ECHA EFSA Topical Scientific Workshop on Soil Risk Assessment, Helsinki, 7 – 8 October, 2015

Degradation, persistence and exposure of pesticides in soil under different environmental scenarios - simulation and measurements

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Introduction to the Problem

Soil persistence or residence time in soil is governed by a) properties of the soil matrix, b) intrinsic chemical propensities, and c) transformation and transport processes governed by driving environmental variables

→ How to consider persistence in risk assessment ?

State of Knowledge

Soil is a filter, buffer and transformation system for chemicals, with known interactions between dissipation processes, driving environmental variables and geographic distribution

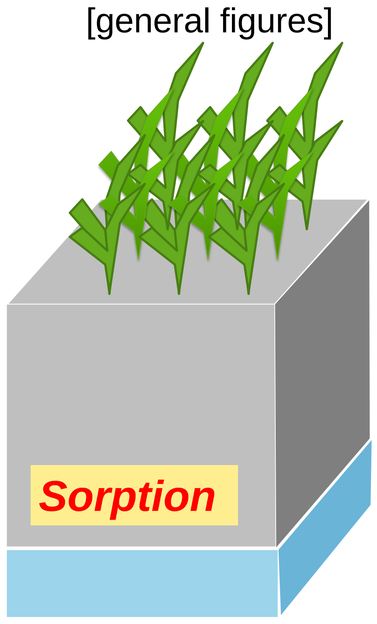
Dissipation processes in and from the soil

Degradation

Photodegradation
[< 1 to 90 %]

Microbial/chemical transformation (incl. bound residues)
[10 to >95%]

[general figures]



Transport

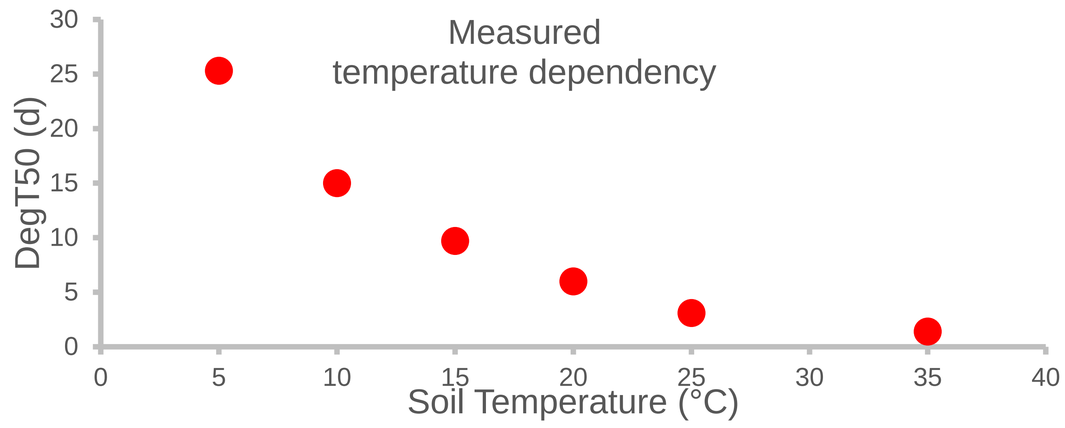
Volatilisation
[0 to >50%]

Offsite Transport (runoff, drainage)
[0 to ~5%]

Plant Uptake
[0 to >5%]

Leaching
[< 1%]

Driving variables and functional relations



$$DegT50_{matrix} = DegT50_{matrix,20Celsius} exp\left(\frac{E_a}{R}\left[\frac{1}{T} - \frac{1}{T_{ref}}\right]\right)$$

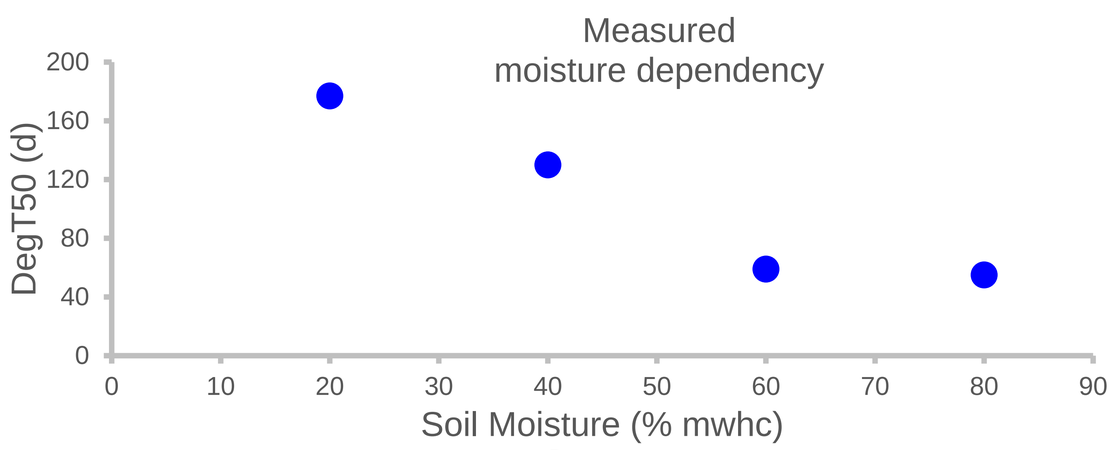
where

E_a = *Arrhenius activation energy (kJ/mol)*

R = *gas constant (0.008314 kJ K^{-1} mol^{-1})*

T = *soil temperature (K)*

T_{ref} = *ref. soil temperature (20 °C = 293.15 K)*



$$DegT50_{matrix} = DegT50_{matrix,FC}\left(\frac{\theta}{\theta_{FC}}\right)^{.B}$$

where

'FC' = at field capacity, i.e matric suction of pF = 2

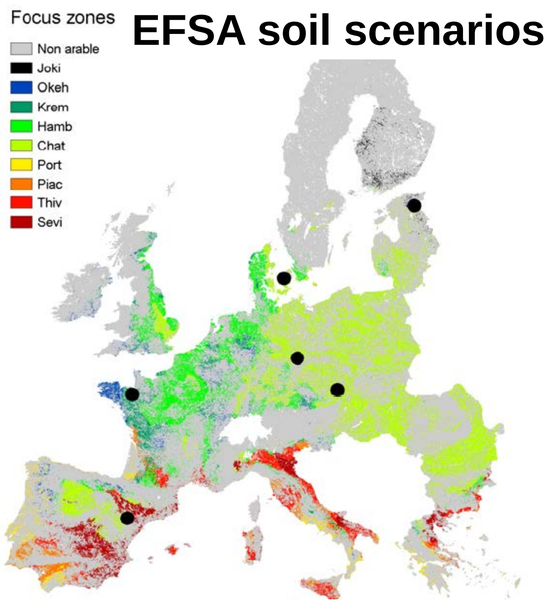
θ = volume fraction of water in soil (m^3 / m^3)

B = moisture-dependency parameter (-)

State variables

Soil matrix,
organic carbon, pH,
microbial activity

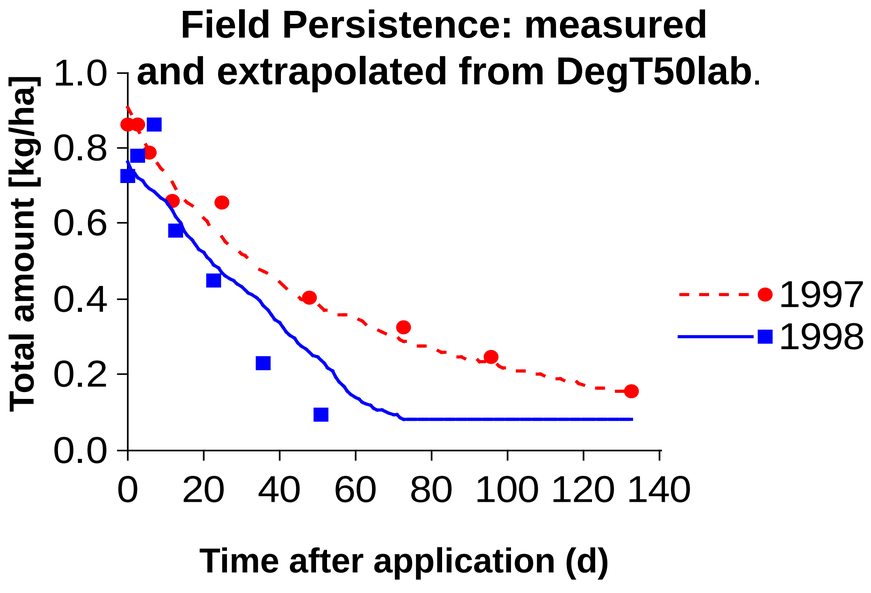
Geographic information



Solutions based on validated assessment tools

Prediction of field persistence/exposure

- Scientific/regulatory accepted methods
- Many validation exercises



Simulated Accumulation

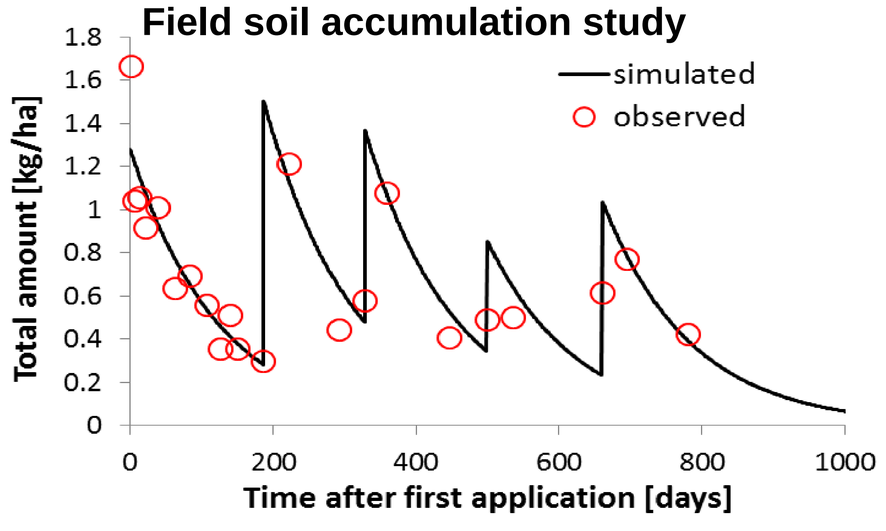
- PERSAM calculations with EFSA soil scenarios

Accumulation in soil (C_t in 0-20 cm)

DegT50 @ 20°C	North ∅ 4.7 °C	Centre ∅ 8.0 °C	South ∅ 11.0 °C
100 d	193%	159%	141%
365 d	553%	421%	350%

Measured Accumulation (33 a.i., > 50 plots)

- No further increase of the maximum concentration after a few years (2-5)
- Max. conc. < 2x higher than 1st application



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Accumulation studies with „persistent“ pesticides

supplement to:
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