



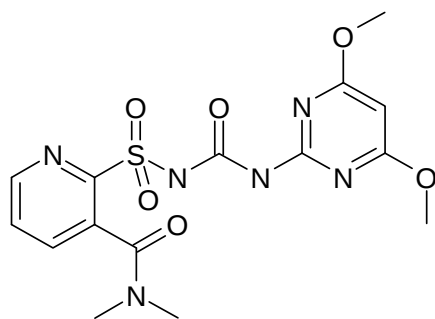
Modelling approaches to foliar uptake

G Bell 2012

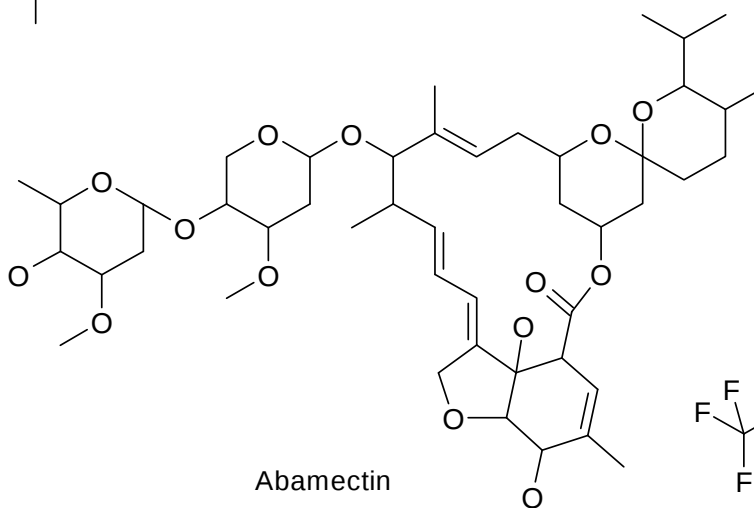
Cyproconazole on soya rust



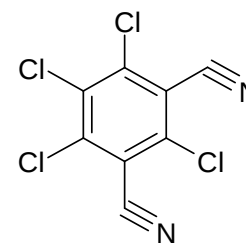
Pesticide variety



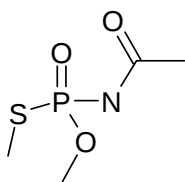
Nicosulfuron



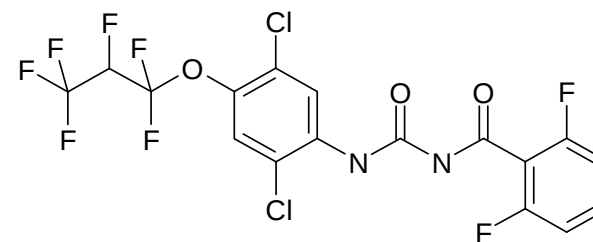
Abamectin



Chlorothalonil



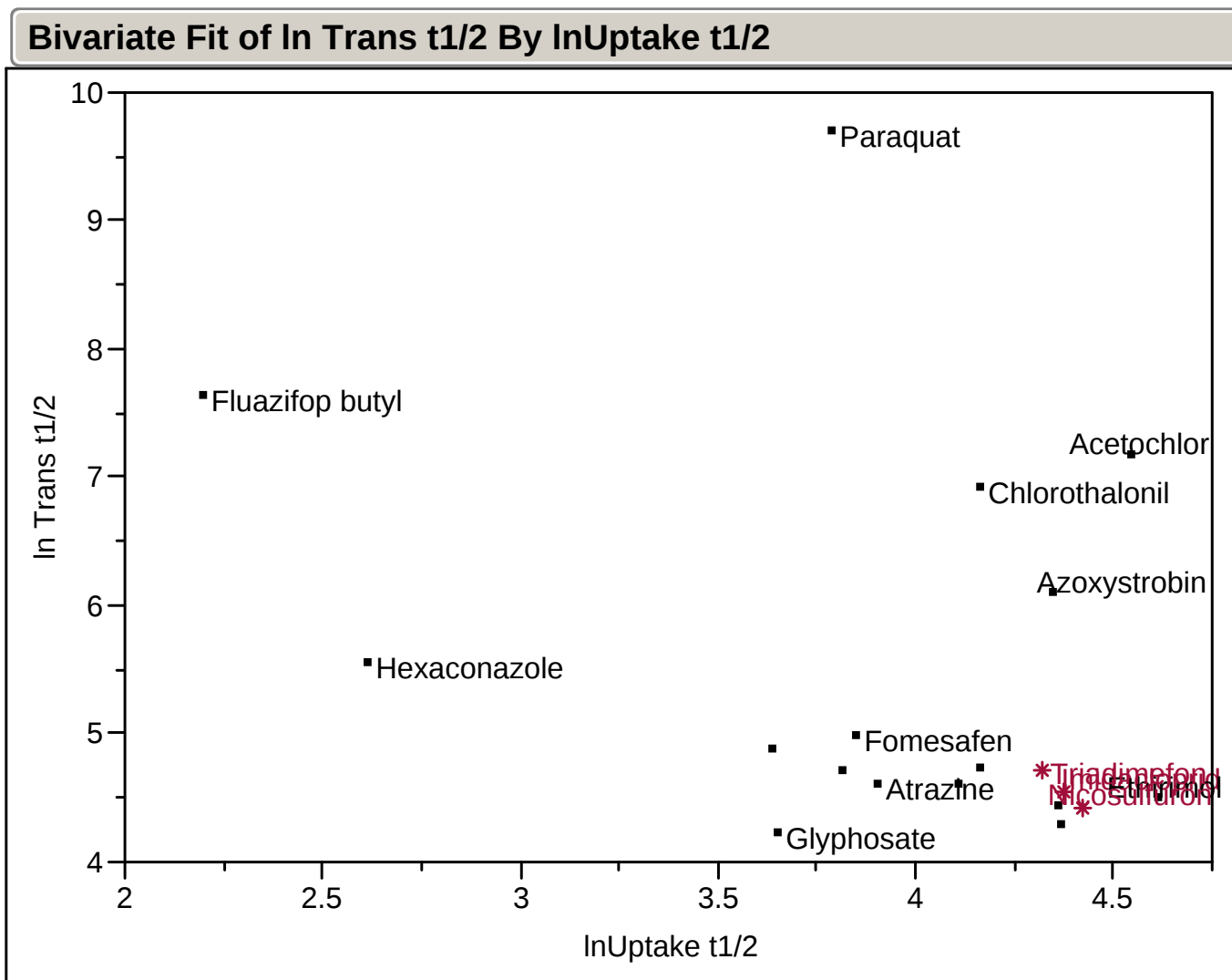
acephate



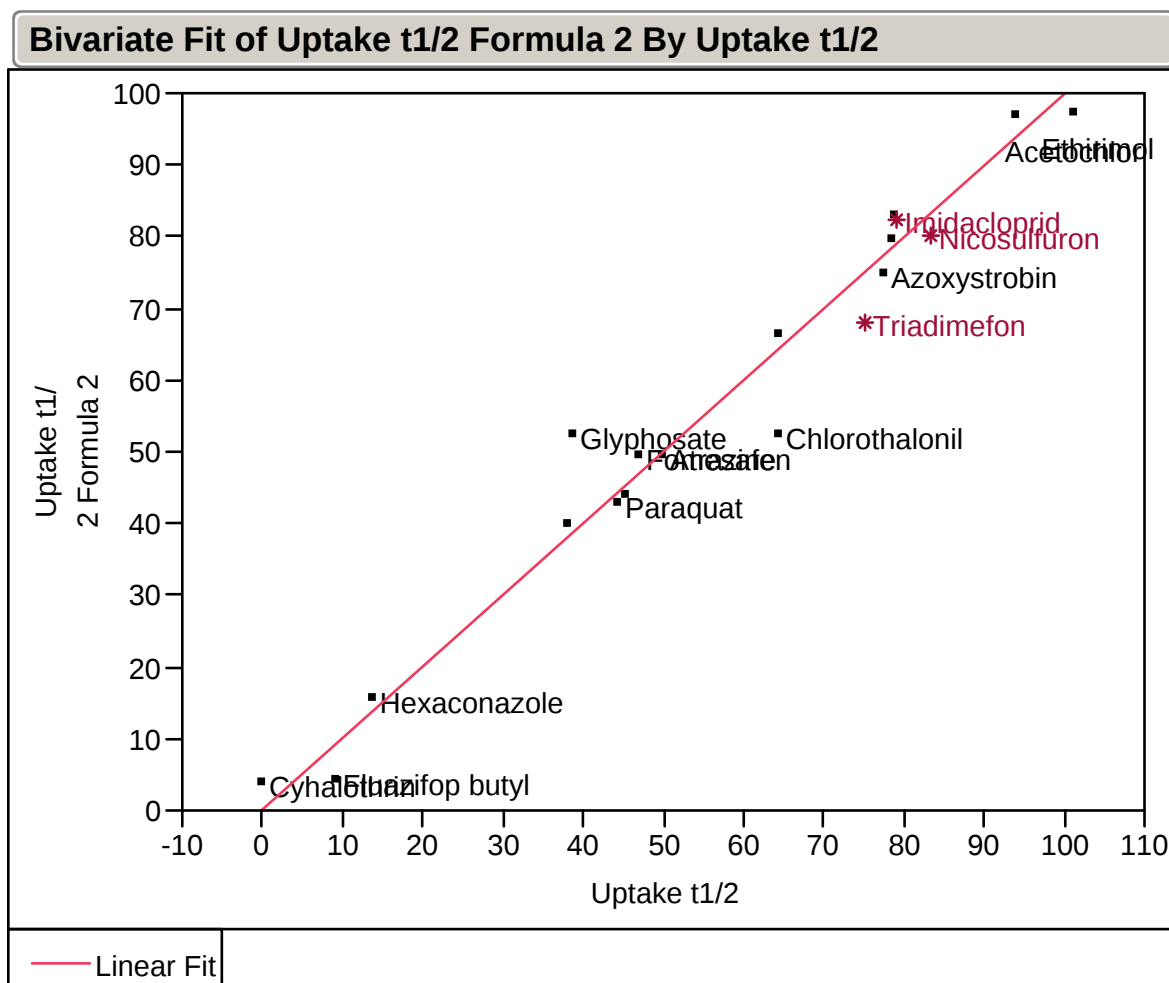
Lufenuron

There are more than 5000 known pesticides

Measured uptake/translocation



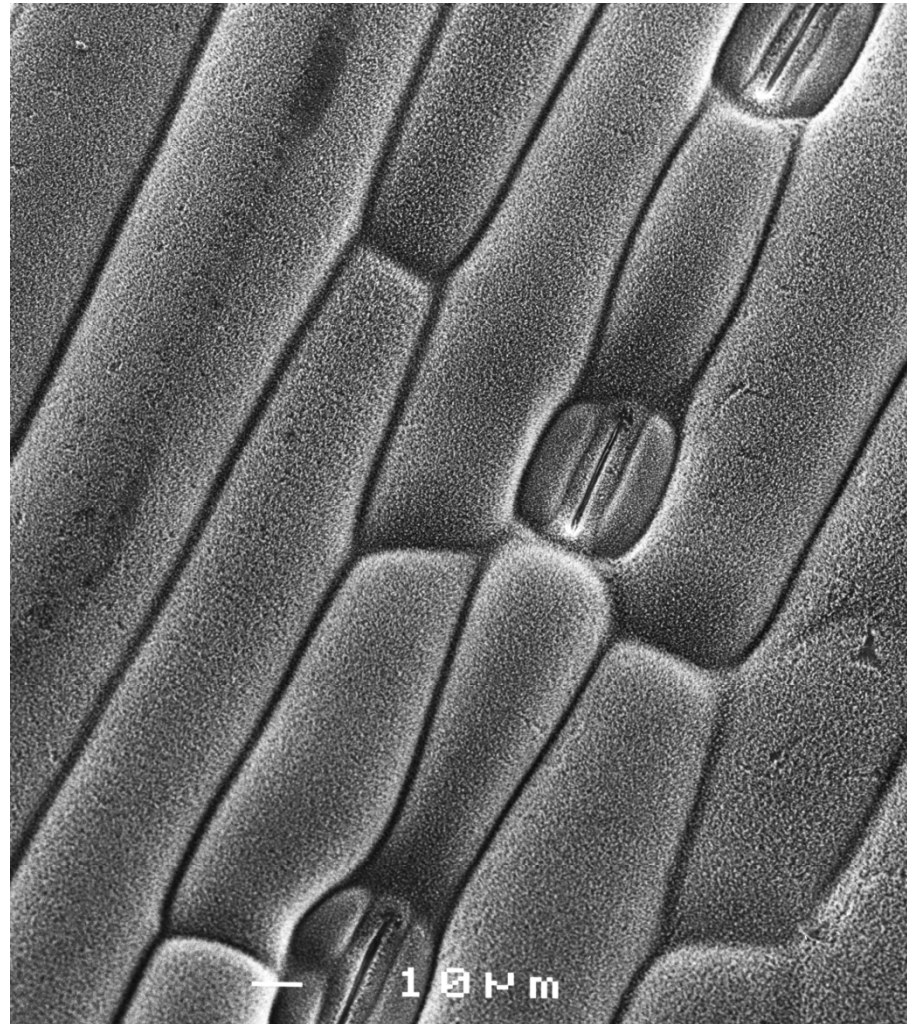
Data modelling based on physical properties



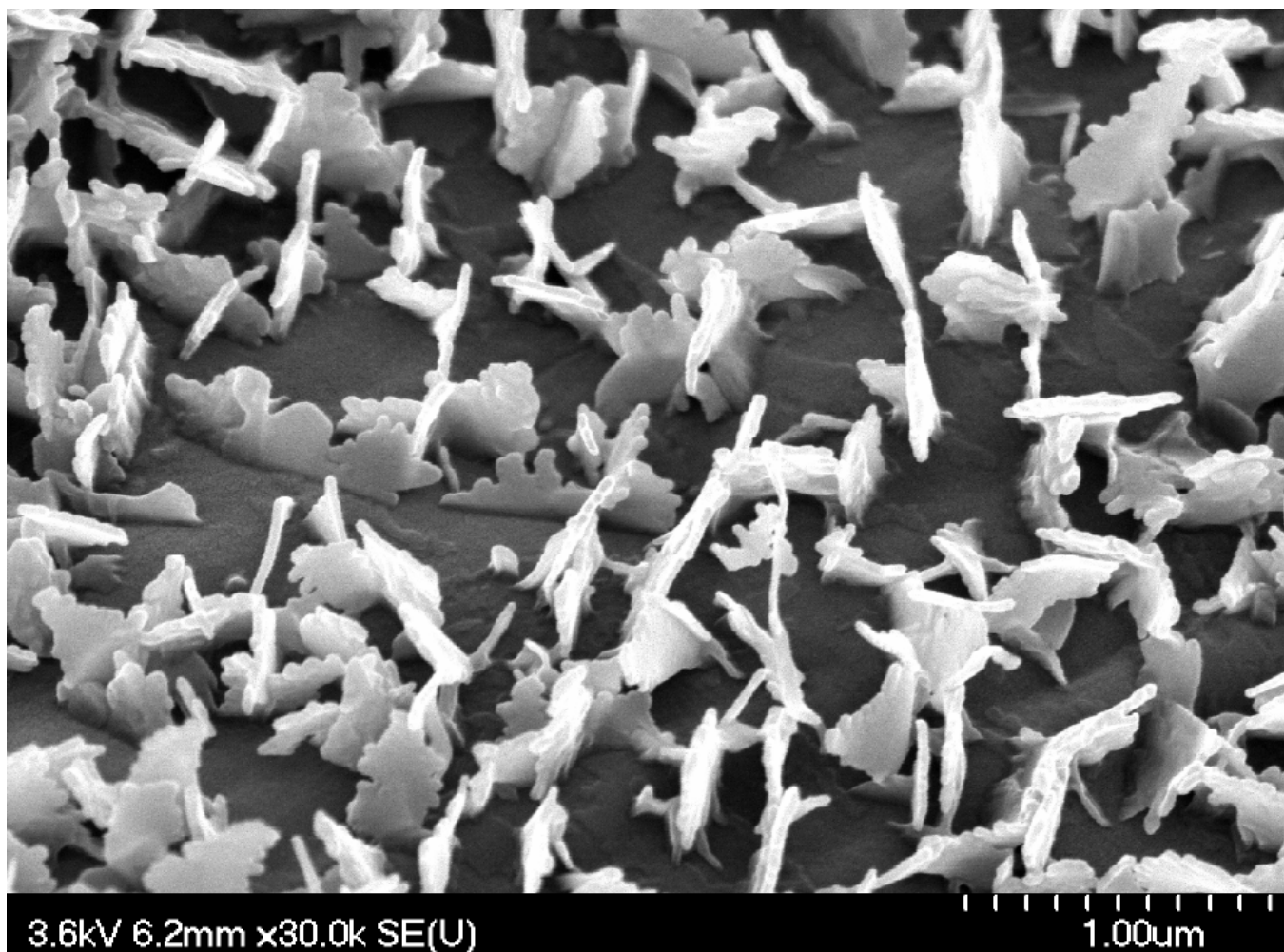
Picture of wheat leaf



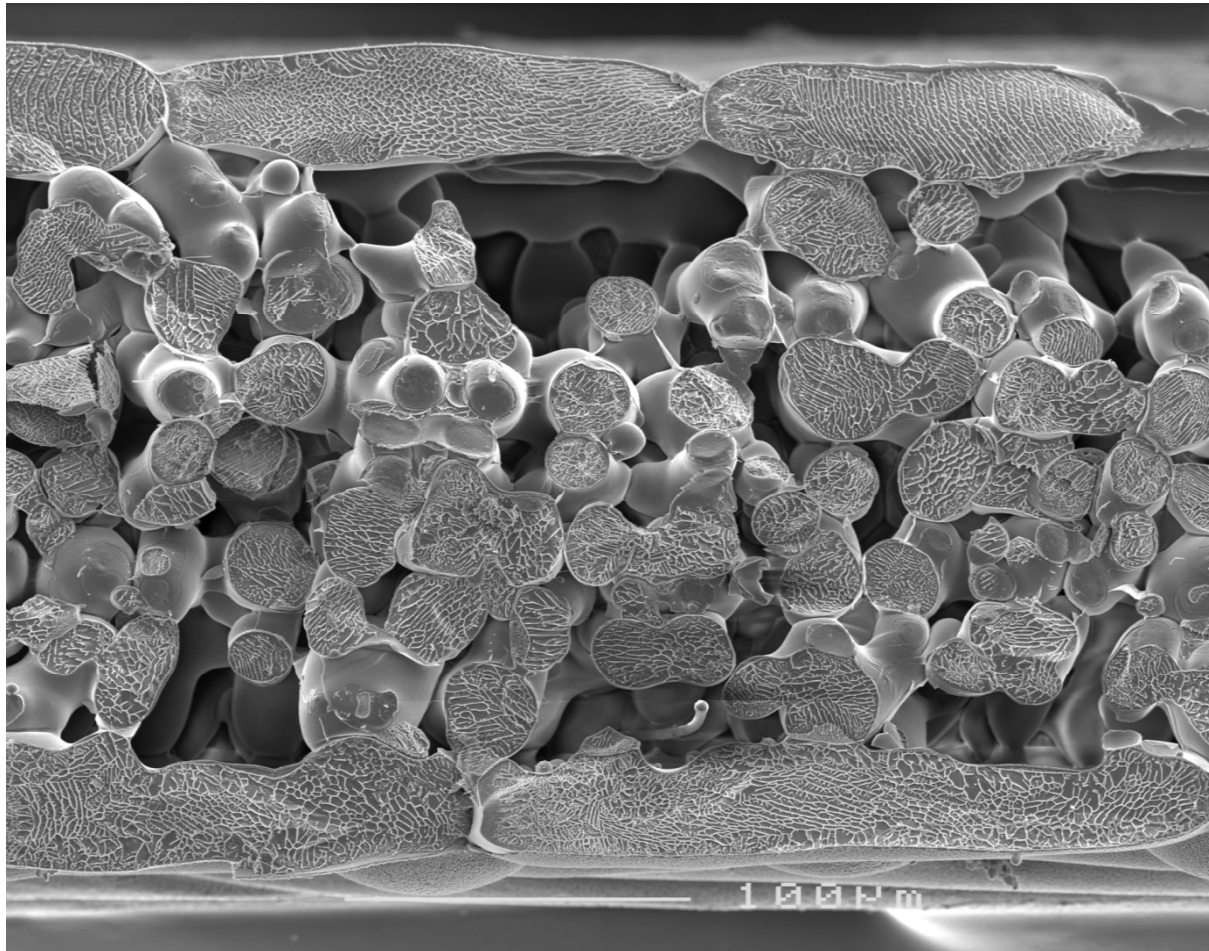
Wheat leaf adaxial surface



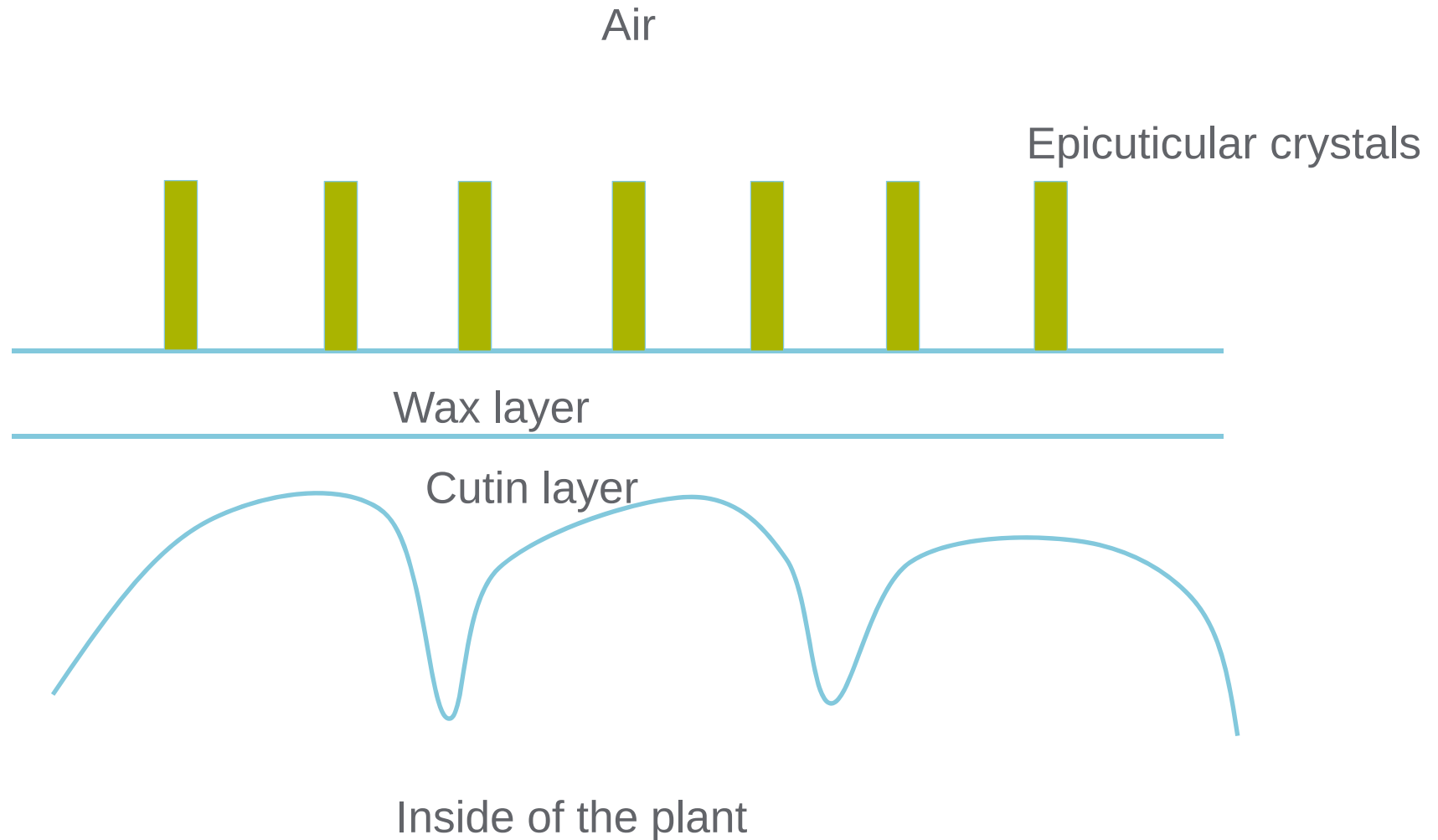
Wheat leaf epicuticular wax crystals



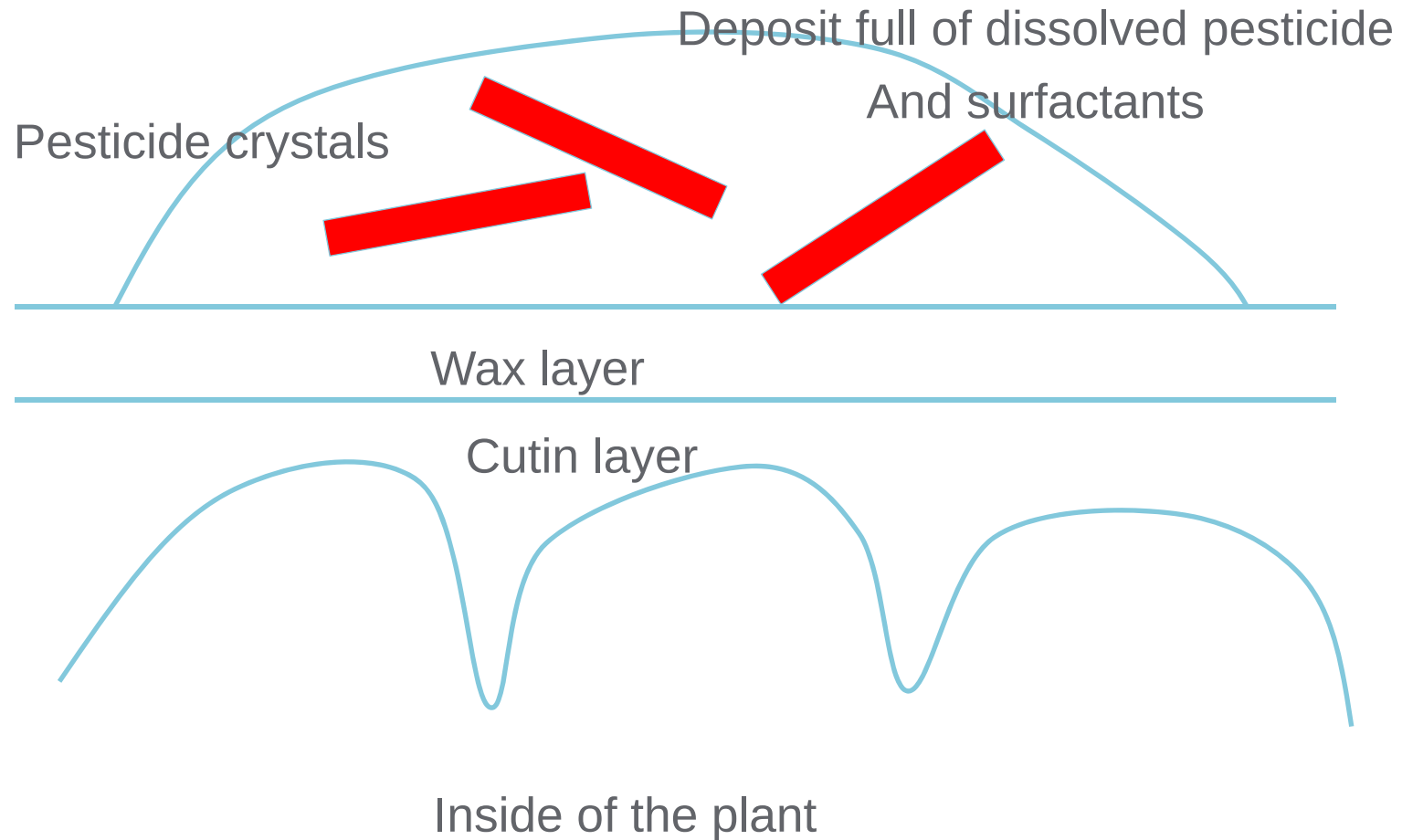
Wheat leaf section



The cuticle – rate limiting step for uptake



The cuticle – rate limiting step for uptake



Fick's law and other equations

Model equations

$$\frac{\partial C}{\partial t} = \frac{\partial}{\partial x} \left(D \frac{\partial C}{\partial x} \right)$$

Valid inside the cuticle for $0 < x < x_1$ for , $0 < t < t_f$

Initial conditions

$$C(0,x) = \begin{cases} K_c/d * C_{d0} & \text{for } x=0 \\ 0 & \text{for } x>0 \end{cases}$$

$$C_d = C_{d0}$$

$$C_p = 0$$

Boundary conditions

Pesticide mass balance in donor

$$V_d \frac{\partial C_{ai}}{\partial t} = \frac{\partial M_{ai}}{\partial t} - D_{ai} S \frac{\partial C_{ai}}{\partial x} \quad x = 0$$

Reduction in solid pesticide

$$\frac{\partial M_{ai}}{\partial t} = V_d k (C_{sai} - C_{dai})$$

$$k = \frac{P \cdot A}{V_d}$$

Pesticide mass balance on the leaf compartment

$$\frac{\partial C_{pai}}{\partial t} = - \frac{D_{ai} \cdot S}{h \cdot V_p} (C_{plantai} - C_{xai} - 1)$$

Pesticide and adjuvant

These equations are applied for both the pesticide and the adjuvant

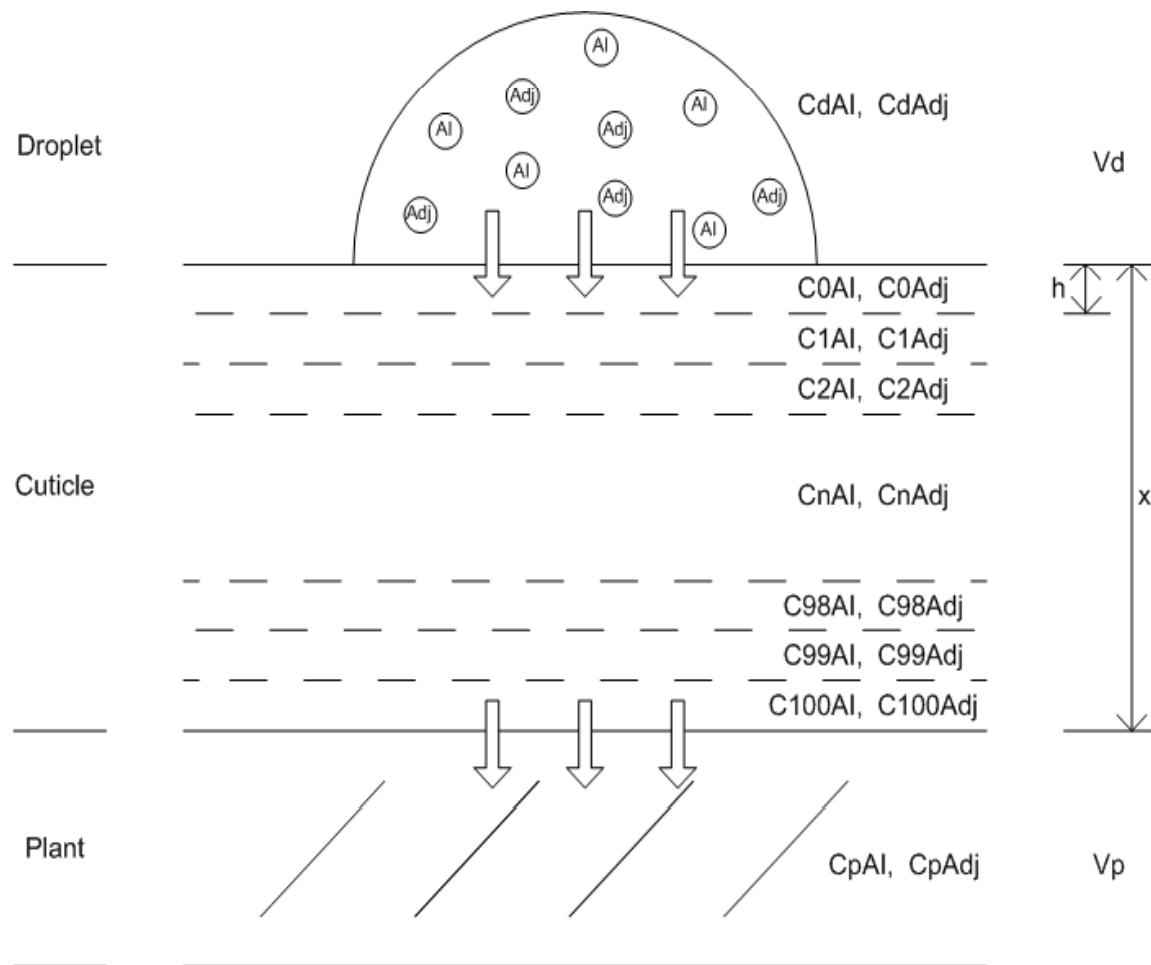
The two materials are considered to be independent except that

The diffusion coefficient of the pesticide is dependent on the concentration of the adjuvant

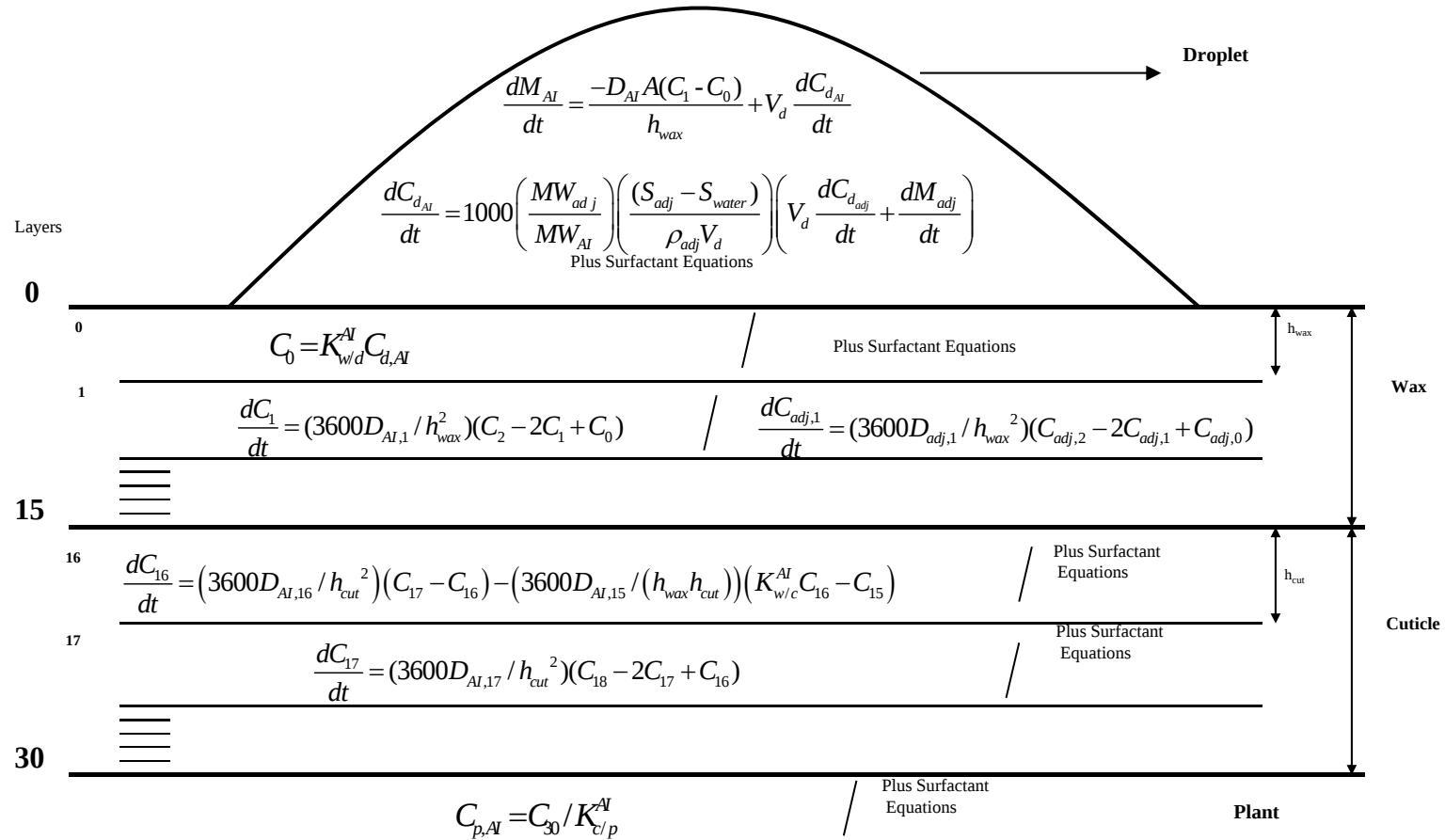
Where possible measured values for partition coefficients

And diffusion coefficients are used

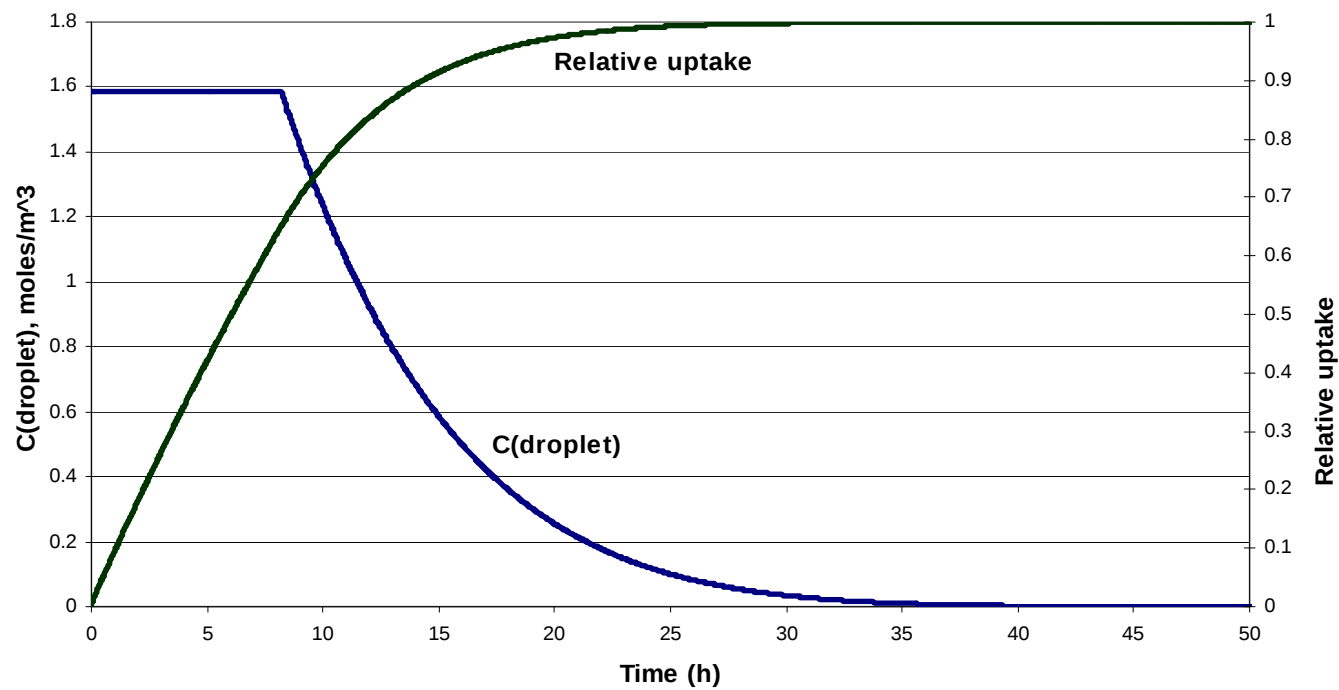
Leaf uptake model



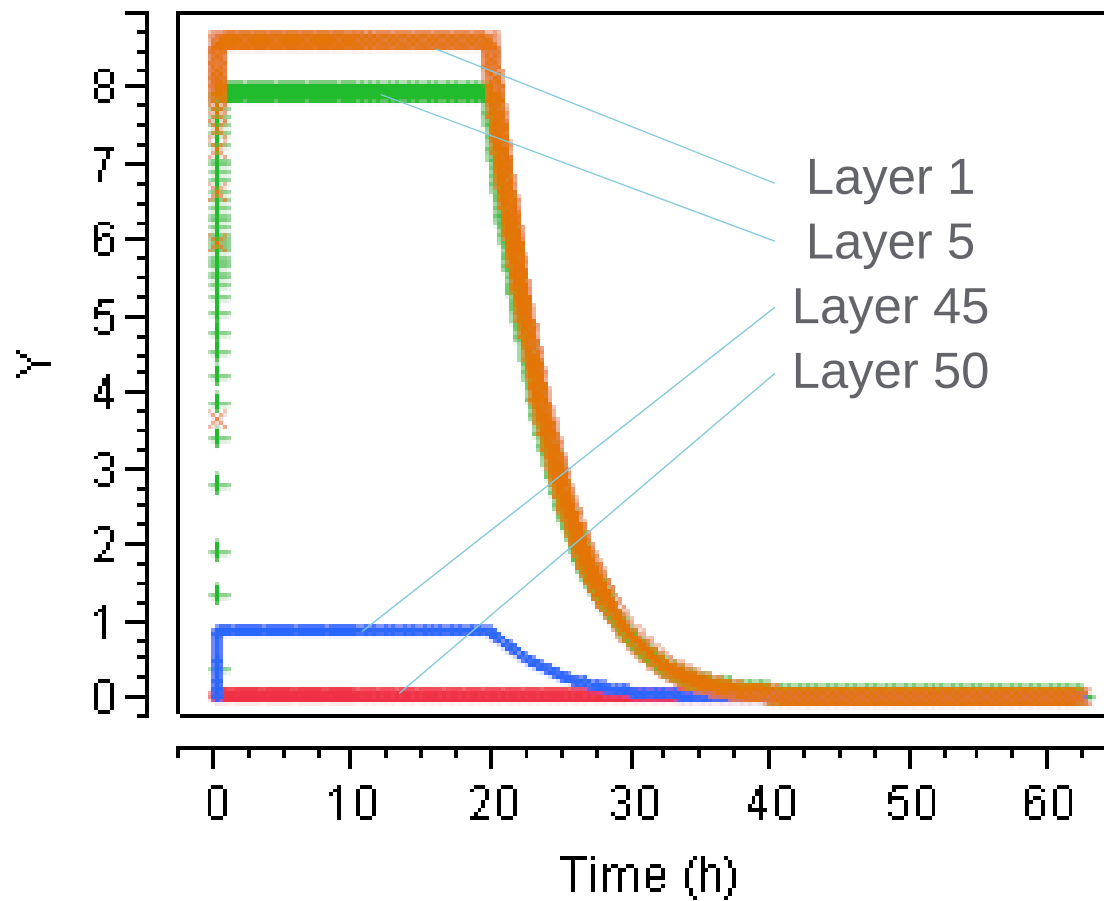
Leaf uptake model



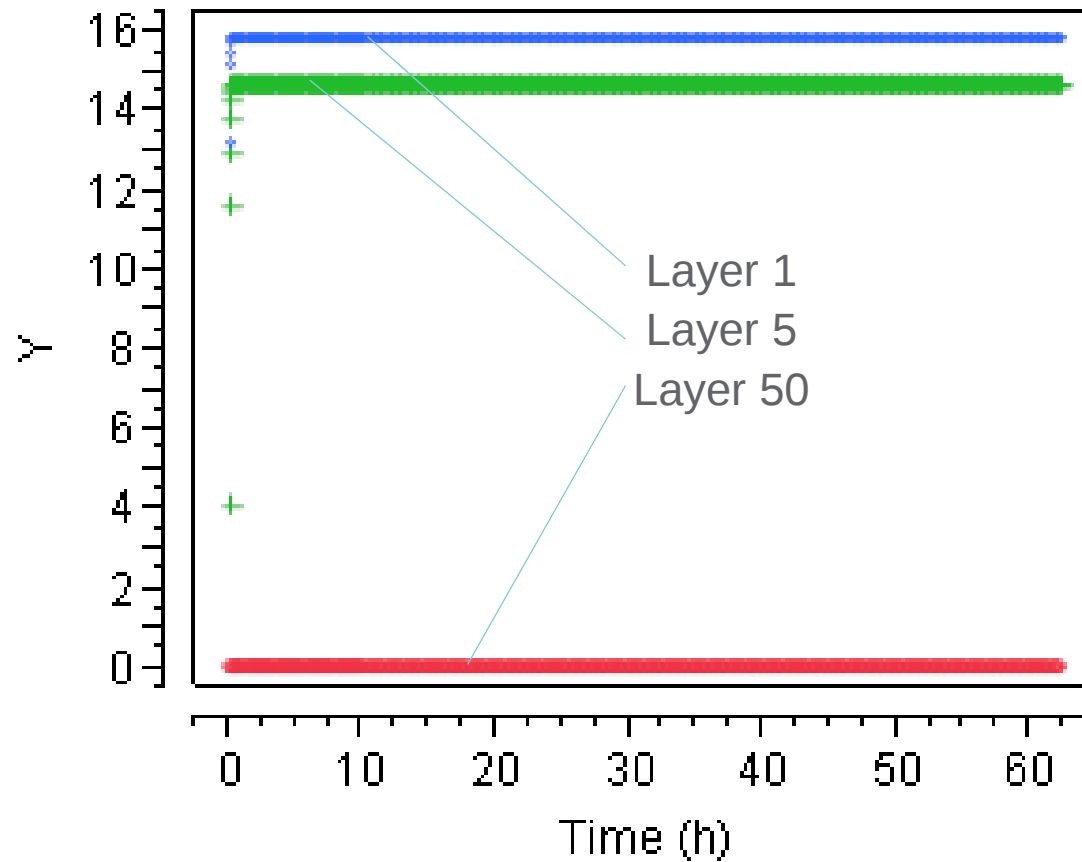
Predicted plant uptake



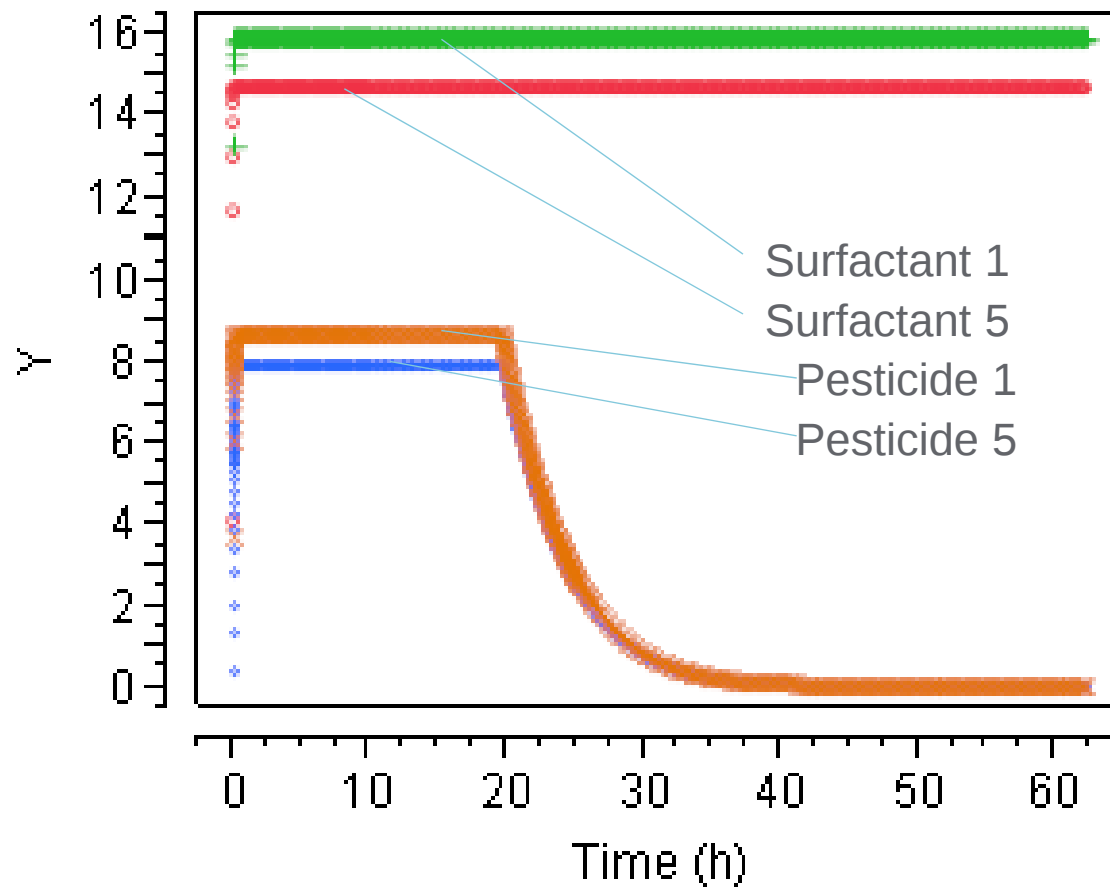
Pesticide uptake into the wax layers



Surfactant concentration in the wax layers



Surfactant and pesticide in wax layers



Cyanazine uptake over 24 h real and predicted

