Shedding Morphogenetically Active Radiation on Functional Structural Plant Models

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Although light quality plays a key role in the dynamics of vegetation, in most FSPM, light is viewed simply as a consumable resource and plants are assumed to be blind to light signals. However, prior to any effort for modelling photomorphogenetic mechanisms, it is necessary to characterise the spatial distribution of light quality over and within plant canopies.

The measurement of local light quality and its modelling approach are rather complex and not currently applied. Nevertheless, measurements of local photosynthetic photon flux density (PPFD) and broadband irradiance (Es) are easy to carry out by using small sensors. Thus, the local spectral photon distribution within a canopy can be estimated whenever the functional relationships between these measurements and photon flux within any spectral band, as well as the photoequilibrium and red:far-red ratio, are known.

The objective of this work was to determine these functional relationships from the light spectra received above and within a canopy. Measurements were made at various positions around a target plant within a population of growing fibre sorghum. The places and the orientations of the sensor were chose to be representative of the main likely perceptive organs in gramineous.

The photomorphogenetic variables considered in this work, are related either to photon flux densities in various wavebands between 330 and 950nm or to the ratio between two photon flux densities. A part of the photon fluxes variables are strictly included in the photosynthetically active radiation band and might be estimated from PPFD measurements using a linear relationship. The other variables are related to both PPFD and Es within a multiple linear relationship. The photoequilibrium and red:far-red ratio were related to the relative transmitted PPFD and to the ratio PPFD/Es within the canopy using a nonlinear model.