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The interaction of leaves with the environment

Plant leaves are highly specialized organs to facilitate gas exchange, carbon uptake and water loss usually upon illumination. Leaf internal structures have an enormous influence on these processes. For example, heterobaric leaves have bundle sheaths with extensions which reach from the upper to the lower epidermis and create closed compartments. Homobaric leaves, on the other hand lack these extensions and have large interconnected intercellular spaces so that lateral diffusion of CO2 can substantially support photosynthesis in particular, when one part of the leaf is shaded being a CO2 source while the adjacent leaf area is illuminated and a CO2 sink. Light environment also plays a key role for a range of plant processes. A light beam interacting with a leaf penetrates the epidermis with little interaction and the largest part of the energy is absorbed bythe pigments in the mesophyll cells driving off water vapor which in turn affects the epidermis with stomata. This interaction feeds back on stomata and provides a control mechanism for the interaction of stomata with the environment. These processes aim at a mechanistic description of the interaction of plants with the environment. Comprehensive understanding of plant interaction with the environment for a prediction of plant performance requires a measurement of phenotyping variation with a range of genotypes. This approach called plant phenotyping is a rapidly evolving concept that links genomics with ecophysiology and agronomy. The basis of this concept is that the functional plant body (phenotype) originates during plant growth and development from the dynamic interaction between the plant genetic background and the environment in which the plant develops.