EMRASS II Vienna jan 2011

Philippe GUETAT,

Critical Parameters

CEA France

Calculation of soil water activity

- 700 L / year of rain

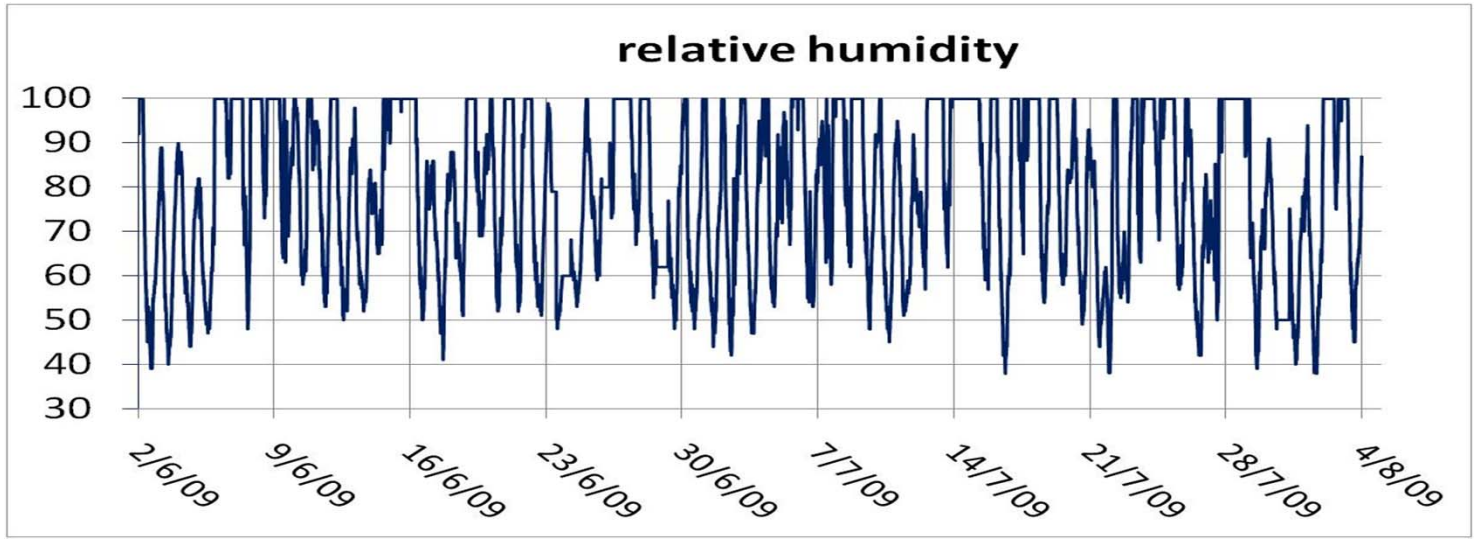
HTO soil (Bq/l) [2]	**69**	**231**	**132**
HTO soil (Bq/l) $0.3\ A_{vap} + 0.7\ A_{rain}$	**68**	**239**	**140**

300 $L.y^{-1}$ of dry vapor / 8 $g.m^{-3}$. => 1.2 10^{-3} $m.s^{-1}$

Supposed to be between 10^{-3} and 10^{-2}

Free water activity assessment

- $C_{veg\ free\ w} = H_r\ C_{air\ m} + (1-H_r)\ C_{soil}$ IAEA tecdoc 1616
- this means that free water activity is practically equal to air moisture activity
- In practice it is not true.



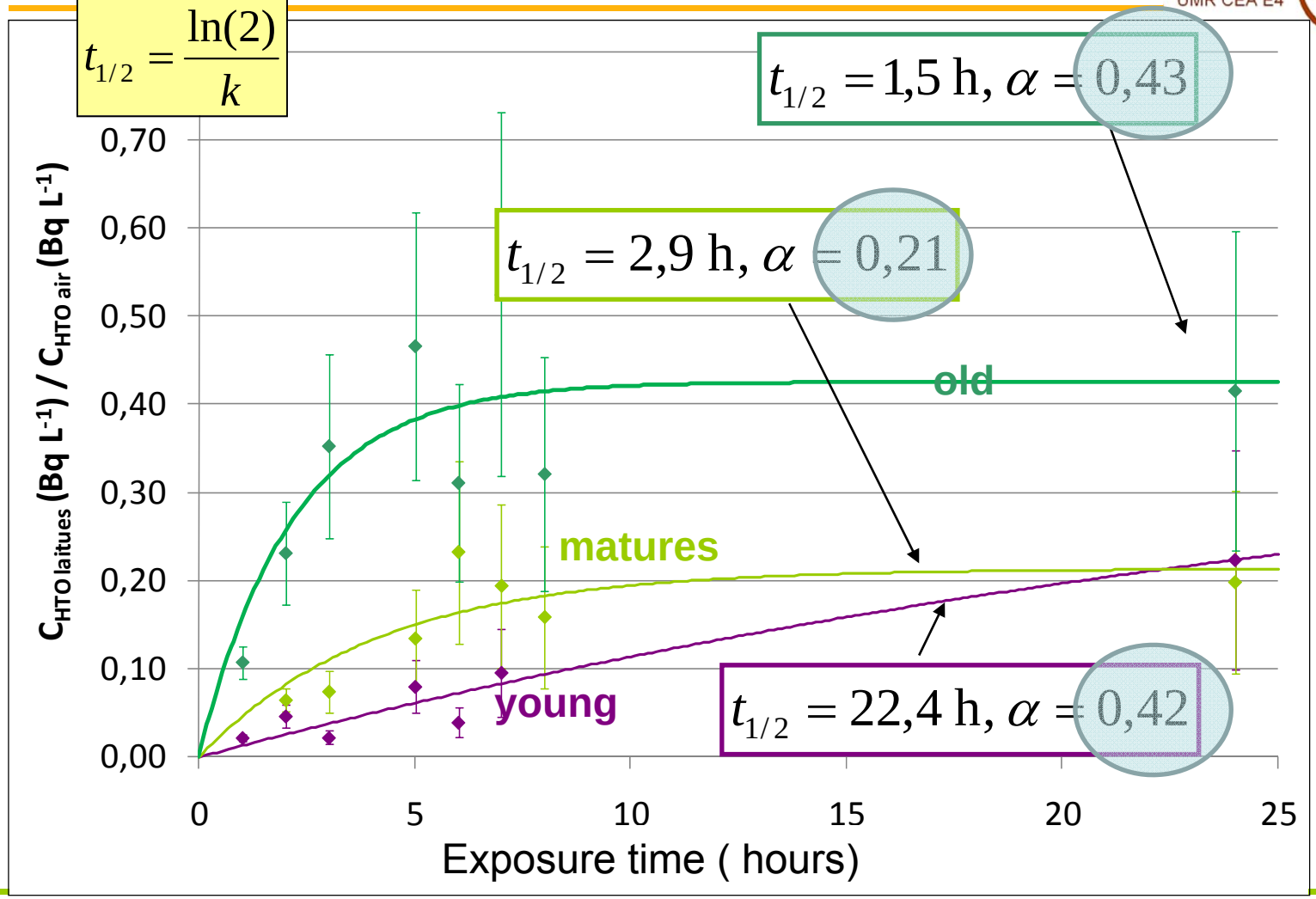
Free waters

(Boyer)

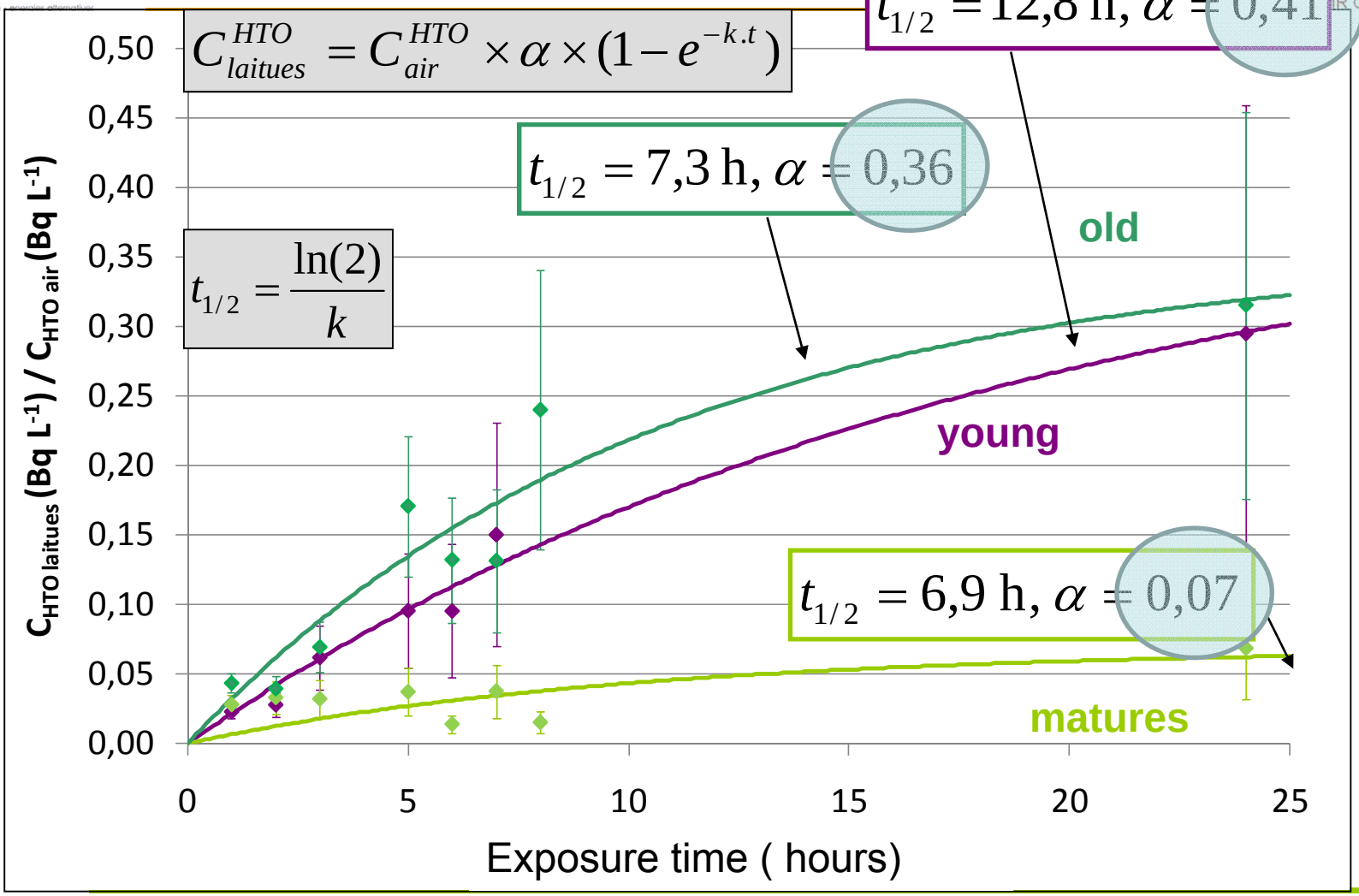
Measures in Free water of lettuce : light

$$C_{laitues}^{HTO} = C_{air}^{HTO} \times \alpha \times (1 - e^{-k.t})$$

$$t_{1/2} = \frac{\ln(2)}{k}$$



Measures in free water of lettuce : darkness



IAEA tecdoc 1616 and Proposal

$$C_{TFWT} = [RH \cdot C_{am} + (1 - RH) \cdot C_{sw}] / \gamma ,$$

$$C_{pfw}^{OBT} = (1 - WC_p) \cdot WEQ_{p\cdot} \cdot R_p \cdot C_{TFWT} ,$$

Proposal for temperate climate – low rain intensity

$C_{free\ w}$ =[0.4 C_{am} +0.6.C_{sw}]] and C_{sw} = 0,3 C_{am} + 0,7 C_{rain}

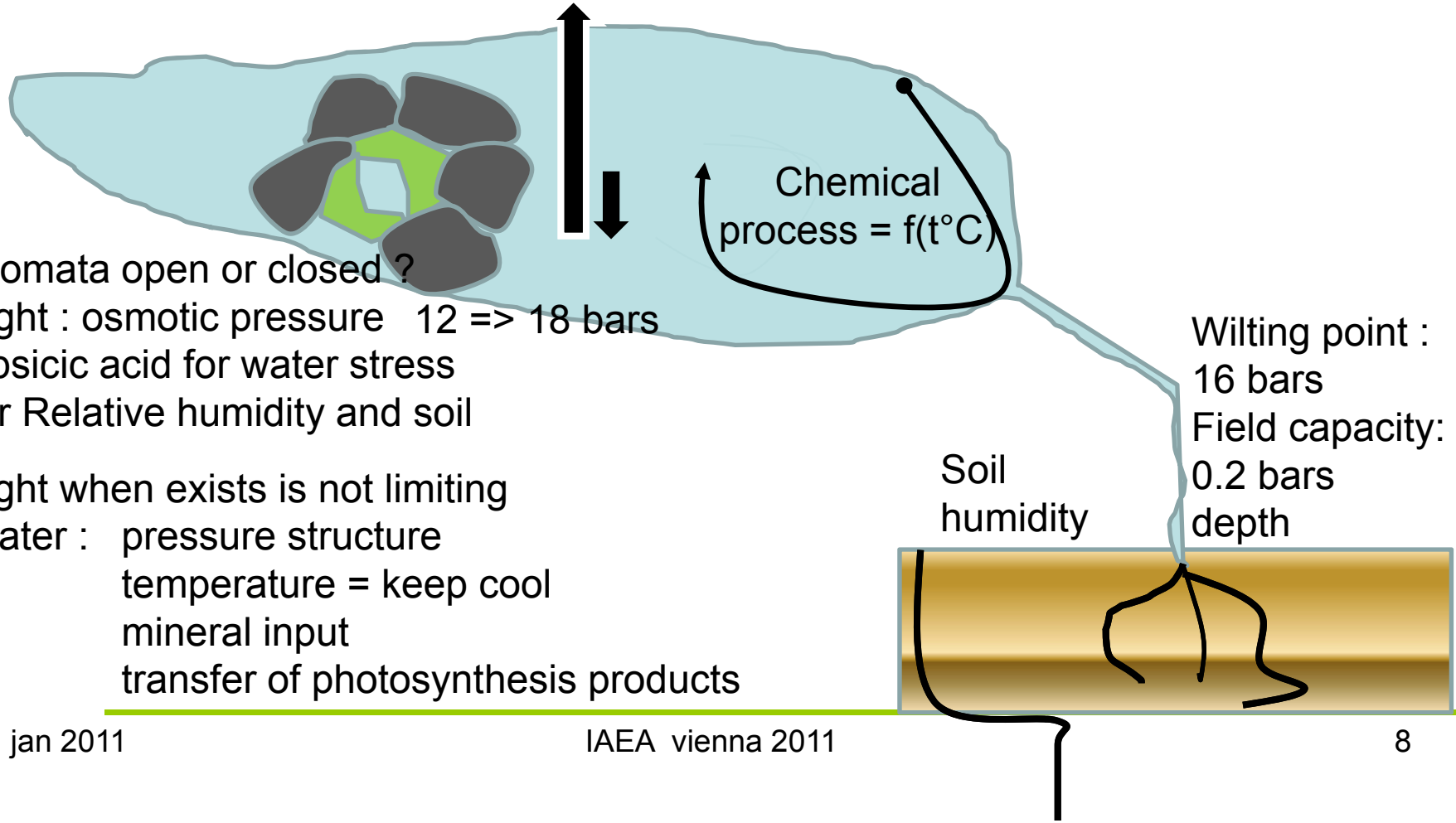
Keep : $C_{comb\ w} = WEQ_p.R_p.[RH.C_{am} +(1-RH).C_{sw}]]$
but R_P to be reassessed

$C_{vegetable} = WC_p.\ C_{free\ w} + (1-WC_p).C_{comb\ w}$

Main parameters ?

Incorporation rate in free water exchange velocity => Integ activity Bq.s/L

Incorporation rate in organic matter s^{-1}



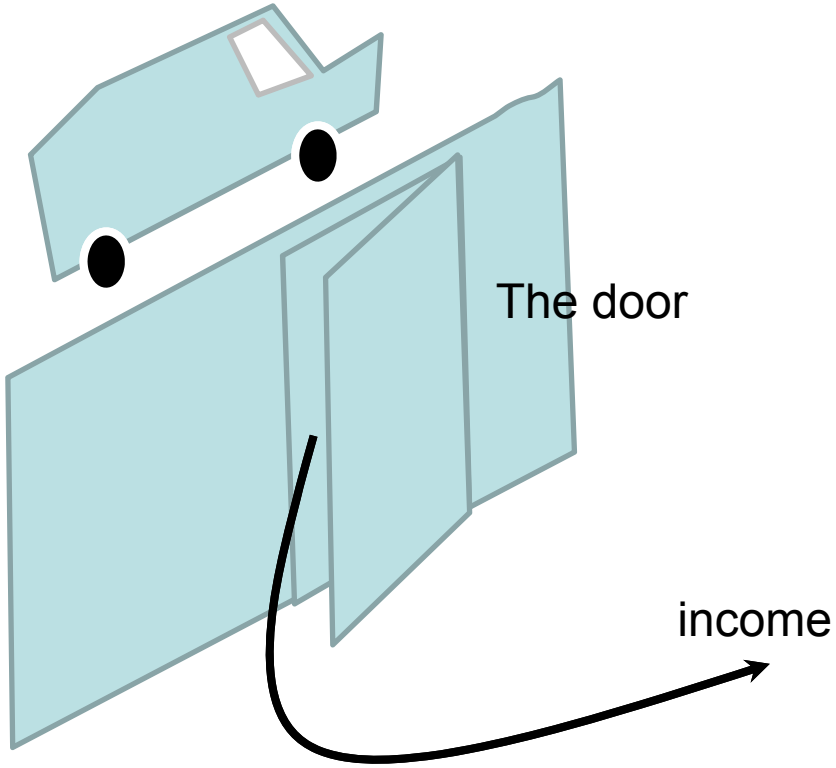
Stomata open or closed ?
Light : osmotic pressure 12 => 18 bars
Absicic acid for water stress
Air Relative humidity and soil

Light when exists is not limiting
Water : pressure structure
temperature = keep cool
mineral input
transfer of photosynthesis products

Wilting point :
16 bars
Field capacity:
0.2 bars
depth

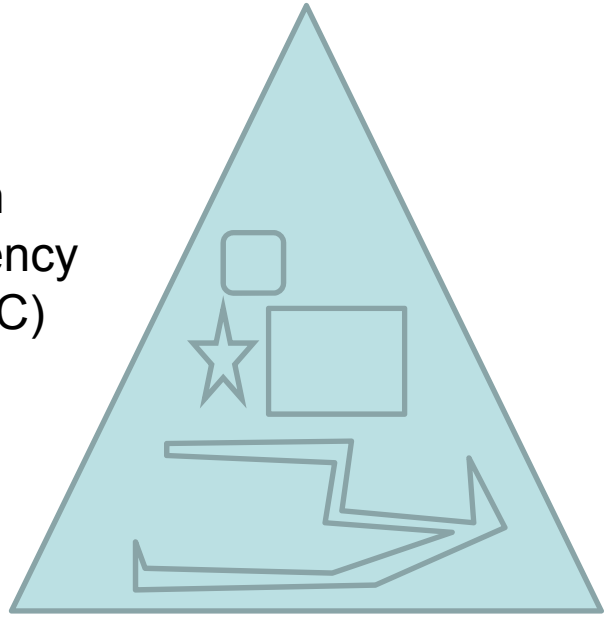
To simplify

The transport from soil



The Machine

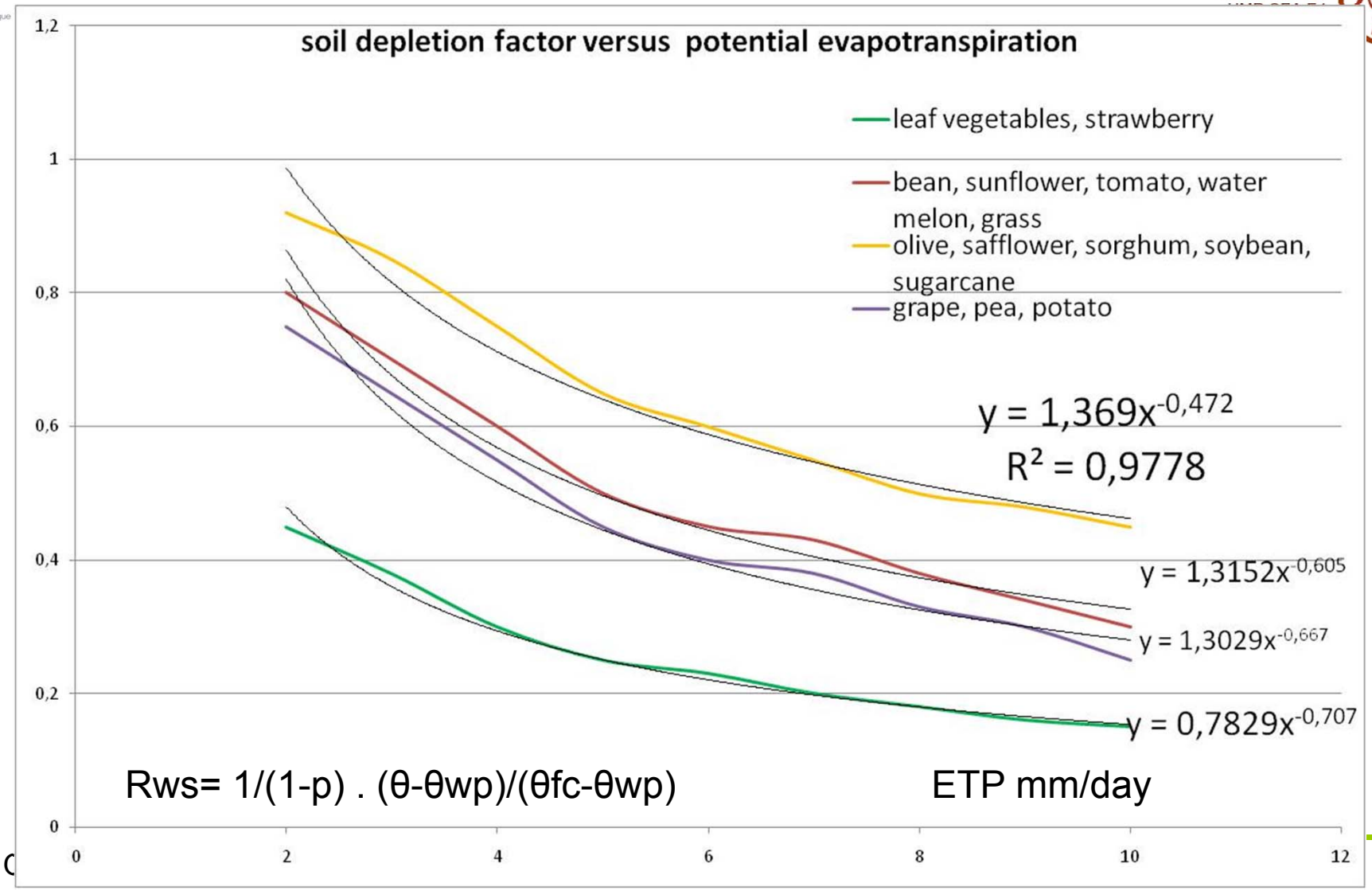
Given efficiency
Fct(t°C)
t_0
t_{max}



Which approach ?

- Plenty parameters to know if the final yield is 0.6 or 0.8 kg/m^2. do we care ?
- Exchange velocity for free water :
  $V_e = LAI / r$: $m\, dA_f/dt = V_e\, (C_{air}-C_{sat}\, A_f)$
  Resistances should be more illustrated
- Incorporation rate in organic matter.
  - When the plants feel well :
    Yield, day.°C, % of water in Org Matter.
    Incorporation rate of HTO in OM in easy conditions.

Soil water contribution



What to know

- Potential Evapotranspiration
- State of soil water content humidity
- Real Evapotranspiration : give a correcting factor, by a factor of max 5.
- To use directly for incorporation factor in organic matter.

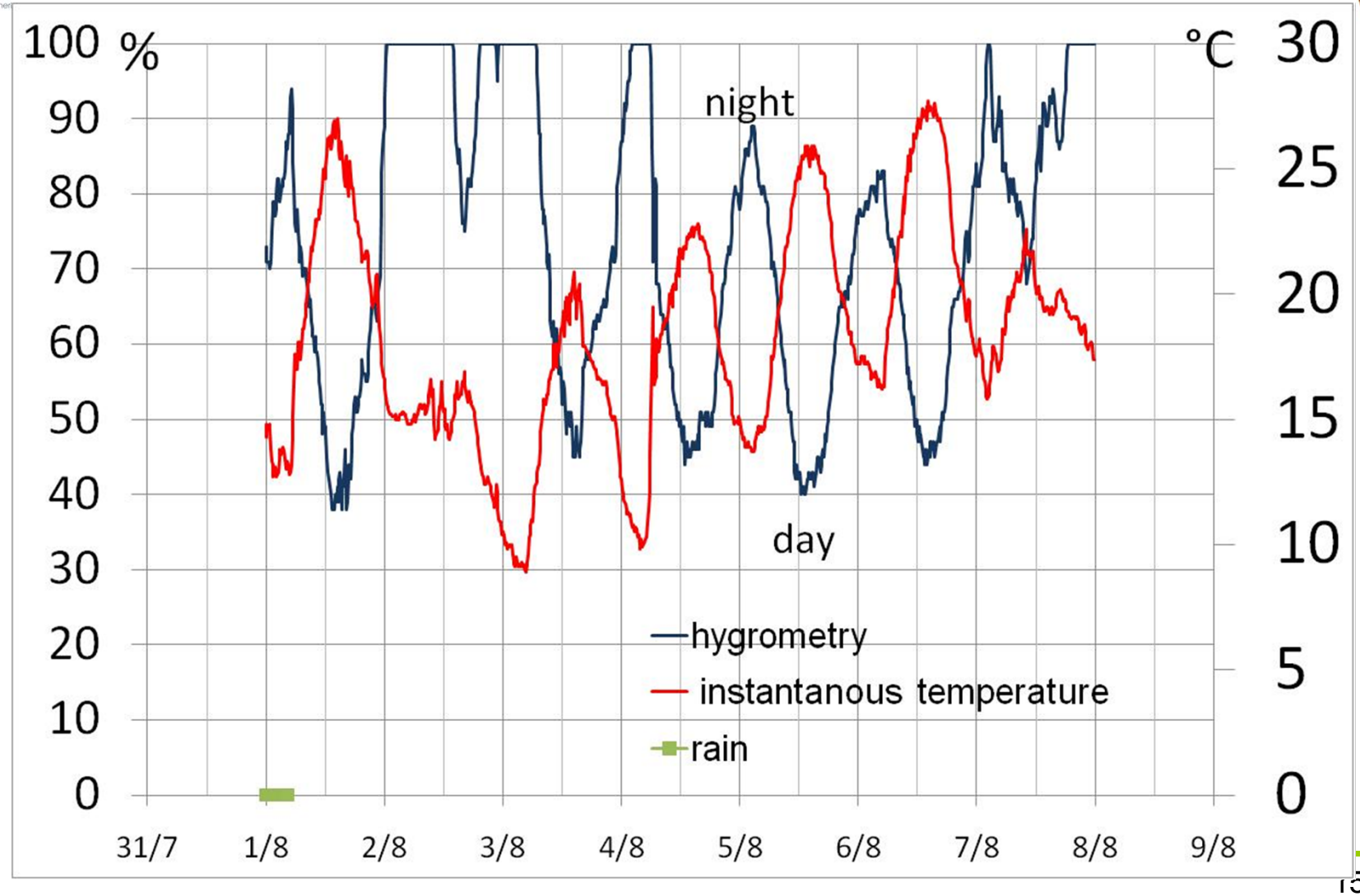
Other points : soil

- Transfer from soil.
- Deposition on soil of the order of 10^{-3} to 10^{-2} m/s. about the same than in plants.
- Dilution in some 100 L/m^2.
- But decrease much slower: ETR/Soil content
- Can be considered as a “normal situation” for the soil pathway.

Other points : rain

- Concentration of rain about 3 to 5 times lower than air moisture. (except at the foot of the stack)
- Dilution in the soil water about 100.
- Same approach as in previous slide.
- Question of the direct leaves transfer.
  - Time of input = time of release + Time of evaporation.

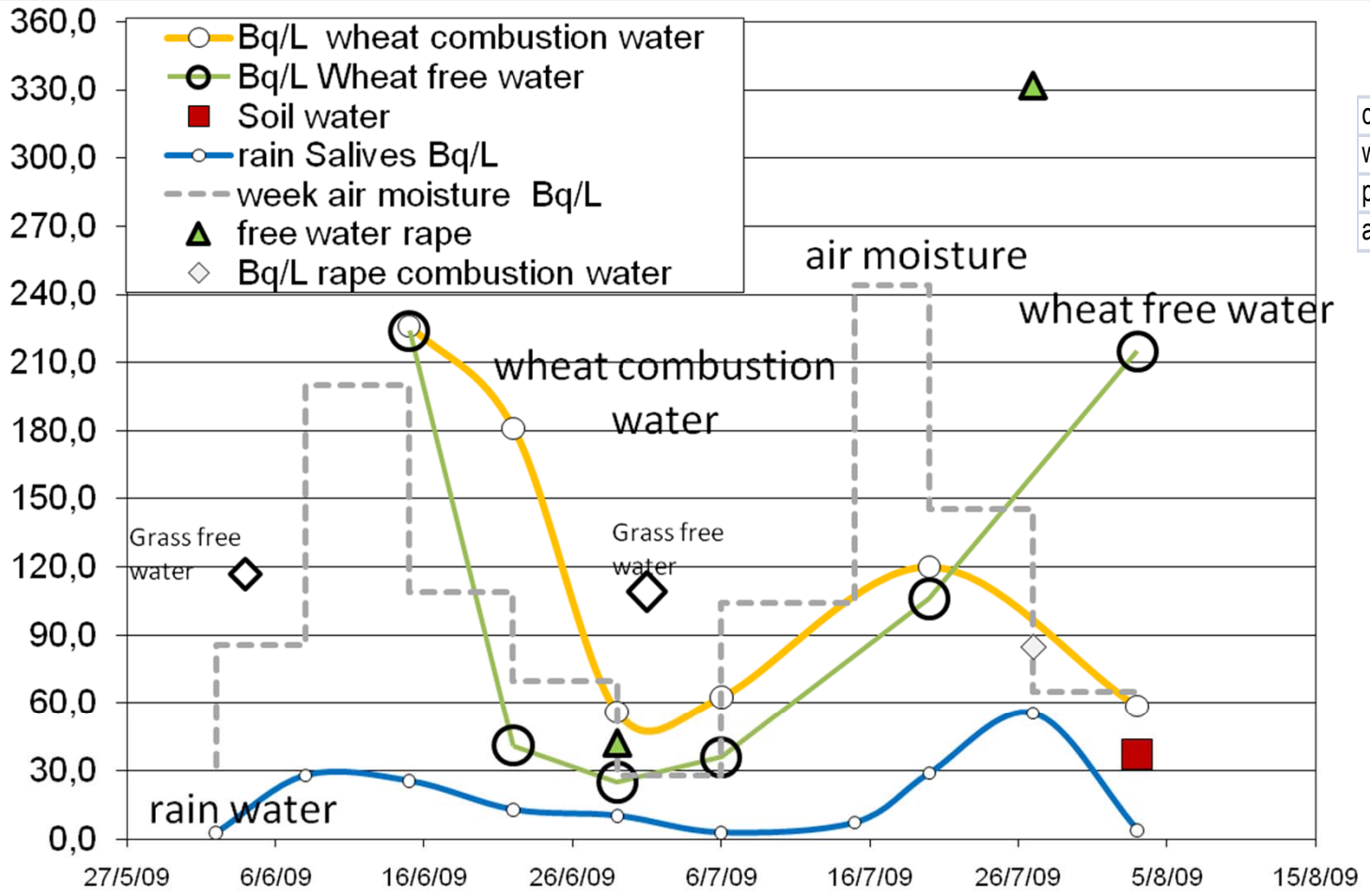
Day and night = not only light or not



Other points : night

- Say that the correction of temperature could be OK. (Day °C)
- On metabolism of incorporation
- On possible input of water
- Should consider that decrease of activity occurs in the next day.
- Do we need something for the stomata ?

Field experiment in 2009 - Total OBT



colza	85
wheat	55,9
potatoes	38,2
apple	70,1

Thank you for your attention