The equations used to simulate the leaf gas exchange are presented below.

We used the FvCB photosynthesis model (Farquhar *et al.*, 1980), which represents net CO2 assimilation rate as:

Eqn 1

where *A*c is the rate of maximum carboxylation and *A*j is the maximum rate of RuBp regeneration (or electron transport) and *R*d is the daytime respiration rate that is not attributable to the photorespiratory pathway.

*A*c and *A*j are given by:

Eqn 2

Eqn 3

where is photorespiratory CO2 compensation point, *c*i is the intercellular CO2 concentration, *V*cmax is the maximum carboxylation velocity, *K*c and *K*o are the Michaelis−Menten coefficients of Rubisco activity for CO2 and O2, respectively, and *J* is the potential electron transport rate, given by:

Eqn 4

where is the photosynthetic irradiance absorbed by the photosystem II, *J*max is the maximum electron transport rate and *θ* is an empirical curvature factor (usually around 0.7).

Note that Eqn A2 and A3 are in the form:

Eqn 5

where *x* and *y* equal *V*cmax and , respectively, when *A*n is limited by *A*c, and equal *J*/4 and , respectively, when *A*n is limited by *A*j.

The diffusion of the CO2 from the leaf surface to the intercellular environment can be described by the MSWF theory:

Eqn 6

where *C*s is the CO2 concentration at the leaf surface (ppm), and are the stomatal and cuticular conductance to CO2, respectively, *E*s is the transpiration through the stomata.

where *g*sw is the stomatal conductance to water, *w*i and *w*s are the water vapour concentration inside and on the surface of the leaf, respectively, in mol mol-1.

And finally, the leaf conductance to water vapor is modeled using the model:

Eqn 7

where *g*0 corresponds to *g*lw for *A*n = 0. Note that Eqn 7 gives the leaf water conductance (*g*lw) and not the stomatal conductance (*g*sw) as *g*0 is assumed to be the sum of the cuticular conductance (*g*cw) and the conductance of the stomata which are imperfectly closed (*g*sw,min).

The system of equations corresponds to:

where l = and k=

The solution for *C*i corresponds to the root of a polynomial of degree 2.