

**Production of primary biomass and  
sequestration of carbon  
with a high water efficiency**

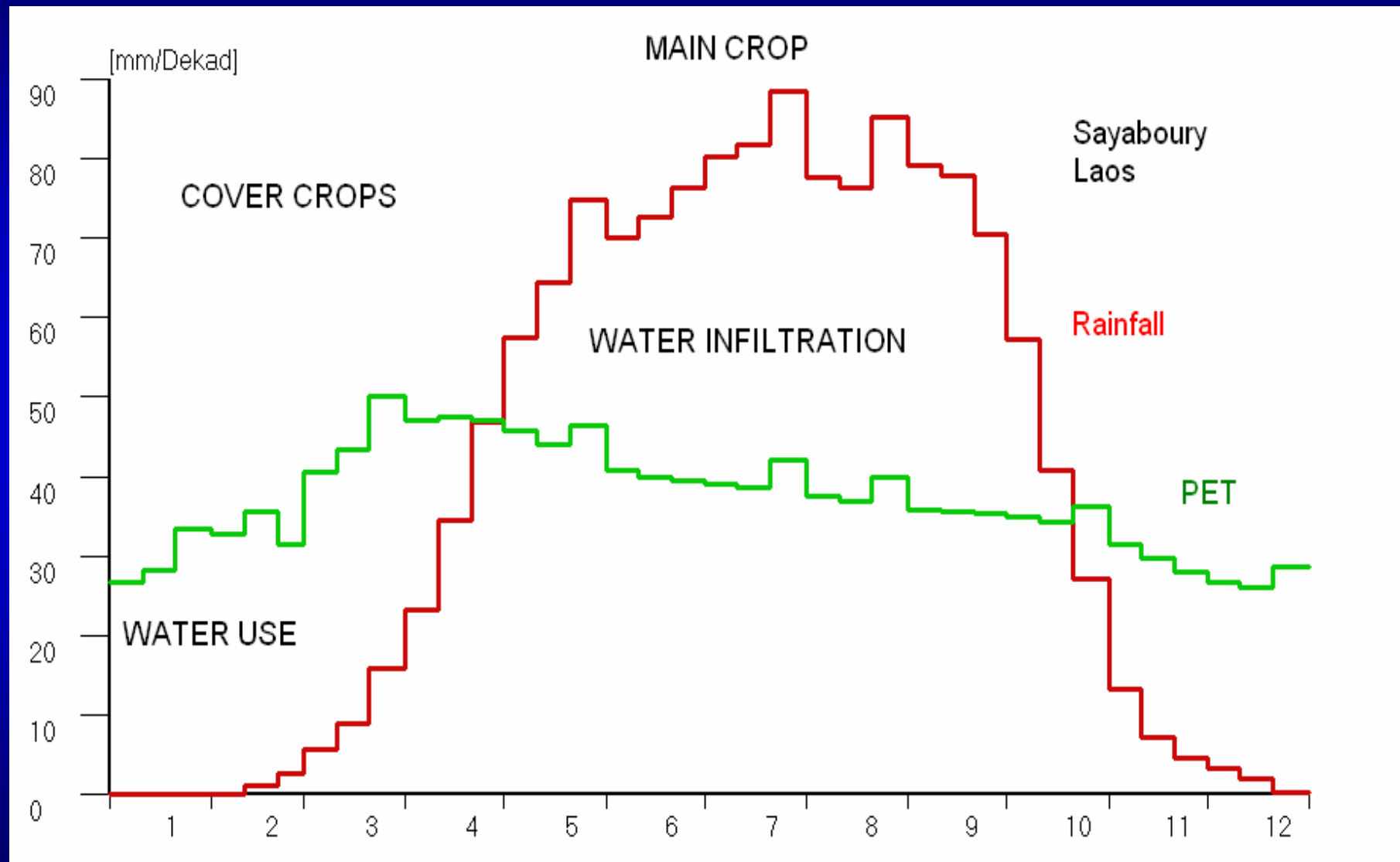
**the comparative advantages of  
DMC rainfed cropping systems**

**Francis Forest , Michel Raunet B. Lidon**

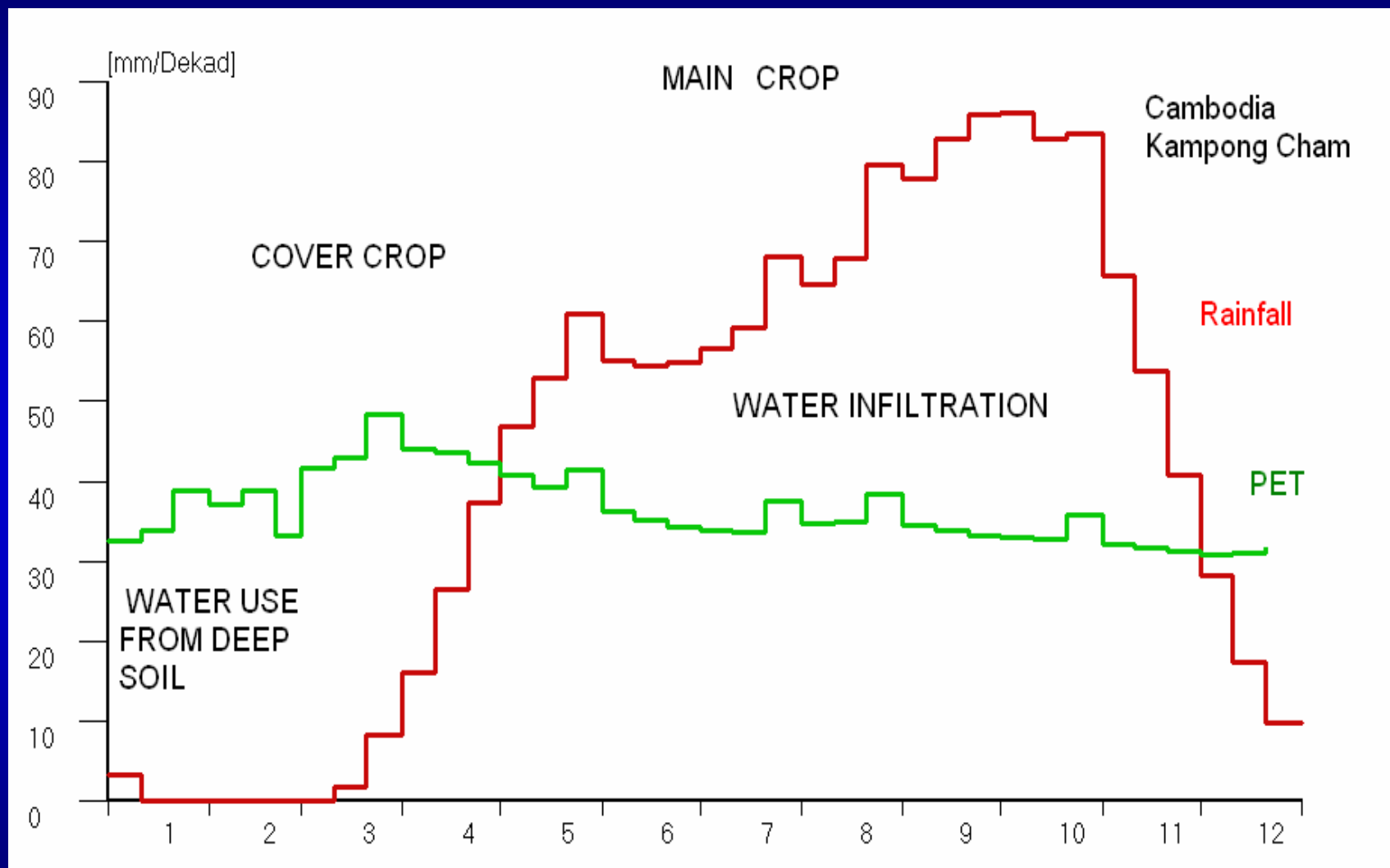
**Regional Workshop on Conservation Agriculture October 28 th November 1st 2008. Xieng Khouang. Laos.**



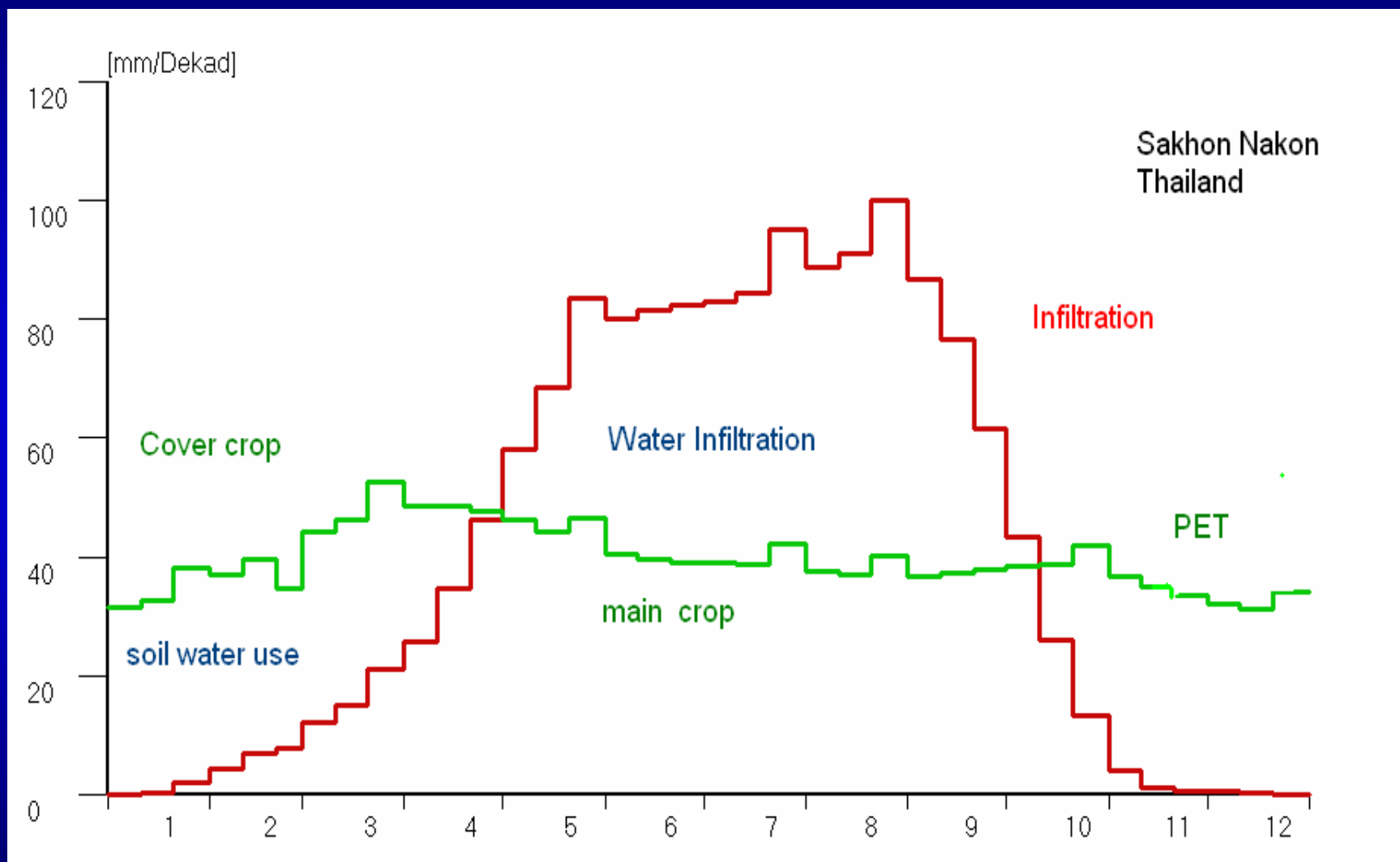
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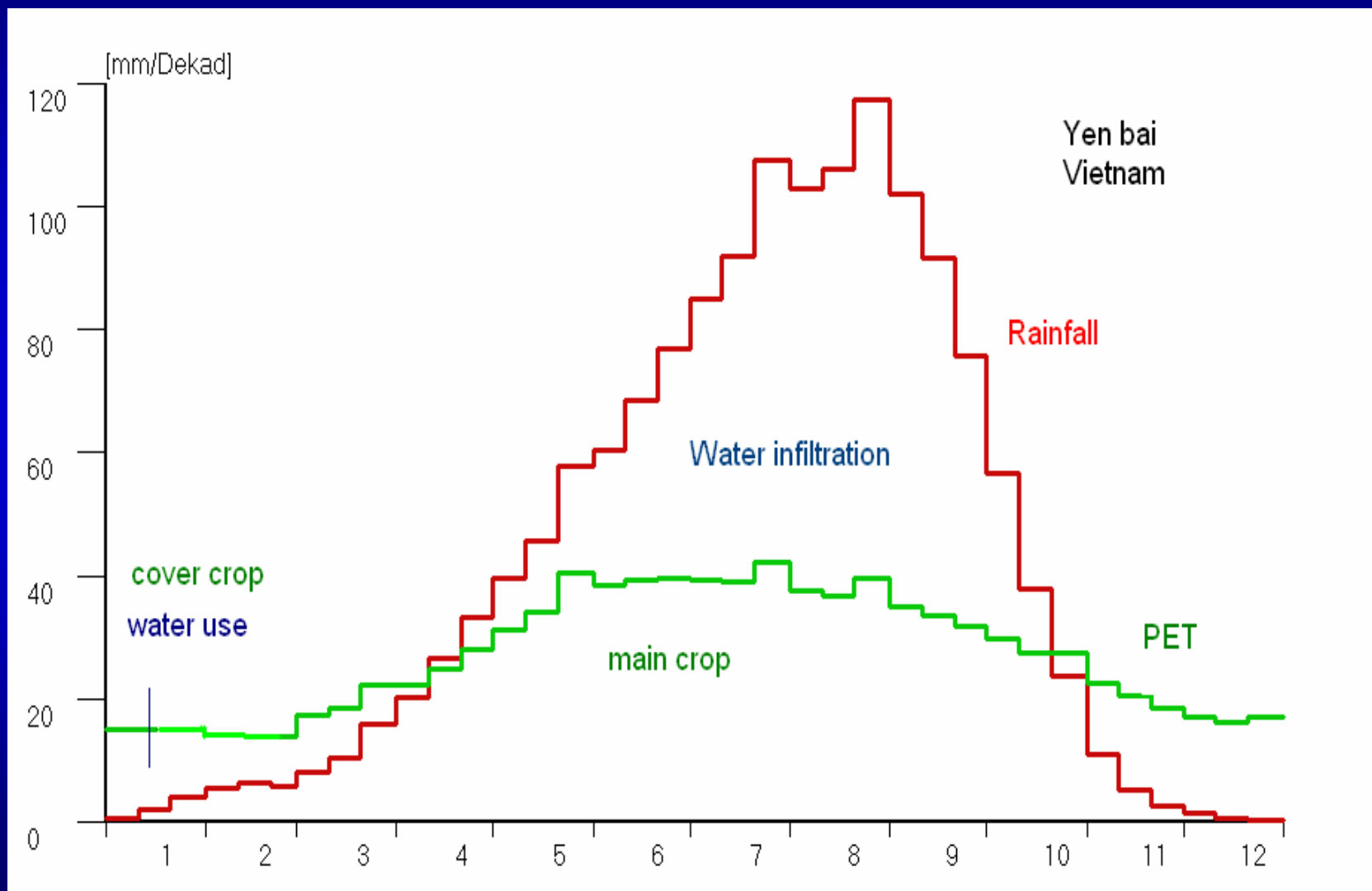
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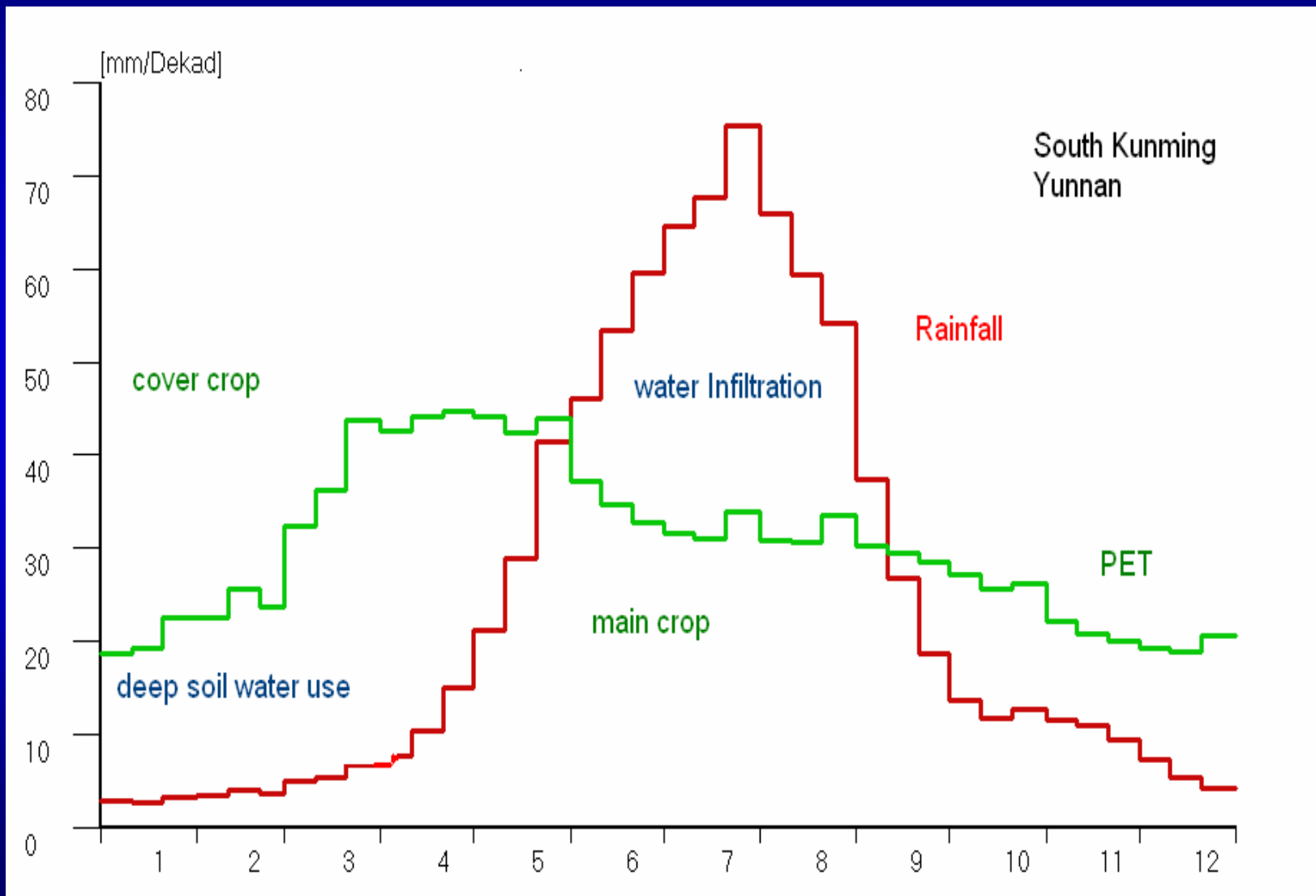
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## The primary biomass Monteith basic model

### Estimating the potential for primary Biomass

$$MS \text{ primary} = \int_{t1}^{t2} E_c \cdot E_b \cdot E_a \cdot R_G dt$$

**R<sub>G</sub>** Global radiation over the canopy during the **crop cycle duration**.

**E<sub>c</sub>** Climatic efficiency linked to bioclimat during the **growing season**

**E<sub>b</sub>** Photosynthetic Active Radiation PAR efficiency linked to **crop's physiology**

**E<sub>a</sub>** useful component of PAR absorbed by the canopy ( linked to **Lai**)



## DMCs and Biomass / Water Efficiency

$$Y_{\text{exp potential IRESP2}} = K_{\text{fert}} \times AET_{\text{cycle}} \times AET_{\text{cp}} / Pot_{\text{METcy}}$$

### DMC effects

$K_{\text{fert}}$  coefficient linked to **fertility** and **drainage**

+++ / -

$AET_{\text{cycle}}$  actual evapotranspiration linked to **soil humidity**

+++++

$AET_{\text{cp}}$  actual evapotranspiration / **flowering** critical phase

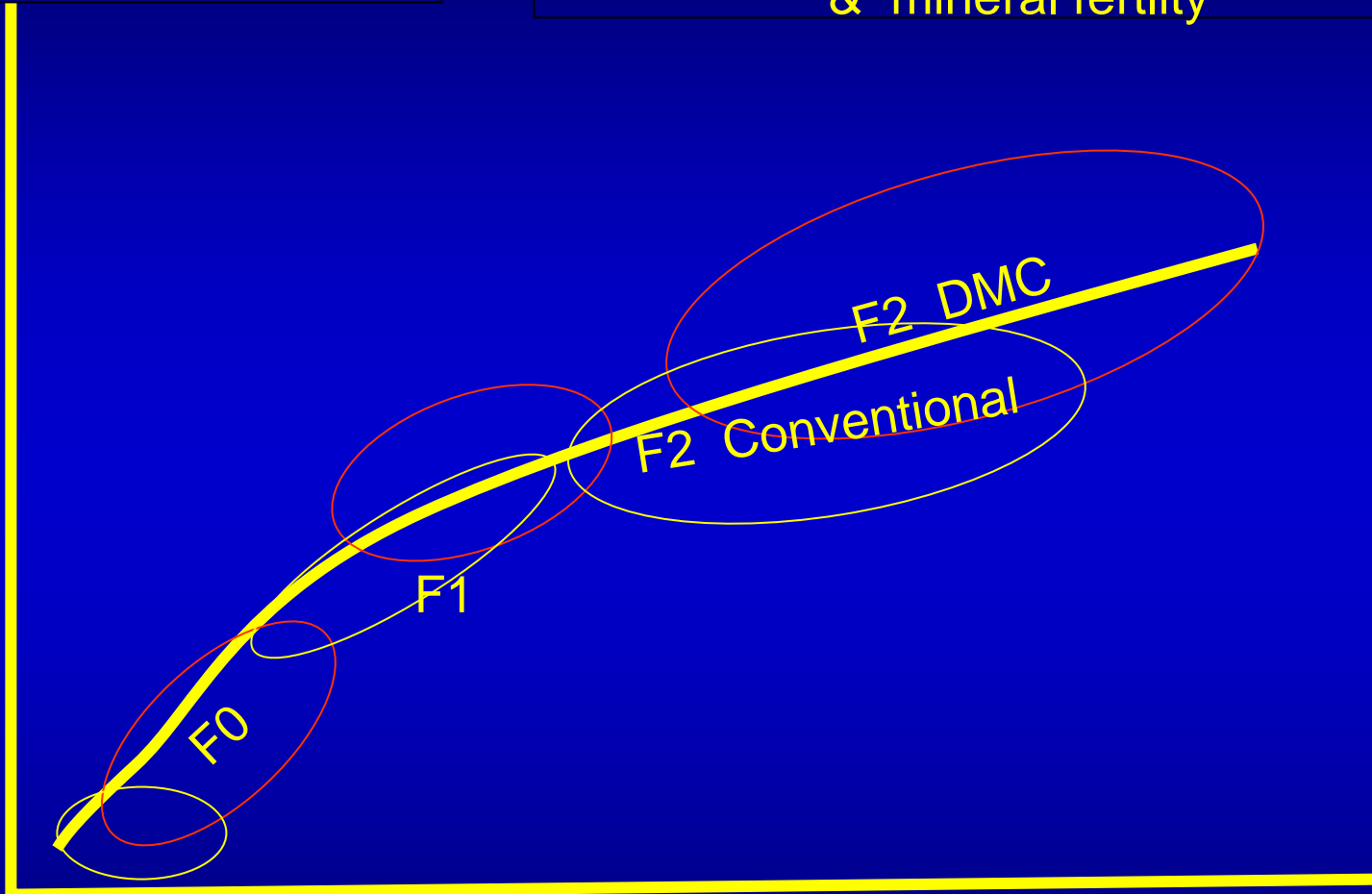
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$Pot_{\text{METcy}}$  : maximal evapotranspiration during the cycle

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Yield Dry matter

Biomass and crop water balance  
& mineral fertility



Forest et al, 1991, R3S

$Kfert \times AET_{cycle} \times AET_{cp} / PotMET_{cy}$

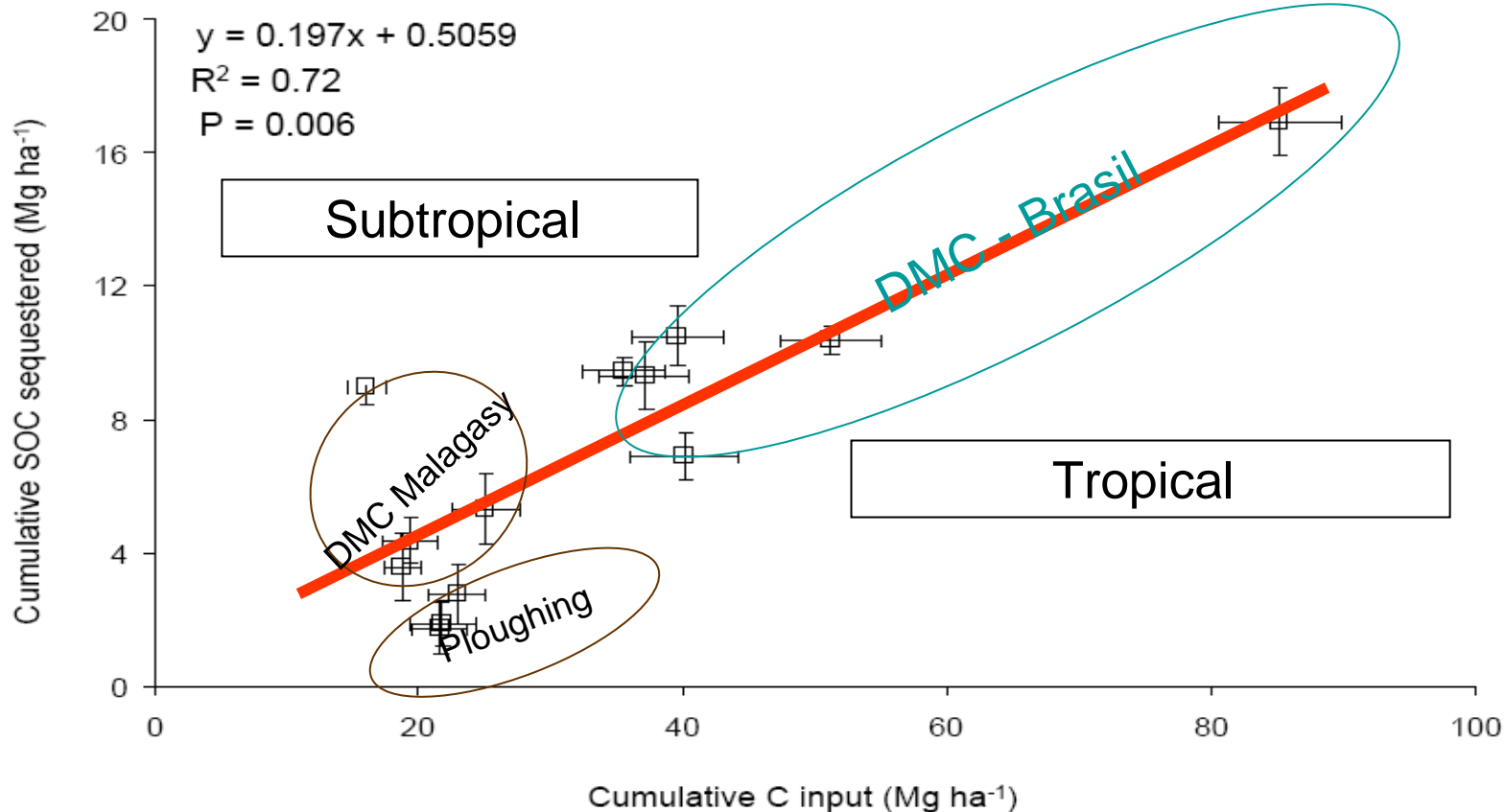
## Soil Carbon balance

$$C = C_0 \cdot e^{-k_2 t} + k_1 M (1 - e^{-k_2 t}) / k_2$$

$$dC/dt = k_1 M - k_2 C = 0.$$

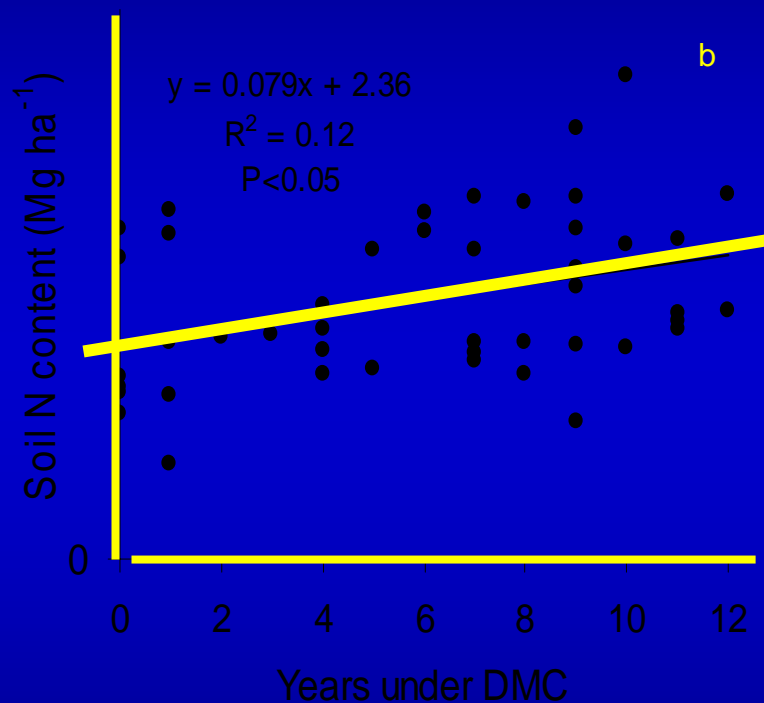
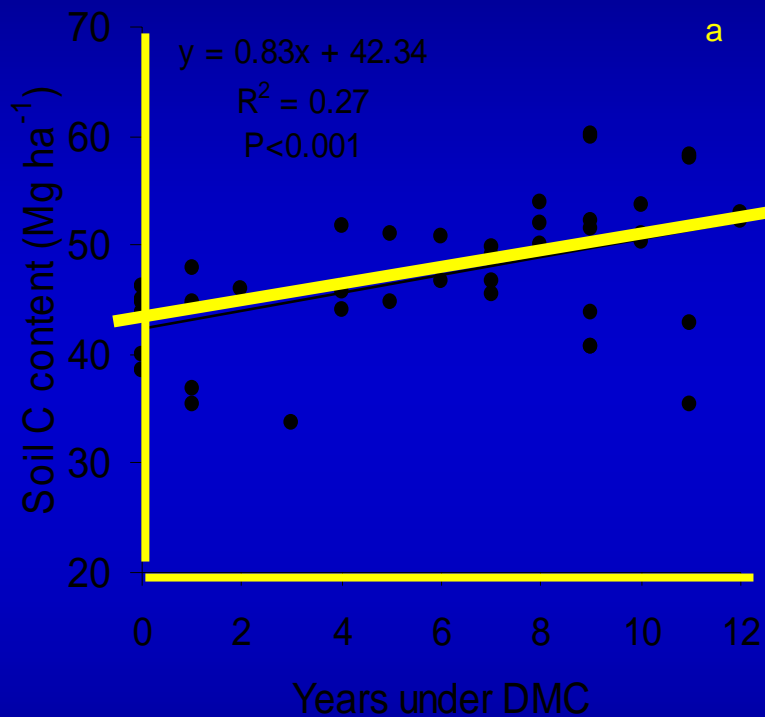
- C :** Humus stock in the soil profile ( 1-10 cm)
- M :** mean annual input of organic matter + + +
- k1 :** Isohumic coefficient
- k2 :** Humus related degradation coefficient - - -
- C0 :** Initial base line

# Biomass recycling – Carbon input and sequestration in crops rotation - Soil management cumulated Effect



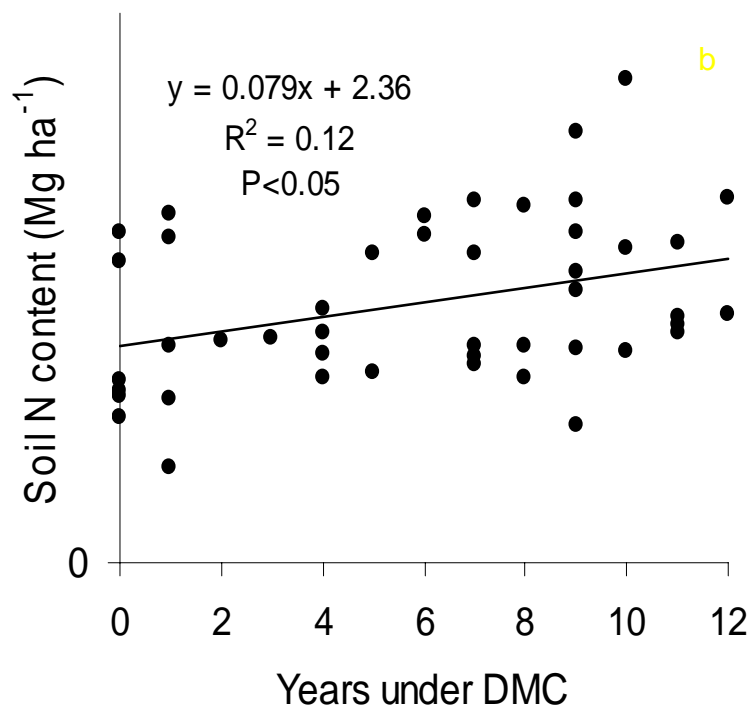
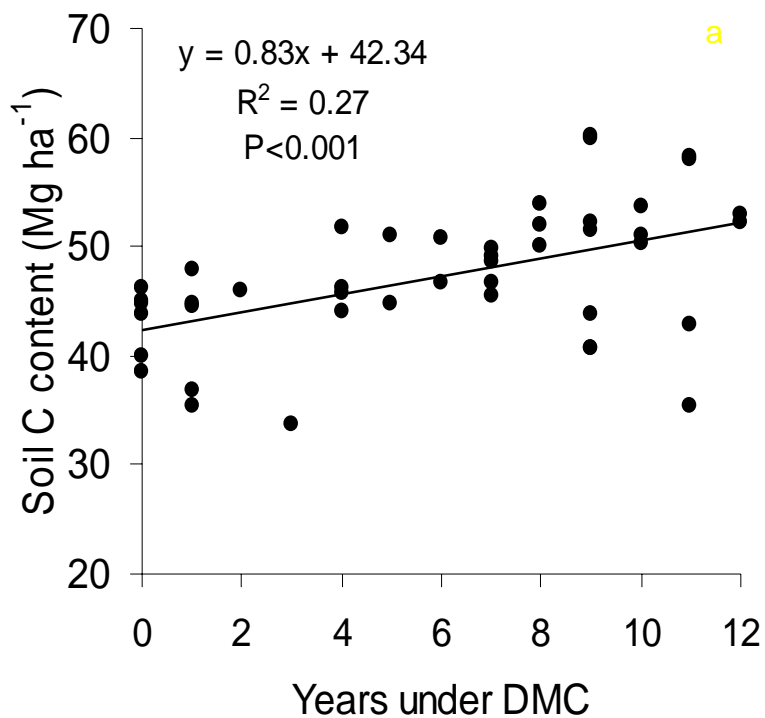
From SA et al, 2008 – to be published

# Carbon and Nitrogen storage in DMCs -



From Corbeels et al,

## Carbon and Nitrogen storage in DMCs -





**Landscape level**

**“Flows”**

**Water**

**Sediment**

**Household resources**

## **REFERENCES**

**On Carbon, Nitrogen storage**

**ARE NEARLY AVAILABLE AT FIELD SCALE**

**NEEDED**

**Observations and data on Carbon Nitrogen  
fluxes at  
Landscape – Watershed scale**









And what about DMCs and terraces ?





And what about DMCs and irrigated rice ?



***THANKS FOR YOUR ATTENTION***