motile gametes are released and fertilization of the ovule occurs. Some grasses produce seed apomictically which is maternal tissue and results in a genetically homogenous crop of daughter seed.

"In Praise of Blue Grass"
Senator John James Ingalls

Lying in the sunshine among the buttercups and dandelions of May, scarcely higher in intelligence than the minute tenants of that mimic wilderness, our earliest recollections are of grass; and when the fitful fever is ended, and the foolish wrangle of the market and forum is closed, grass heals over the scar which our descent into the bosom of the earth has made, and the carpet of the infant becomes the blanket of the dead.

Grass is the forgiveness of nature--her constant benediction. Fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Streets abandoned by traffic become grass-grown like rural lanes, and are obliterated. Forests decay, harvests perish, flowers vanish, but grass is immortal. Beleaguered by the sullen hosts of winter, it withdraws into the impregnable fortress of its subterranean vitality, and emerges upon the first solicitation of Spring. Sown by the winds, by wandering birds, propagated by the subtle horticulture of the elements which are its ministers and servants, it softens the rude outline of the world. Its tenacious fibres hold the earth in its place, and prevent its soluble components from washing into the wasting sea. It invades the solitude of deserts, climbs the inaccessible slopes and forbidding pinnacles of mountains, modifies climates, and determines the history, character, and destiny of nations. Unobtrusive and patient, it has immortal vigor and aggression. Banished from the thoroughfare and the field, it bides its time to return, and when vigilance is relaxed, or the dynasty has perished, it silently resumes the throne from which it has been expelled, but which it never abdicates. It bears no blazonry or bloom to charm the senses with fragrance or splendor, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, and yet should its harvest fail for a single year, famine would depopulate the world.

John James Ingalls (1833-1900), Senator from Kansas from 1873 to 1891, wrote this address "In Praise of Blue Grass," printed in the Kansas Magazine, 1872, and excerpted here from Grass: The Yearbook of Agriculture, 1948. USDA, Washington, DC