

# Proposal for Inclusion of Measured Canopy Processes in Soil Risk Assessment

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# Background

- Recent draft guidance by EFSA included an estimation of the amount of substance reaching soil after a washoff event. These were calculated as an average of modelled values

Crop	PEARL	PELMO	Average
	Washed-off	Washed-off	
Onions	0.52	0.36	0.44
Onions	0.73	0.53	0.63
Onions	0.75	0.69	0.72
Onions	0.80	0.59	0.70
Onions	0.37	0.35	0.36
Onions	0.33	0.50	0.42
Onions	0.26	0.87	0.57
Onions	0.15	0.06	0.11

- Large differences could be observed between model estimates
- There was no provision for modifying these estimates using compound properties
- Here we propose an alternative method for estimating washoff losses consistent with EFSA methodology but containing options to refine appropriately

# Why Are models different?

## Models represent washoff differently

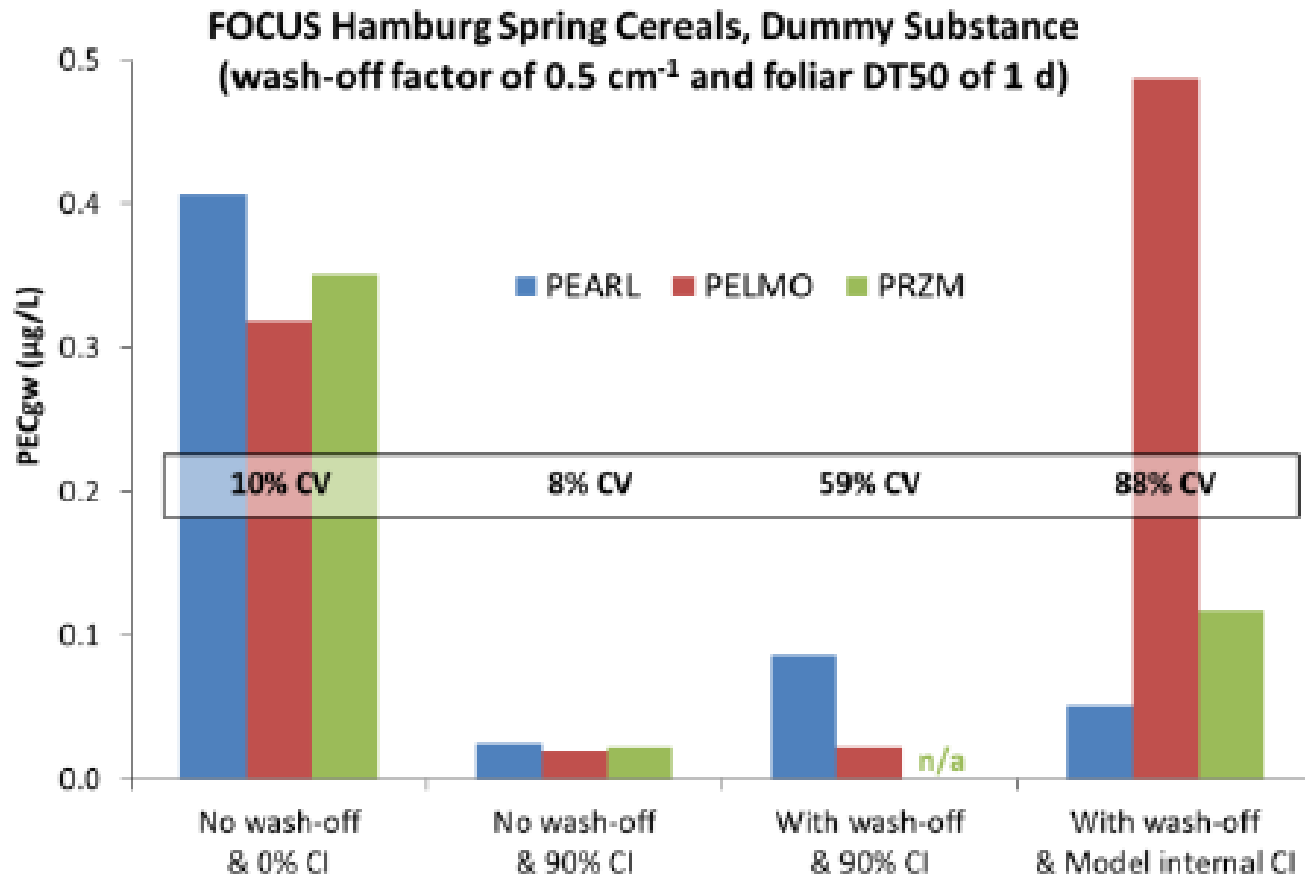
- Linear
- Exponential
- Linear but quasi exponential as daily rainfall is split over several timesteps

## The same washoff parameter will give different results for the same size rainfall event

- E.g.  $0.25 \text{ cm}^{-1}$  gives 50% washoff for 2cm event linear and 40% washoff exponential

## Currently washoff occurs during irrigation and models do not have same irrigation amounts.

# Does it Matter?

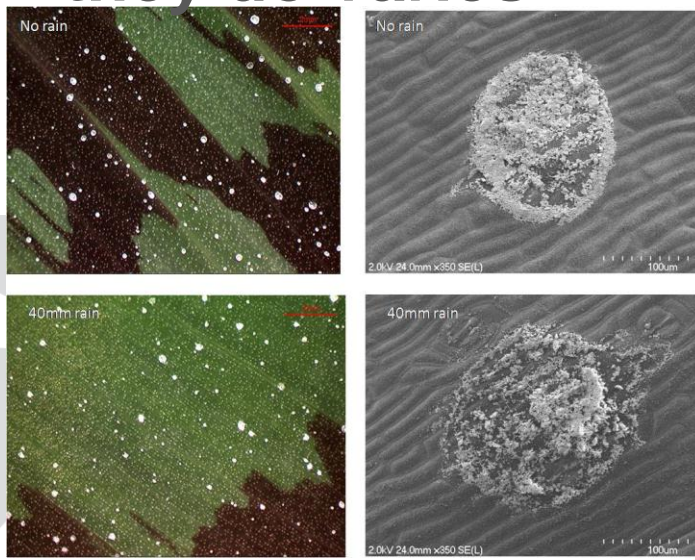


# What is Important?

- Some PPPs are designed to enter into leaf surfaces as a result of their mode-of-action
  - Herbicides
  - Insecticides active against sucking pests
  - Plant growth regulators
  - Fungicides with curative action
- These residues are effectively not available to be washed off

# Residues on leaf surfaces

- Some PPPs have an extremely short existence on leaves e.g. photo-degradation
- Some PPPs are designed to remain on leaf surfaces (preventative action) and may be available to washoff, but the extent to which they do varies

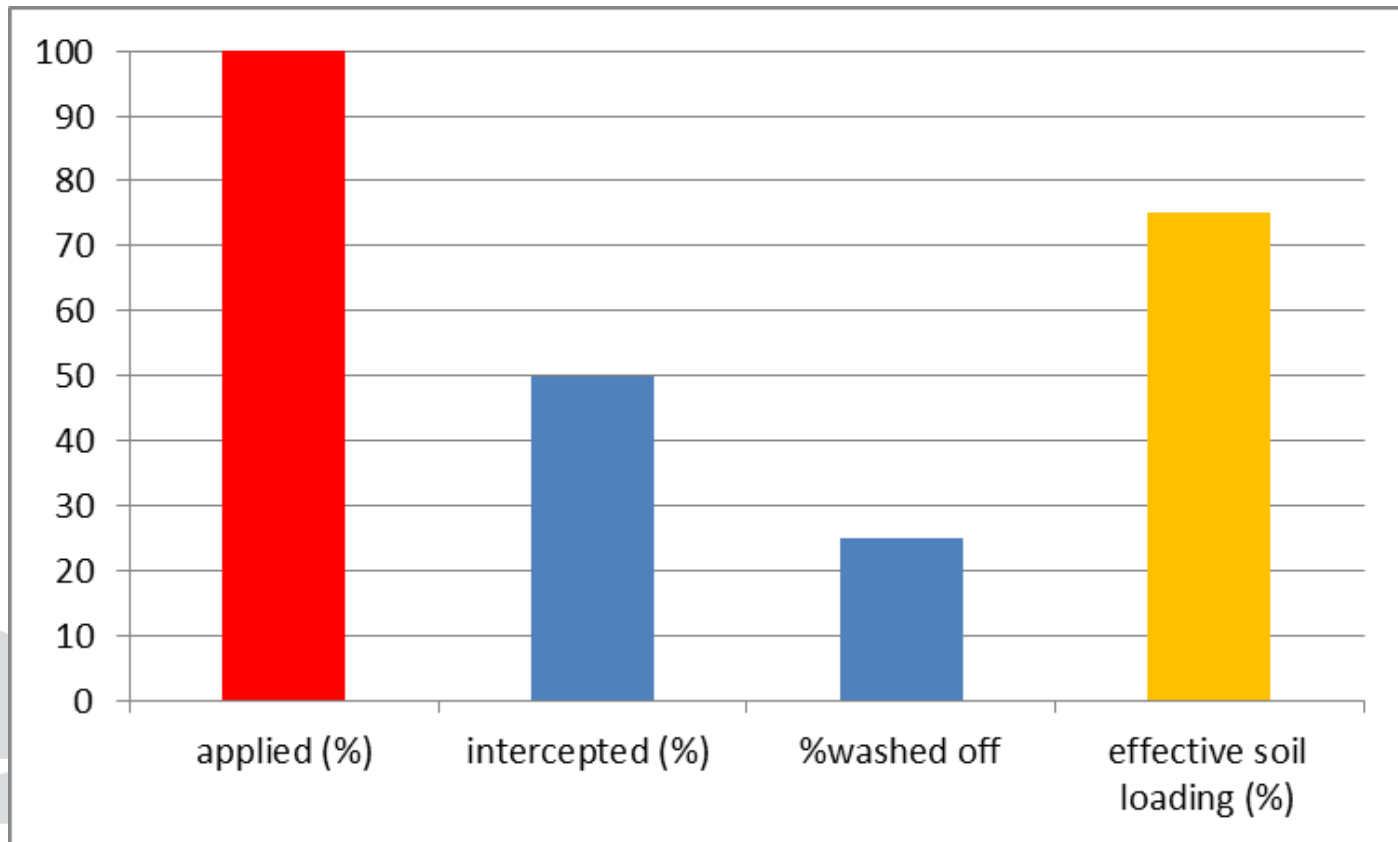


# Contention

- ▶ Although the EFSA calculation is a pragmatic approach to resolve model differences, not enough is known about the science of modelling washoff to allow models to calculate washoff amounts directly.
- ▶ Some means of simply and consistently estimating washoff amounts using known compound behaviour is required.

# Proposal for a Solution

- Force a washoff event of known size, estimate the amount washed off and include it as part of the application.





# Outline of the principle Idea

- ▶ **Model independent calculation of washoff**
- ▶ **Manual calculation of additional soil loading due to washoff based on a simple approach**
- ▶ **Considering a „realistic worst-case“ rainfall event:**
  - Realistic worst-case rainfall amount (mm per day)  
→ 90th%ile
  - Shortest average time period between all possible applications and such a rainfall event
  - Data taken from FOCUSgw (20 years) and FOCUSsw (PRZM 20 years; MACRO 7 years)

# Realistic Worst-Case Event

- **20 mm (2 cm)** as reasonable wc value based on **90th%ile excluding days without rainfall**

90th%ile daily rainfall (cm)			
C Chateaudun	0.60	D1 Lanna	0.44
H Hamburg	0.70	D2 Brimstone	0.58
J Jokioinen	0.51	D3 Vreedepeel	0.61
K Kremsmünster	0.77	D4 Skousbo	0.56
N Okehampton	0.95	D5 La Jailliere	0.54
O Porto	1.11	D6 Thiva	0.30
P Piacenza	0.68	R1 Weiherbach	0.63
S Sevilla	0.25	R2 Porto	1.35
T Thiva	0.35	R3 Bologna	0.54
		R4 Roujan	0.42

90th%ile daily rainfall (cm) - excluding zeros			
C Chateaudun	0.98	D1 Lanna	1.15
H Hamburg	1.01	D2 Brimstone	0.91
J Jokioinen	0.89	D3 Vreedepeel	1.00
K Kremsmünster	1.33	D4 Skousbo	1.00
N Okehampton	1.40	D5 La Jailliere	1.00
O Porto	1.99	D6 Thiva	2.13
P Piacenza	2.14	R1 Weiherbach	1.08
S Sevilla	2.05	R2 Porto	2.43
T Thiva	1.55	R3 Bologna	1.50
		R4 Roujan	2.12

- 9 days as minimum average time until **20 mm sum of rainfall** is reached (min of all scenarios & application seasons)

C Chateaudun	13	D1 Lanna	17
H Hamburg	11	D2 Brimstone	14
J Jokioinen	14	D3 Vreedepeel	13
K Kremsmünster	10	D4 Skousbo	14
N Okehampton	9	D5 La Jailliere	16
O Porto	11	D6 Thiva	25
P Piacenza	13	R1 Weiherbach	12
S Sevilla	31	R2 Porto	9
T Thiva	25	R3 Bologna	16
		R4 Roujan	15



# Calculation of Washoff amount

The fraction of the dose washed off from the canopy ( $f_w$ ) and the total fraction reaching soil ( $f_{soil}$ ) can be easily calculated considering

- an exponential wash-off calculation
- 20 mm rainfall event 9 days after foliar treatment
- Default washoff factor of  $1 \text{ cm}^{-1}$
- Default foliar half-life of 10 days
- Default foliar uptake factor of 0
- New EFSA crop interception values (EFSA, 2014a)

The total fraction reaching soil ( $f_{soil}$ ) is calculated as

$$f_{soil} = (1 - f_i) + f_i * e^{-\frac{\ln 2 * DAT}{DT50_{foliar}} * (1 - e^{-wq})}$$

where  $f_i$  is the fraction of the dose intercepted, DAT is the time between foliar treatment and wash-off event,  $DT50_{foliar}$  is the foliar half-life,  $w$  the wash-off factor and  $q$  the amount of rainfall. A foliar uptake is at this stage not explicitly considered for the calculation.

# Proposal vs EFSA Detail - $f_{\text{soil}}$

- very similar answers

Crop	new EFSA crop interception values (%)					Fraction reaching soil - Preliminary Model independent calculation (until harvest)						Fraction reaching soil EFSA proposal (until harvest)					
	BBCH code					BBCH code					mean	BBCH code					mean
	00-09	10-19	20-39	40-89	90-99	00-09	10-19	20-39	40-89	90-99	10-99	00-09	10-19	20-39	40-89	90-99	10-99
Beans	0	25	40	70	80	1.00	0.87	0.79	0.62	0.57	0.71	1.00	0.85	0.85	0.65	0.45	0.70
Cabbage	0	25	40	70	90	1.00	0.87	0.79	0.62		0.76	1.00	0.85	0.85	0.60		0.77
Carrots	0	25	60	80	80	1.00	0.87	0.68	0.57		0.70	1.00	0.85	0.70	0.45		0.67
Cotton	0	30	60	75	90	1.00	0.84	0.68	0.60	0.52	0.66	1.00	0.90	0.90	0.50	0.25	0.64
Maize	0	25	50	75	90	1.00	0.87	0.73	0.60	0.52	0.68	1.00	0.85	0.75	0.60	0.35	0.64
Onions	0	10	25	40	60	1.00	0.95	0.87	0.79		0.87	1.00	0.95	0.90	0.75		0.87
Peas	0	35	55	85	85	1.00	0.81	0.70	0.54	0.54	0.65	1.00	0.75	0.70	0.65	0.55	0.66
OSR summer	0	40	80	80	90	1.00	0.79	0.57	0.57	0.52	0.61	1.00	0.75	0.60	0.60	0.55	0.63
OSR winter	0	40	80	80	90	1.00	0.79	0.57	0.57	0.52	0.61	1.00	0.75	0.60	0.60	0.35	0.58
Sugar beets	0	20	70	90	90	1.00	0.89	0.62	0.52		0.68	1.00	0.90	0.75	0.50		0.72
Soybeans	0	35	55	85	65	1.00	0.81	0.70	0.54	0.65	0.68	1.00	0.85	0.80	0.70	0.55	0.73
Sunflowers	0	20	50	75	90	1.00	0.89	0.73	0.60	0.52	0.68	1.00	0.90	0.80	0.70	0.35	0.69
Tobacco	0	50	70	90	90	1.00	0.73	0.62	0.52	0.52	0.60	1.00	0.70	0.65	0.65	0.40	0.60
Tomatoes	0	50	70	80	90	1.00	0.73	0.62	0.57	0.52	0.61	1.00	0.75	0.75	0.65	0.65	0.70
Crop	BBCH code					BBCH code					mean	BBCH code					mean
	00-19	20-29	30-39	40-69	70-99	00-19	20-29	30-39	40-69	70-99	10-99	00-19	20-29	30-39	40-69	70-99	10-99
Spring cereals	0	20	80	90	80	1.00	0.88	0.53	0.47	0.53	0.60	1.00	0.90	0.65	0.60	0.60	0.69
Winter cereals	0	20	80	90	80	1.00	0.88	0.53	0.47	0.53	0.60	1.00	0.90	0.60	0.55	0.55	0.65
mean all crops						1.00	0.84	0.67	0.57	0.54	<b>0.67</b>	1.00	0.84	0.74	0.61	0.47	<b>0.68</b>

- The alternative proposal would in principle support several refinement options ...

# Potential Refinement Options

- Measured washoff factor (default =  $1 \text{ cm}^{-1}$ )
- Measured foliar half-life (default = 10 days)
- Realistic timing of the additional soil loading due to washoff (default = on the same day)
- Foliar Uptake (default = 0)
- Consideration of soil-climatic zone according product label (default = standard FOCUS data)

# Summary

- **The proposal can be simply incorporated into existing calculations and maintains the consistency of models**
- **Results with default values give similar results to EFSA tables**
- **Allows for the incorporation of measured values for wash-off factor and foliar half-life**
- **This is an interim measure until more is known about the science of washoff**