

Puzzled by Poaceae?--A Grass Identification Workshop

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WHAT IS A "GRASS?"

The word "grass" is used to describe those plant species most commonly used in lawns and pastures, or used to cover road shoulders, or even as slang for items as diverse as money and marijuana. The English word grass probably comes from the Old High German (no, not *that* kind of high!) word *gras*, generally used to describe any herbage suitable for livestock grazing.

Botanically speaking, what makes a grass a grass? Three major characteristics separate the grass family from all other plant families:

1. The flowers lack petals and are borne between bracts in a leafless inflorescence.
2. The leaves are flat, long and slender, and form a sheath around the stem.
3. The stems are round, generally hollow, and somewhat swollen at the nodes.

Remember: although an unknown plant specimen may possess one or even two of these characteristics, that does not necessarily mean you are looking at a grass. It is the combination of all three characteristics that defines the grass family.

HOW IMPORTANT IS THE GRASS FAMILY?

The grass family is one of the largest of all plant families. Some 170 genera, including more than 1400 wild and cultivated species, grow in the U.S. and Canada alone. Worldwide, about 10,000 species from 700 genera comprise Poaceae.

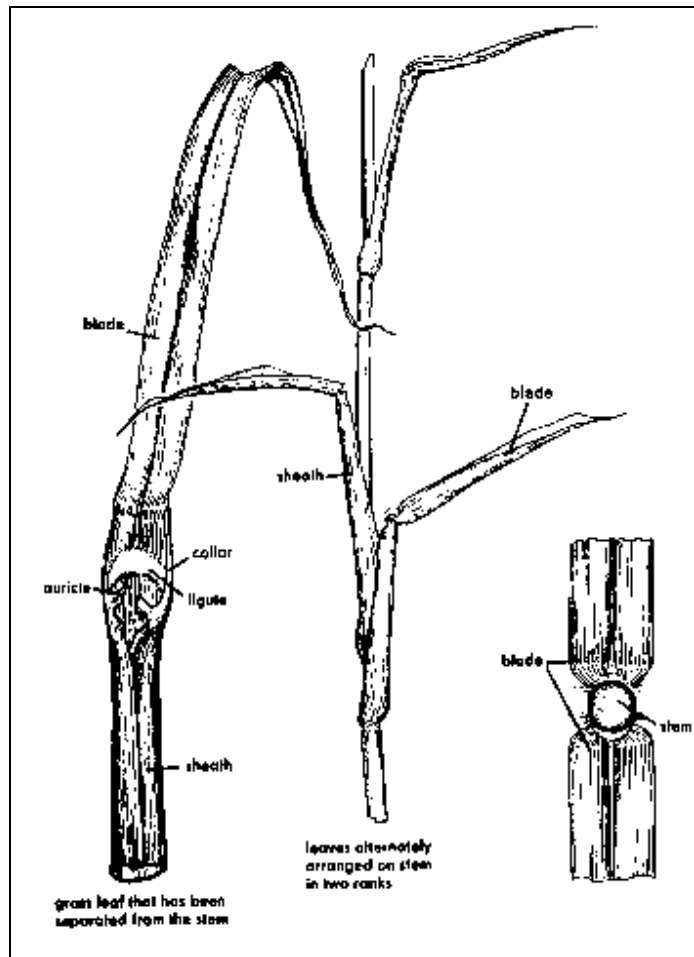
No plant family comes close to Poaceae in its importance to world agriculture. Wheat (*Triticum aestivum*), rice (*Oryza sativa*), corn (*Zea mays*), oat (*Avena sativa*), rye (*Secale cereale*), barley (*Hordeum vulgare*), and the many species of sorghum and millet provide the grains which are the staff of life for nearly all of the peoples on earth. Many species of range and pasture grasses, in addition to the grains listed above, are used for livestock forage and feed. Turf and ornamental grasses are used and appreciated for their durability and beauty throughout the world (the namesake for the grass family, *Poa*, is the genus from which current cultivated varieties of bluegrass have been developed). Finally, grasses such as bamboo lend their service for construction and plumbing in many countries. Clearly, humans and grasses are closely tied, and have been for centuries.

HOW DO WE IDENTIFY THE GRASSES?

The current system of plant taxonomy is based primarily on reproductive structures—it is the flowers of the plant, more than any other character, that really define the species. Consequently, observing a plant's inflorescence is the best way to positively identify that plant. This is especially true of grasses, which often resemble each other so closely that species differentiation using only vegetative characters is very difficult.

Grasses are difficult to identify because many of their reproductive and vegetative structures are unique to the family. They are also very small, making observation extremely tedious. If we ever hope to learn grass identification, we have to have a good understanding of what these structures are, and where they are located. Let's begin, then, with a discussion of how grass plants are put together.

Vegetative Structures. All grasses are monocotyledonous plants (or *monocots*). This means that grasses have only one cotyledon, which is the first or "seed" leaf that emerges from a seed. In actuality, the first structure that emerges from a grass seed is a cylindrical, soda straw-like structure called a *coleoptile* which is rigid enough to push through the soil. It is from within this tube that the fragile cotyledon grows upward to the surface and unfurls.



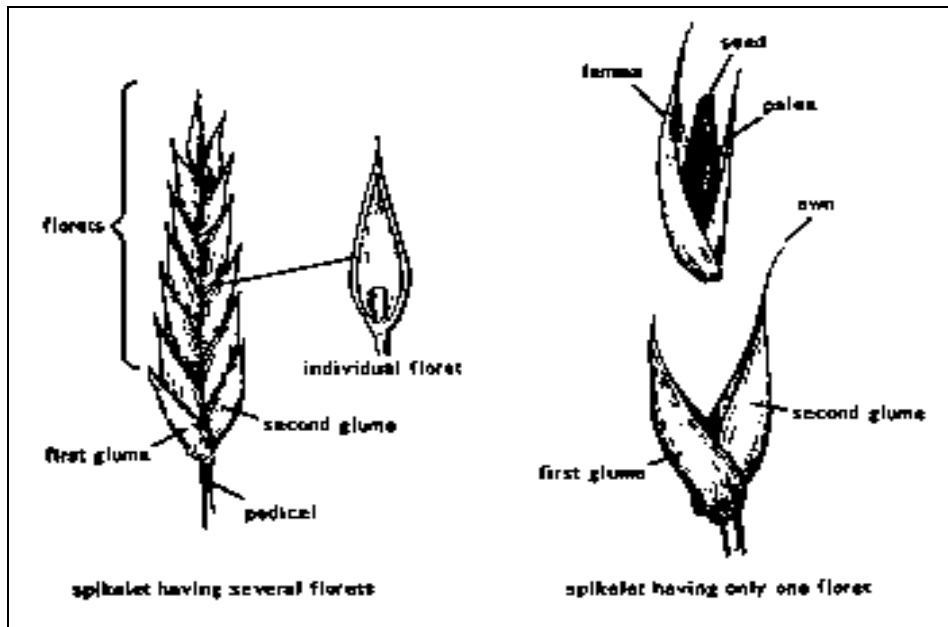
As the grass plant continues to grow, leaves are formed, each of which emerges from within the leaf that preceded it. Think of a grass as growing much like an extending car antenna, except this antenna has leaf *blades* growing out on alternate sides of the stem. The characteristics of the blades, including blade width, whether the expanded blade is rolled or flat, whether or not the midrib is distinctly visible on the upper surface, presence or absence of hairs, and whether newly emerging blades are rolled or folded, are all commonly used for grass recognition and identification. The "tube" or "sleeve" part of the leaf (the part that wraps around the stem) is termed the *sheath*. The degree to which the sheath is open (the edges merely overlapped) or closed (the edges fused together into a seamless sleeve) and the presence or absence of hairs are commonly used vegetative characters. The entire leaf, then, extends upwards from a *node*, up the sheath, and outward to the tip of the blade. (Figure 1).

The structures at the junction of the blade and sheath are also of interest. This is the *collar* of the leaf, and there are two types of structures that grasses may possess in this region. The first are *auricles*, finger-like projections of the upper edges of the sheath that appear to wrap

around the stem. The presence or absence of these paired structures is a useful identification feature. Auricles may be short, long, or absent and smooth or fringed with hairs. The second structure is the *ligule*, a small projection located between the blade and the stem. To best observe this structure, gently pull the blade away from the stem, and it will pop into view. The ligule may be completely membranous, a ring of hairs, or hairs that form a fringe on a membranous base. The type of ligule, as well as its length, overall shape, and texture of the leading edge are key identification features. (Figure 1).

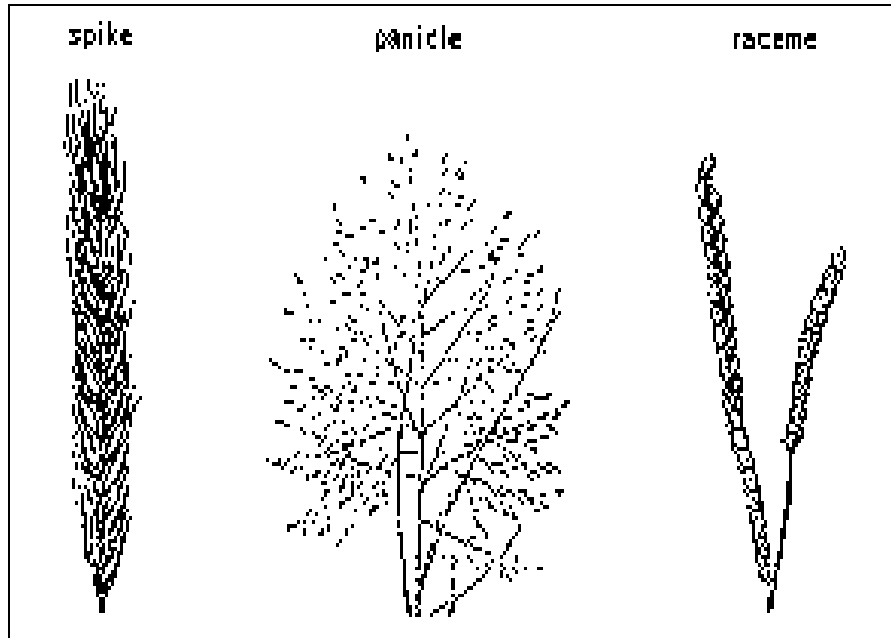
Reproductive structures.

The individual flowers of grass plants are called *florets*. A typical floret has three stamens (male flower parts) and a single ovary with two stigma (female flower parts) at the tip. The ovary is borne between two tiny, leaf-like bracts. The outer bract is the *lemma*, and the usually smaller, inner bract is the *palea*. These structures are usually green when the plant is in flower, becoming chaffy to leathery as the seed ripens. The length, texture, and number of major veins (nerves) of the palea and lemma all aid in species identification. In addition, lemmas are frequently *awned*, and this presence (or absence) of an awn, where it is inserted (e.g., at the tip, middle, or near the base), as well as its length and shape, are good characters to note. (Figure 2).



Florets may be borne singly, or in clusters up to 14 or more. These clusters of florets are termed *spikelets*, each with two additional bracts at the base. These bracts are the *glumes*, which may be variously awned and nerved. Spikelets will break away from the stem or *disarticulate* in one of two ways: (1) above the glumes, leaving the empty glumes on the plant after the spikelets have dropped, or (2) below the glumes, in

which case the glumes remain attached to the spikelet as it drops. (Figure 2).



How the spikelets are borne within the inflorescence is also important for identification. If the spikelets are attached directly to the main stem, the inflorescence is called a *spike*. Usually spikes are single within an inflorescence, although some species (e.g., bermudagrass) bear multiple spikes. If each spikelet is borne on a short or long stem (*pedicel*) which in turn is attached alternately up the main stem, the inflorescence is called a *raceme*. Finally, if the spikelets are borne on pedicels which in turn attach to other branches and ultimately to the main stem,

the inflorescence is called a *panicle*. Panicles are usually diffuse and open, although some (e.g., foxtail and timothy) are densely congested and very spike-like. (Figure 3).

IDENTIFYING GRASSES USING A KEY

A plant key is designed to help the user quickly identify an unknown plant through the use of carefully selected choices. The choices often are in mutually exclusive pairs; that is, one plant can only be accurately described by one of the two statements. This is termed a *dichotomous* ("forking") key. For example, the contrasting statements may be "ligule < 1mm long or absent" versus "ligule > 1 mm long." For a given plant, then, only one term applies: either the plant has ligules shorter or longer than 1 mm, not both. But remember that plants are living things, and living things are always somewhat variable. To guard against possible error, always observe the character in question on several different organs or plants. By averaging your answers, you are more likely to choose the correct description.

Keys are often numbered and/or lettered to aid in matching the dichotomous statements, so the correct comparisons are made by the user. For example, when using the enclosed key, be sure to compare the statement at 2a (Spikelets containing a single fertile floret) with the opposing statement at 2b (Spikelets containing two or more fertile florets), or 10a (Leaf tips prow-like) with 10b (Leaf tips flat).

Keys are powerful tools, but, like any road map, a key must be correctly used to arrive at the correct destination. A user who incorrectly answers the often technical choice is lost and will arrive at the wrong answer, or eventually arrive at a fork where neither statement accurately describes the unknown plant. Careful use of correct botanical information is a must to successfully key plants!

One last thing to consider about keys: they only allow you to identify species actually used when constructing the key. If, for example, you attempted to identify Indian ricegrass (a nonweedy native species, *Oryzopsis hymenoides*) using the enclosed key, you would key the plant to bentgrass (*Agrostis*). This is because Indian ricegrass, with its particular combination of characters, was not used when this key was constructed. Other grass species might result in failure to find an accurate description at one of the forks, or in a different incorrect identification. So always compare your plant with a description and illustration or photo of the answer to eliminate the chance of incorrect identification. If, after several attempts, you still are not convinced that your specimen matches the description, try a different key (such as Vascular Plants of the Pacific Northwest) or send the specimen to an authority who can positively identify it. If you must, collect another specimen after it has matured and try again to identify it using a key using reproductive structures. In any case, *never be satisfied allowing your unknown grass to remain unknown!*

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WHICH GRASSES ARE WE CONCERNED ABOUT?

The Pacific Northwest is home to many species of Poaceae. Many are native grasses; that is, they are species which originated in this region. Others are alien species, either brought in purposefully for agricultural or horticultural reasons (e.g., wheat, smooth brome, reed canarygrass) or accidentally as a contaminant in crop seed, ship's ballast, or some other imported commodity (e.g., wild oat, downy brome, green foxtail).

Alien grasses are frequently weedy, defined as invasive and persistent species which interfere with human activities and are, therefore, undesirable. In this workshop, the focus is on identification of weedy grasses, or those crops which may persist as volunteers. The following is a list of 33 genera of grassy weeds in Washington.

| Weed | Genus | Weedy Species | Distribution | Photo ¹ |
|------------------|----------------------|--------------------------------------|---------------|--------------------|
| Goatgrass | <i>Aegilops</i> | <i>cylindrica</i> | common (east) | 408 |
| Bentgrass | <i>Agrostis</i> | <i>stolonifera, tenuis</i> | common | 412 |
| Foxtail | <i>Alopecurus</i> | <i>myosuroides, pratensis</i> | common | 414 |
| Oatgrass | <i>Arrhenatherum</i> | <i>elatium</i> | common | 416 |
| Windgrass | <i>Apera</i> | <i>interruptus</i> | common (east) | --- |
| Oat | <i>Avena</i> | <i>fatua</i> | common | 418 |
| Brome | <i>Bromus</i> | many | common | 420-33 |
| Sandbur | <i>Cenchrus</i> | <i>longifolium</i> | common (east) | 434 |
| Bermudagrass | <i>Cynodon</i> | <i>dactylon</i> | occasional | 436 |
| Orchardgrass | <i>Dactylis</i> | <i>glomerata</i> | common | 438 |
| Crabgrass | <i>Digitaria</i> | <i>sanguinalis, ischaemum</i> | common | 440 |
| Barnyardgrass | <i>Echinochloa</i> | <i>crus-galli</i> | common | 446 |
| Wildrye | <i>Elymus</i> | <i>canadensis</i> | occasional | --- |
| Quackgrass | <i>Elytrigia</i> | <i>repens</i> | common | 410 |
| Lovegrass | <i>Eragrostis</i> | <i>minor</i> | occasional | 450 |
| Fescue | <i>Festuca</i> | <i>elatior, myuros, octoflora</i> | common | 454 |
| Velvetgrass | <i>Holcus</i> | <i>lanata, mollis</i> | common (west) | 456 |
| Barley | <i>Hordeum</i> | <i>vulgare, leporinum, jubatum</i> | common | 458-61 |
| Ryegrass | <i>Lolium</i> | <i>multiflorum, perenne</i> | common | 464 |
| Panicum | <i>Panicum</i> | <i>capillare, miliaceum</i> | common (east) | 466-71 |
| Knotgrass | <i>Paspalum</i> | <i>distichum</i> | rare | --- |
| Canarygrass | <i>Phalaris</i> | <i>arundinacea</i> | common | 476 |
| Timothy | <i>Phleum</i> | <i>pratense</i> | common | --- |
| Bluegrass | <i>Poa</i> | <i>annua, bulbosa, compressa</i> | common | 480-83 |
| Rabbitsfootgrass | <i>Polypogon</i> | <i>monspeliensis</i> | common (east) | 484 |
| Hardgrass | <i>Sclerochloa</i> | <i>dura</i> | common (east) | --- |
| Rye | <i>Secale</i> | <i>cereale</i> | common | 488 |
| Foxtail | <i>Setaria</i> | <i>glauca, viridis, verticillata</i> | common | 490-93 |
| Johnsongrass | <i>Sorghum</i> | <i>halepense</i> | rare | 494 |
| Dropseed | <i>Sporobolus</i> | <i>neglecta</i> | occasional | --- |
| Medusahead | <i>Taeniatherum</i> | <i>asperum</i> | common (east) | 496 |
| Wheat | <i>Triticum</i> | <i>aestivum</i> | common | --- |
| Ventenata | <i>Ventenata</i> | <i>dubia</i> | common | 498 |

¹Page number in *Weeds of the West* (revised 1992).

Key to 33 Genera of Weedy Grasses in the PNW

- 1a Inflorescence open, panicles or racemes
 - 2a Spikelets containing a single fertile floret
 - 3a Ligule mainly a fringe of hairs
 - 4a Inflorescence a paniclepanicum
 - 4b Inflorescence consisting of multiple spikesbermudagrass
 - 3b Ligule membranous
 - 5a Glumes shed with the spikelets
 - 6a Inflorescence a panicle; plant perennial..... velvetgrass
 - 6b Inflorescence a raceme; plant annual crabgrass
 - 5b Spikelets shed leaving glumes on the plant..... bentgrass
 - 2b Spikelets containing two or more fertile florets
 - 7a Glumes shed with the spikelets
 - 8a Ligules absentbarnyardgrass
 - 8b Ligules present..... johnsongrass
 - 7b Spikelets shed leaving glumes on the plant
 - 9a Ligule mainly a fringe of hairs lovegrass
 - 9b Ligule mainly membranous
 - 10a Leaf tips prow-like..... bluegrass
 - 10b Leaf tips flat
 - 11a Sheaths closed for > 50% of their lengthbrome
 - 11b Sheaths closed for < 50% of their length, usually open to the base
 - 12a Spikelets > ½ inch long oat
 - 12b Spikelets < ½ inch long
 - 13a Stems flattened; leaves folded in the bud..... orchardgrass
 - 13b Stems round; leaves rolled in the bud
 - 14a Lemmas not awned
 - 15a Ligule > 4 mm long.....canarygrass
 - 15b Ligule < 1 mm long..... fescue
 - 14b Lemmas awned
 - 16a Awn bent, attached near midlength
 - 17a Plant perennial, over 3 feet tall..... oatgrass
 - 17b Plant annual, about 2 feet tall..... ventenata
 - 16b Awn straight, attached near tip
 - 18a Ligule > 2 mm long..... windgrass
 - 18b Ligule < 1 mm long..... fescue
 - 1b Inflorescence dense, spike or spike-like panicle
 - 19a Spikelet modified into a spiny bur sandbur
 - 19b Spikelet not bur-like
 - 20a Spikelet a hardened, cylindrical “joint” with florets inside..... goatgrass
 - 20b Spikelet not as above
 - 21a Spikelets containing a single fertile floret
 - 22a Glumes shed with the spikelets
 - 23a Spikelet not on a pedicel
 - 24a Stem pith-filled knotgrass
 - 24b Stem hollow
 - 25a Inflorescence a spike..... barley

- 25b Inflorescence a raceme crabgrass
- 23b Spikelet on a short pedicel
 - 26a Glumes not awned meadow foxtail
 - 26a Glumes awned..... rabbitsfootgrass
- 22b Spikelets shed leaving glumes on the plant
 - 27a Ligule mainly membranous..... timothy
 - 27b Ligule mainly a fringe of hairs
 - 28a Inflorescence consisting of multiple spikes bermudagrass
 - 28b Inflorescence a spike-like panicle..... dropseed
- 21b Spikelets containing two or more fertile florets
 - 29a Glumes shed with the spikelets
 - 30a Plant low-growing, nearly prostrate; leaf tips prow-like..... hardgrass
 - 30b Plant upright; leaf tips flat..... foxtail
 - 29b Spikelets shed leaving glumes on the plant
 - 31a Stems flattened; leaves folded in the bud orchardgrass
 - 31b Stems round; leaves rolled in the bud
 - 32a First glume lacking; spikelets edgewise to the stem ryegrass
 - 32b Both glumes present; spikelets flatwise to the stem
 - 33a Ligule absent barnyardgrass
 - 33b Ligule present
 - 34a Usually 2 to 3 spikelets per node
 - 35a Usually 3 spikelets per node barley
 - 35b Usually 2 spikelets per node
 - 36a 2-6 florets per spikelet; glumes 1-5 nerved
 - 37a Plant perennial..... wildrye
 - 37b Plant annual..... medusahead
 - 36b 3-12 florets per spikelet; glumes 3-9 nervedquackgrass
 - 34b Usually 1 spikelet per node
 - 37a Glumes stiff, 1 nerved..... rye
 - 37b Glumes not stiff, at least 3 nerved.....wheat

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