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Stomata : The Plant's Port of Entry

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Whether it is a golf course green, home lawn or athletic field, we often forget that a turf is composed of millions of individual plants. How each of those plants respond to environmental and cultural management programs dictates the quality of the turf. When we look at the structure and function of individual turfgrass plants, the complexity of life is easily seen.

In this paper, one small plant structure — stomata — will be discussed. Stomates are rather simple structures that allow for gas exchange and transpiration to occur. However, when you think of survival of turfgrass plants through the necessity to create usable energy from solar radiation via photosynthesis, and the dissipation of heat from the plant via transpiration, stomata play a critical regulation role.

Stomata structure

The stomatal area of the leaf blade includes the guard cells and the stomatal pore (Esau, 1977). The stomatal pore or opening is where carbon dioxide (CO2) enters the plant for photosynthesis and the point of transpiration of water from the leaf. Two cells called the guard cells define the stomatal pore. The guard cells are rather elongated and slightly constricted in the middle. When guard cells are turgid they create the open pore.

The stomatal area generally accounts for 1% of the total leaf surface. For turfgrass species, the stomatal density is approximately 2% to 3% of the leaf surface (Beard, 1973). The number of stomates can vary depending on the turfgrass species. Green et al. (1990) calculated the stomatal density for ten turfgrass species and found greater stomatal density on the adaxial (upper) leaf side then the abaxial (bottom). Densities ranged on the adaxial side from 68 stomata mm-1 for tall fescue to 203 stomata mm-1 for hard fescue. Interestingly, no stomata were found on the abaxial side of hard fescue, sheep fescue, chewings fescue and rough bluegrass.

Although we think of all plants having stomata, some plants do not. There are two major groups of astomatous plants (Woodward, 1998). The first group contains plants that never possessed stomates, like the gametophytes of bryophytes and lichens. The second group contains plants that were stomatous at one time, but developed effective astomatous characteristics. These types of plants are generally aquatic or parasitic in nature.

As previously mentioned, stomates play a role in gas (CO_2) exchange and transpiration. A question that can be asked is: What did stomates initially evolve to do? The earliest land plants were astomatous with a thick cuticle around their arial organ (Edwards et al. 1996).

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