SIXTH FRAMEWORK PROGRAMME

FOOTPRINT

Identification of key climatic factors affecting pesticide loss by leaching and drainage

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Talk outline

- Context and objectives
- Description of climatic variables
- Statistical results
  - Multivariate - classification trees
  - Univariate - Spearman correlations
- Conclusions

Context (1/2)

> The definition of climatic scenarios for pesticide fate and modelling

Fig 1: Suggested Climatic Zone Map of Europe

FOCUS, 1995

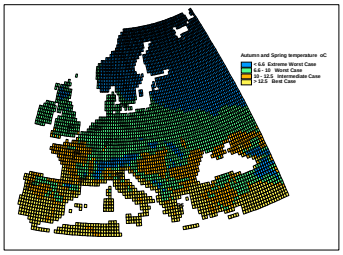
TABLE 2.: Definition of the climatic scenarios

Scenario number	precipitation excess class (mm yearly)	temperature class (°C annual average)
1	<400	0-5
2	>400	0-5
3	<400	5-10
4	>400	5-10
5	<400	10-15
6	>400	10-15
7	<400	15-20
8	>400	15-20

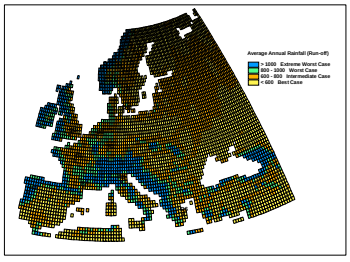
FOCUS, 1997

Context (2/2)

FOCUS, 2003



Autumn and spring temperatures



Average annual rainfall

> Are temperatures and average annual rainfall the most important variables regulating pesticide loss?

Objectives

- Identify key climatic factors influencing pesticides loss
- Decide whether the information can support the development of climatic scenarios

Approach

- Undertake MACRO runs for:
  - Leaching and drainage
  - 3 pesticides
  - 9 soil types (4 for drainage, 5 for leaching)
  - 2 application seasons (spring vs. fall)
  - 10 application dates
  - 6 synthetic climate series for the same station
- Characterise the weather datasets in detail
- Relate the loss of pesticides to climate characteristics
  - Multivariate stats: Data mining CART analysis
  - Univariate stats: Spearman correlations

Climatic Factors

- ***Cumulative rain for indicated time before or after application (d)***
  Rx [x = -91, -61, …, 0, 1, 2, …, 14, 30, 61, …, 365, 729]
- ***Average temperature over indicated time (d)***
  Tx [x = 0, 1, 2, …, 14, 30, 61, …,365, 729]
- ***"Lag" time until single-day rain event (mm) before or after application***
  Lx [x = -30, -20, -10, 10, 30, 40, 50]

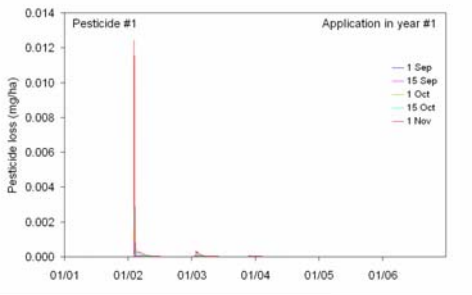
Climatic Factors, continued

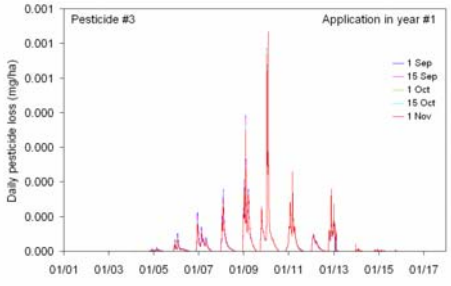
- ***Time for cumulative rain amount (mm)***
  Cx [x = 2, 5, 10, 20, 50, 100]
- ***Winter rain amount for indicated months***
  WRA_x_y [x = Sep, Oct, Nov; y = Mar, Apr]
- ***Winter recharge amount for indicated months***
  WRE_x_y [x = Sep, Oct, Nov; y = Mar, Apr]

Pesticide Properties

- ***Pesticide 1***
  - Mobile - Koc 20 ml/g
  - Slightly persistent - DT50 7.8 days
- ***Pesticide 2***
  - Moderately mobile - Koc 100 ml/g
  - Moderately persistent - DT50 23.3 days
- ***Pesticide 3***
  - Moderately mobile - Koc 220 ml/g
  - Very persistent - DT50 88 days

Typical results





Results

Leaching

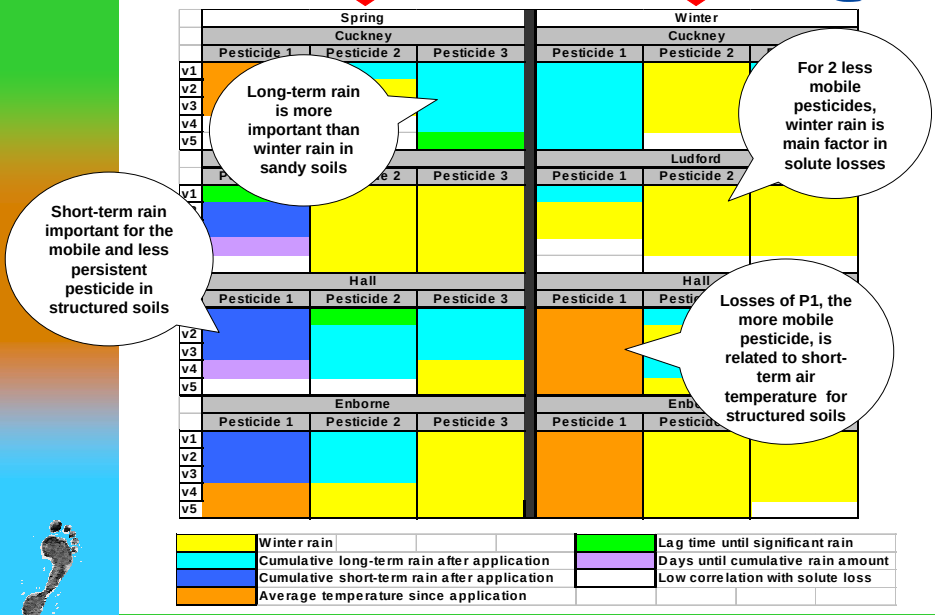
Spearman Correlations – Leaching Example

Ludford soil					
Pesticide 1		Pesticide 2		Pesticide 3	
L50	*-0.648*	*WRA_nov_apr*	*0.862*	*WRA_oct_apr*	*0.973*
R10	*0.494*	*WRA_nov_mar*	*0.822*	*WRA_nov_apr*	*0.971*
R61	*0.487*	*WRA_oct_apr*	*0.813*	*WRA_sep_apr*	*0.925*
C100	-0.474	*WRA_sep_apr*	*0.789*	*WRA_oct_mar*	*0.918*
R20	0.463	*WRA_oct_mar*	*0.787*	*WRA_nov_mar*	*0.869*

The top 5 correlated variables are shown for each soil-pesticide combination

The most influential variables are at the top. A colour coding scheme is used

Spearman Correlations - Leaching



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Results

Drainage

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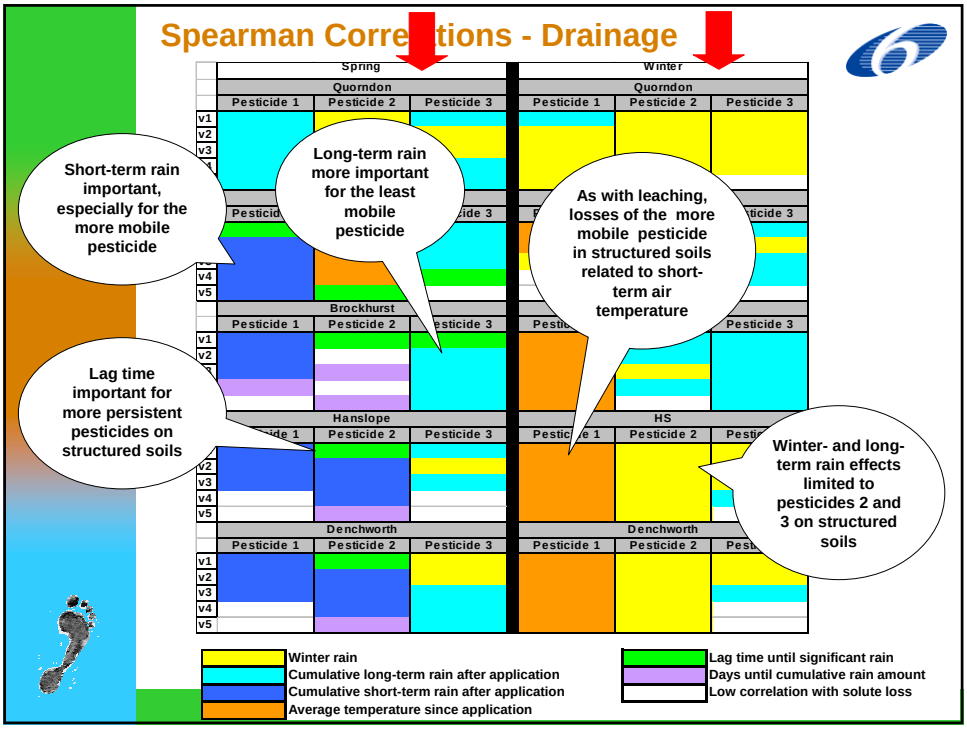
Spearman Correlations - Drainage



Conclusions

- General rules regarding influence of factors on pesticides loss can be drawn
- Clay is the overall dominant factor affecting pesticide loss in leaching and drainage
- Strong influence of winter rain for both spring and fall applications

Conclusions, continued

- Pesticides most easily leached influenced by short-term rainfall and temperature
- Time until significant rain events ('lag time') more important for drainage
- The information is used to define climatic zones in Europe
- The analyses are being repeated for other climates in Europe

Variables to be used in the definition of climatic zones

- Average Annual Rainfall
- Rainfall from 1 October to 31 March
- Number of 2-mm rainfall events in April-May-June
- Number of 20-mm rainfall events in April-May-June
- Number of 50-mm rainfall events in April-May-June
- Number of 20-mm rainfall events in September-October-November
- Average temperatures in September-October-November
- Average temperatures in April-May-June

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