Relationship of the Brimstone field trial site to the D2 FOCUS Surface Water Scenario

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ECPA project contracted to NRSI, Silsoe

Background

- The $FOCUS_{sw}$ D2 scenario represents an extreme worst case for drainage inputs to edge-of field water bodies (99^{th} percentile for drained land in EU – see $FOCUS_{sw}$ report).
- Soils characterising the D2 scenario are clayey throughout (>35% clay content), slowly permeable and seasonally wet with field drains to alleviate the seasonal waterlogging. Dense, massive impermeable clay (>50%) occurs below 1.2 m.
- Specific soil drainage characteristics for the scenario are based on data from the Brimstone experimental field site in the UK. Calculated PECsw values represent the impact of these specific characteristics.
- Where do the Brimstone soil characteristics 'fit' within the range of soil characteristics for the scenario?

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Analytical Methods

- The D2 Scenario is almost all located in England (see $FOCUS_{sw}$ report). NSRI Soil databases for England used to carry out analysis.
- D2 soil characteristics correlated with English 'soil series' – The 'Denchworth soil grouping'.
- Statistical analysis of data available for the Denchworth grouping carried out to establish where the Brimstone soil fits into the D2 range.
- NSRI/DEFRA National Soil Inventory data used – topsoil analysis from samples taken on a 5km x 5km grid (5691 data points).
- 217 data points available for the Denchworth soil grouping.

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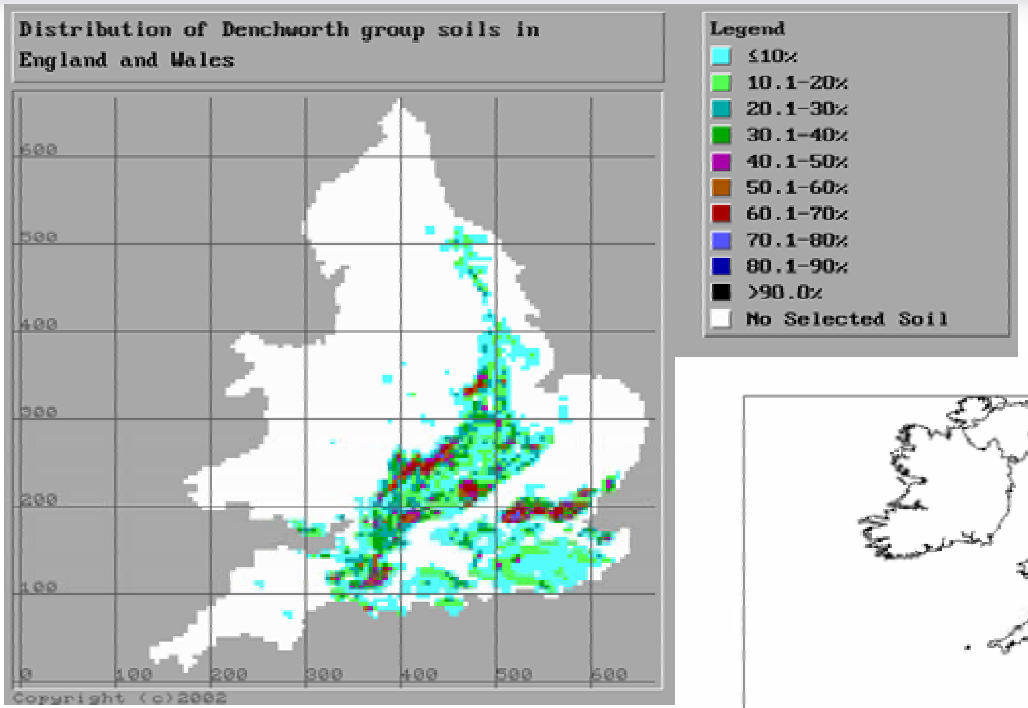
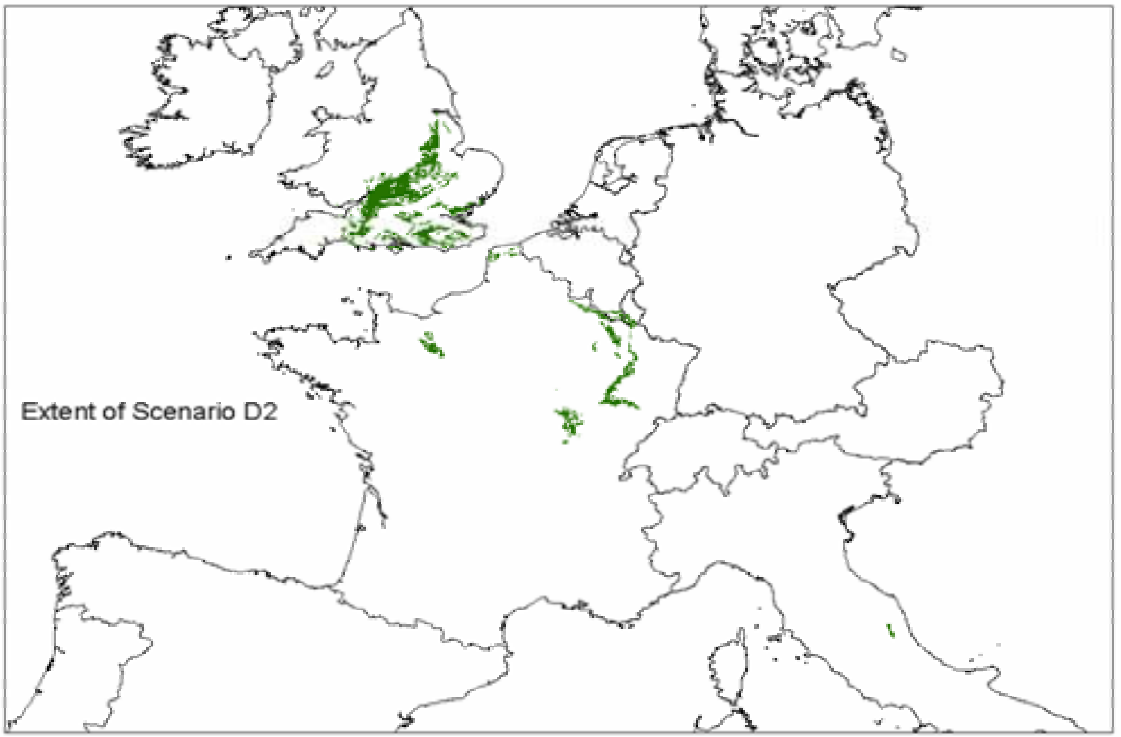
Correlation between D2 scenario and the Denchworth group



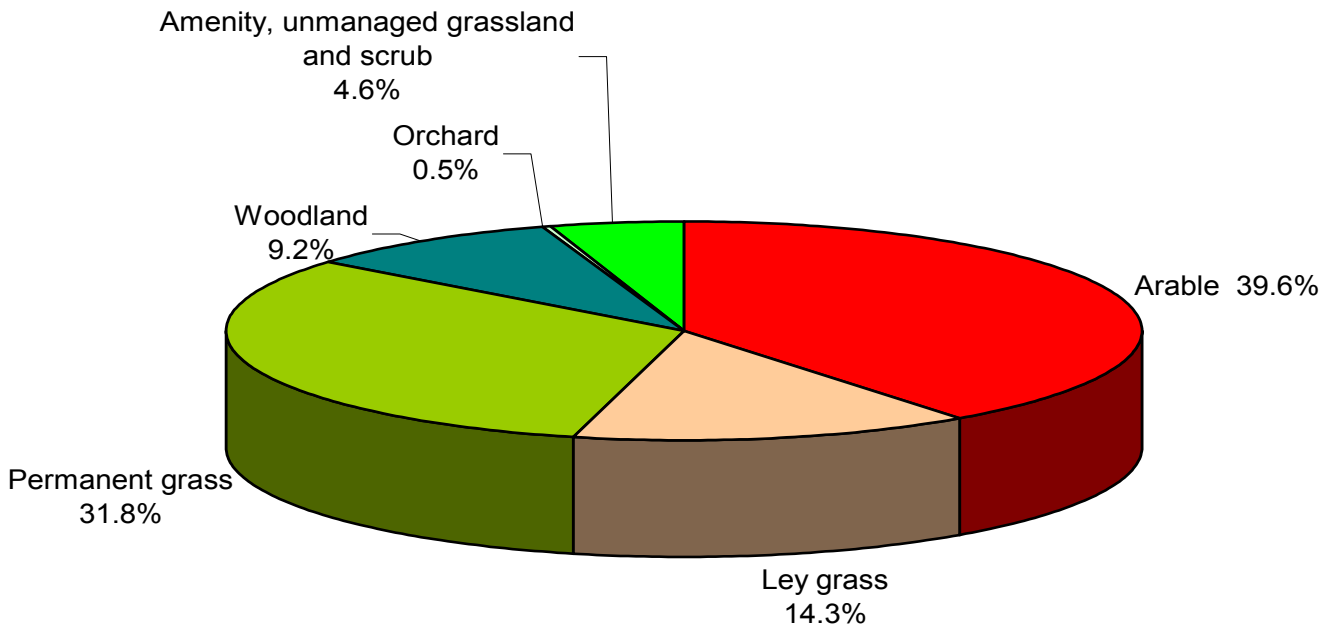


Land Use within the Denchworth soil group

D2 Scenario Crops:

Winter cereals; Winter Oilseed Rape; Field beans; Grass

Land use within the Denchworth soil group



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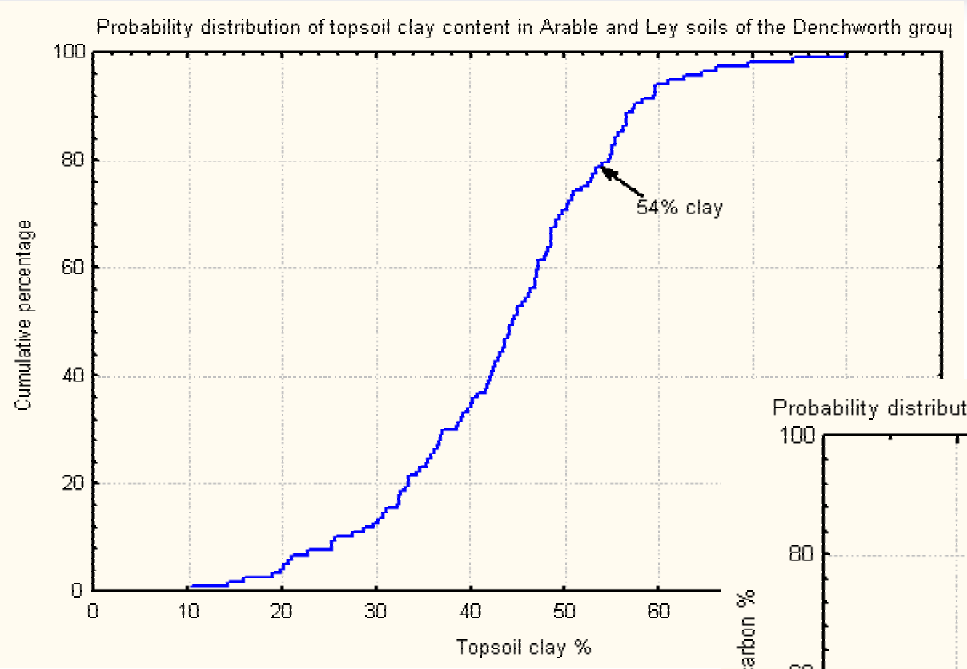
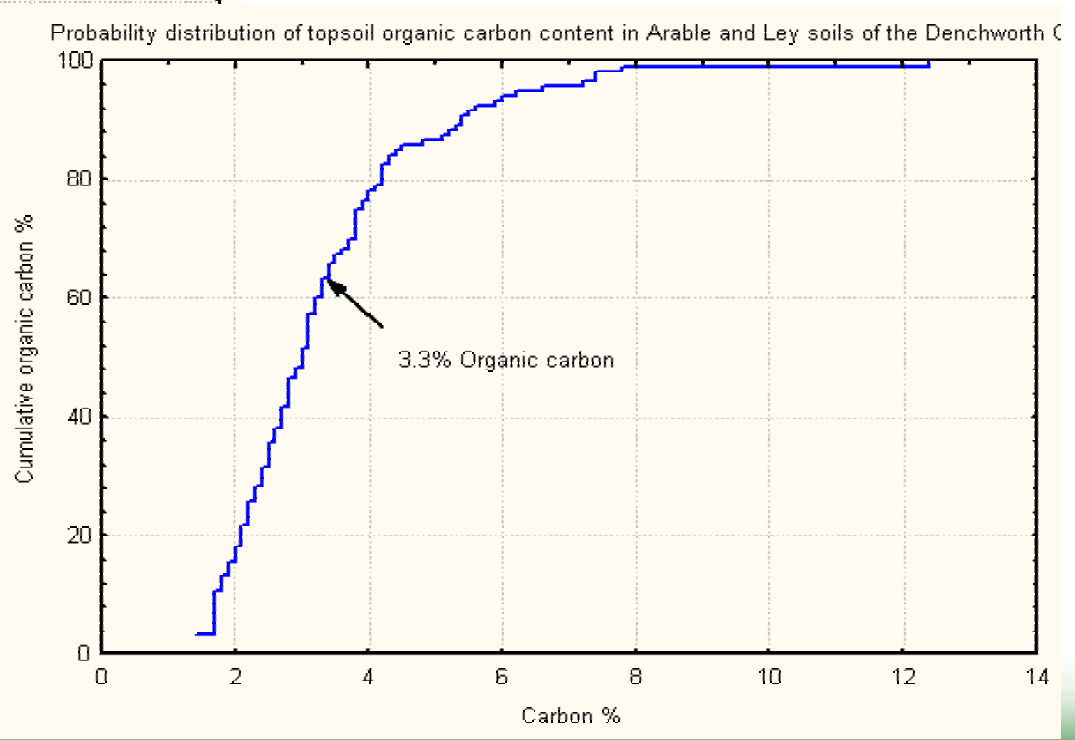
D2 (Brimstone) soil parameters in relation to the Denchworth group





Where does the D2 soil parameterisation fit ?

- Soil factors affecting pesticide fate for the D2 scenario:
  - Relationship between macropore and micropore domains (susceptibility to by-pass flow).
  - Organic carbon content (sorption).
- For the D2 soil the macropore / micropore relationship is mainly determined by clay content **(larger clay contents greater susceptibility to by-pass flow).**
- Soils with ± 5% more/less clay than the D2 soil are likely to be parameterised differently with respect to the macropore/micropore relationship.
- Soils with ± 0.2% more/less organic carbon content are likely to have significantly different sorption.

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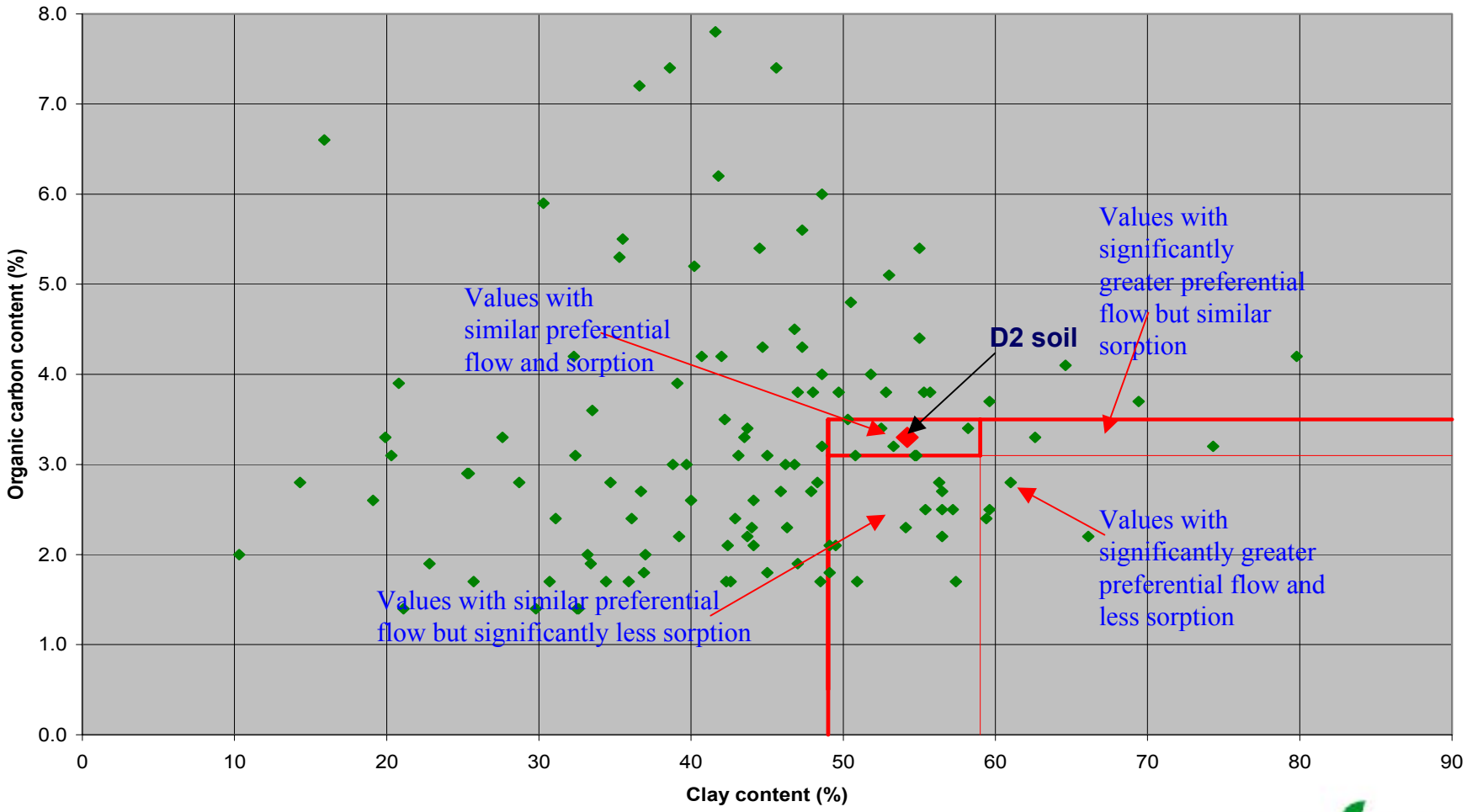
Interpretation of results



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Quantifying the worst-case nature of the D2 soil -1

- Only 20 % of soils in the Denchworth group have the same or worse combined characteristics for sorption & preferential flow.

- 39% of the soils in the group have significantly ‘better’ combined characteristics for sorption & preferential flow.

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Quantifying the worst-case nature of the D2 soil - 2

- 38% of soils in the group have characteristics giving significantly less preferential flow but also significantly less sorption.
- 3% of soils in the group have characteristics giving significantly more preferential flow but also significantly more sorption.
- Difficult to assess the impacts resulting from the latter two cases where sorption and preferential flow characteristics act in opposition – highly dependent on compound properties.
- It is likely that for all but strongly sorbed compounds, changes in preferential flow will offset any changes in sorption.

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Conclusions

- The D2 scenario agro-environmental characteristics represent only **0.8%** of all agricultural land in the EU and **2%** of all drained agricultural land.
- No drained agricultural land has worse soil characteristics and only 0.7% of such land has worse climate characteristics. It represents a **99th percentile** agro-environmental worst-case.
- Within this context, the parameterised D2 soil is likely to give losses in the extreme quartile of the range expected within the D2 agro-environmental scenario, especially for less strongly sorbed compounds.

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ECPA Experience: Reference Compounds Spring

daily or annual % loss exceeds Step 2 value
daily % loss > 50% of Step 2; multiple drainage events could exceed Step 2
Step 2 seasonal/annual % loss due to drainage and runoff

SPRING APPLICATIONS: Analysis of maximum daily losses (% of applied)

Cmpd	D1	D2	D3	D4	D5	D6	Step 2 / N	Step 2 / S
A	< 0.01	1.51	< 0.01	< 0.01	< 0.01	1.44	0.59	1.17
B	< 0.01	0.38	< 0.01	< 0.01	< 0.01	0.90	0.53	1.05
C	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	0.26	0.51
D	0.08	2.17	< 0.01	0.05	0.03	1.75	1.35	2.70
E	0.13	1.66	< 0.01	0.02	0.01	0.53	1.21	2.41
F	0.02	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.59	1.17
G	0.65	2.80	0.24	0.58	1.15	2.44	1.47	2.93
H	0.73	2.30	0.09	0.50	0.60	1.03	1.31	2.62
I	0.46	0.60	< 0.01	0.12	0.12	0.87	0.64	1.28

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ECPA Experience: Reference Compounds Autumn

daily or annual % loss exceeds Step 2 value
daily % loss > 50% of Step 2; multiple drainage events could exceed Step 2
Step 2 seasonal/annual % loss due to drainage and runoff

AUTUMN APPLICATIONS: Analysis of maximum daily losses (% of applied)

Cmpd	D1	D2	D3	D4	D5	D6	Step 2 / N	Step 2 / S
A	0.10	1.39	< 0.01	< 0.01	< 0.01	0.21	1.96	1.57
B	0.04	0.58	< 0.01	< 0.01	< 0.01	0.20	1.75	1.4
C	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.85	0.68
D	0.67	3.84	0.04	0.53	0.74	1.00	4.50	3.60
E	1.1	1.53	< 0.01	0.21	0.29	0.82	4.02	3.22
F	0.1	0.15	< 0.01	0.02	0.02	0.43	1.96	1.56
G	1.22	4.11	0.39	1.45	2.53	2.92	4.89	3.91
H	2.05	2.79	0.11	0.87	1.26	2.19	4.37	3.50
I	0.85	0.92	< 0.01	0.17	0.17	1.67	2.13	1.70

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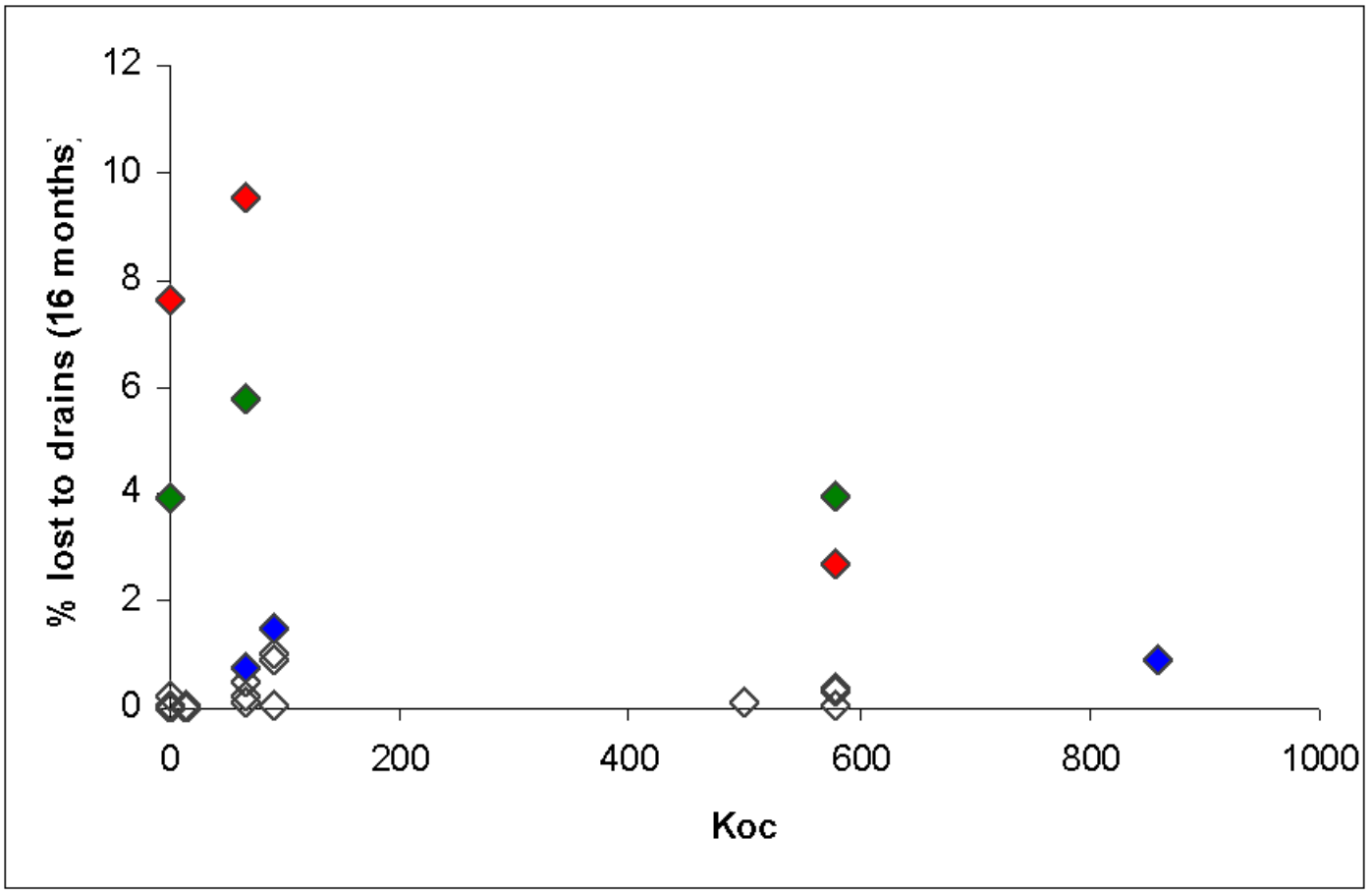
ECPA Experience With Scenarios: Annual Losses D2



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ECPA Conclusions

- D2 Scenario is an extreme worst-case scenario in Europe
- Concentrations can often exceed Step 2 concentrations, particularly for Spring application, annual losses are high
- FOCUS scenarios correctly identify substances for which drainage may be an issue, there is a question mark whether D2 can discriminate between these substances.
- ***Need to re-visit the D2 scenario in the light of experience using FOCUS SW***

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