Sensitivity analysis of pesticide application timing on exposure estimates of the new 20-year FOCUS surface water drainage scenarios

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Introduction

The EFSA draft scientific report [1] on FOCUS multiyear surface water simulations questioned the use of a pesticide application timer (PAT) in the European risk assessment on surface water exposure. Currently, a PAT is used to determine actual application dates from a window of intended dates in order to prevent conditions which disagree with agronomical practice.

Ignoring PAT rules could result in unrealistic predicted environmental concentrations (PECsw), for example by considering pesticide applications on rainy days. In addition, disregarding precipitation patterns might increase the overall variability of simulation results.

Objective

A sensitivity analysis was carried out to assess the effect of different PAT options on PECsw of FOCUS surface water drainage scenarios. Three PAT alternatives were evaluated:

(i) No-PAT, applications were assumed to take place on a particular date in each simulated year; modifications of the current FOCUS PAT with application windows of (ii) 7 days and (iii) 15 days centered on the intended day of application. The latter two options generally avoid application dates which are followed by heavy precipitation events.

Data and method

- The latest versions available with the EFSA Repair WG at that time, i.e. SPIN 3.3, SWASH 6.4, PATv25/9/2019, MACRO 5.5.4, and TOXSWA 6.6.4 were used.
- A set of hypothetical compounds recommended by the EFSA Repair working group with varying Koc (10, 100, and 1000 L/kg) and DT_{50} (3 and 30 days) values was simulated.
- Three PAT options were compared (as described above) for each intended application date between January 1st and December 31st.
- Early applications on winter cereals were simulated. The application rate was set to 1 kg a.s./ha. Drift and interception were set to zero.
- 26 years (including 6 years of warm-up period) were simulated for each combination of PAT, compound, scenario, and intended application date. A total of over 9,500 simulations were run and analyzed.
- The resulting day-to-day PECsw using different PAT candidates were then compared to the current FOCUS single year assessment approach.

Results and discussion

- PECsw obtained from No-PAT calculations were extremely sensitive to the application date and were generally larger in magnitude than results obtained from other PAT options (**Figure 1**).
- The 7-d and 15-d PAT options reduced the day-to-day variability in PECsw due to less dependence on the intended application date. The No-PAT option had a larger variance in PECsw with a large number of potential outliers due to its strict adherence to the intended application date (**Figure 2, boxplot**).
- The PAT candidates with application windows of 7 and 15 days resulted in smoother PECsw patterns compared to the current FOCUS PAT approach which showed typical stepped PECsw pattern (**Figure 1**).
- Extending the application window from 7 to 15 days had only a minor effect on derived maximum PECsw (**Figure 1**), indicating that an application window of 7 days is sufficient to avoid application dates that are inconsistent with agricultural practice.
- Besides the PAT, the target percentile of PECsw chosen as an assessment endpoint had large influence on results for compounds sensitive to rainfall (**Figure 3, top**). The maximum PECsw from the single-year FOCUS approach were generally closer to the median of the 20-year PECsw approach than to the maximum. This indicates that the overall maximum of 20-year PECsw might be too conservative as an assessment endpoint.
- The agreement between the new 20-year assessment approach and the current FOCUS approach is much better for substances with increased sorption which are less sensitive to rainfall such as substance F (**Figure 3, bottom**).

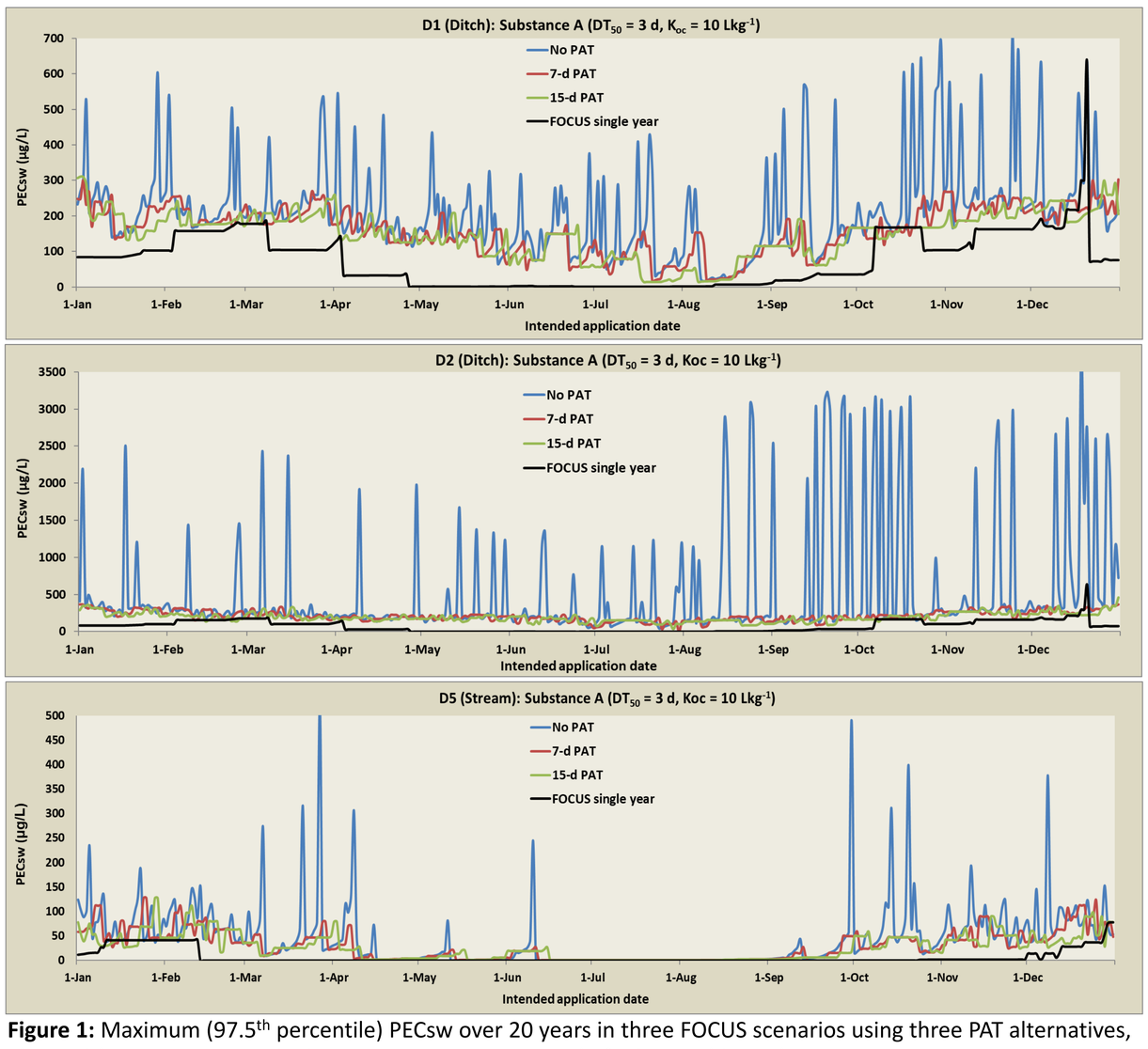

Figure 1: Maximum (97.5th percentile) PECsw over 20 years in three FOCUS scenarios using three PAT alternatives, along with current FOCUS single year assessment approach, for low sorbing substance A

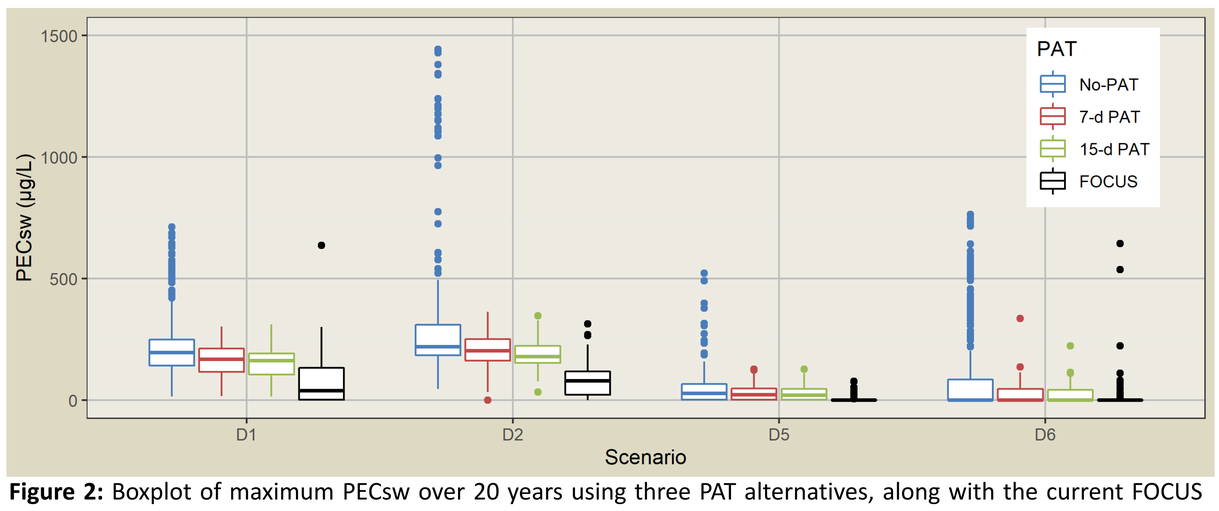

Figure 2: Boxplot of maximum PECsw over 20 years using three PAT alternatives, along with the current FOCUS single year assessment approach, for low sorbing substance A; y-axis was clipped to remove additional D2 outliers

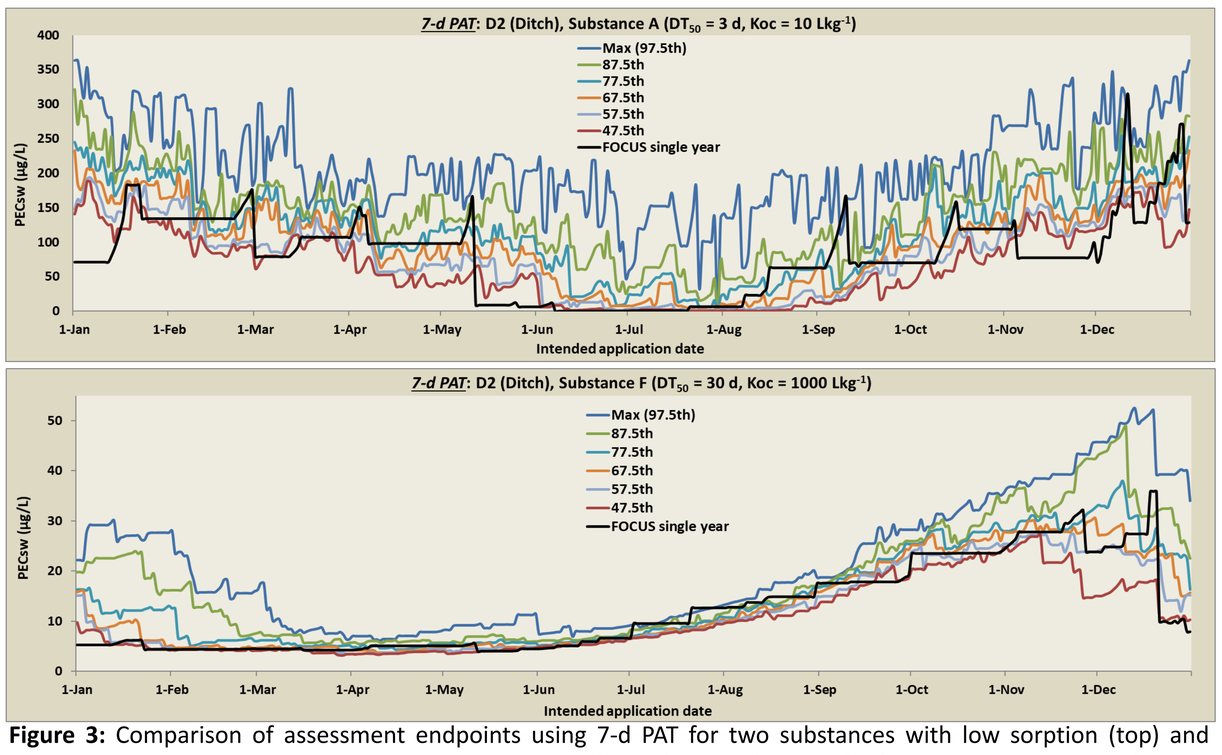

Figure 3: Comparison of assessment endpoints using 7-d PAT for two substances with low sorption (top) and strong sorption (bottom) properties over 20 years of simulation, along with the current FOCUS single year assessment approach

Conclusions

The results emphasize the need for a PAT in FOCUS surface water 20-year assessments. The PAT option with a 7 day application window seems to be most appropriate as it effectively reduces day-to-day variability in PECsw for the drainage scenarios. It avoids unrealistic extreme drainage events but ensures at the same time that applications occur close to the intended application date. In addition, using the maximum of the 20-year PECsw as an assessment endpoint could result in erratic assessment results, in particular in combination with the No-PAT option.

References

[1] EFSA, 2018. Scientific report of EFSA on the "repair action" of the FOCUS surface water scenarios (draft). https://www.efsa.europa.eu/en/consultations/call/180924

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