Without care severe deviations in the model calculation of wash-off can result. The existing FOCUS models use different concepts to simulate the wash-off process and need different parameterization from experimental data. FOCUS (2009). In particular the following stipulations are critical for a between models which undermines the harmonisation process undertaken by FOCUS (2009). Assessing Potential for Movement of Active Substances and their Metabolites to Ground Water in the EU. Report of the FOCUS Ground Water Work Group, EC Doc. Ref. Sanco/13144/2010 version 1. [604 pp.]

References


Introduction

Foliar wash-off is the process by which pesticides applied to leaf surfaces may be removed by rainfall after application and enter the soil. Dependent upon compound properties and application timing the inclusion of wash-off can influence the outcome of PEC groundwater (PECgw) calculations. Recent regulatory interest in the wash-off process has suggested that wash-off from plant surfaces be included into the leaching evaluation of foliar applied pesticides (EFSA, 2012 & 2013). For PECgw calculations, EFSA proposed a default foliar half-life of 10 days and a default wash-off coefficient of 0.1 mm/day and tabulated crop interception values of FOCUS (2010) with some adjustments based on recent research.

We investigate the feasibility and consistency of including foliar wash-off into the groundwater assessment with the current parameterization of the FOCUS groundwater models and FOCUS scenarios.

Materials and Methods

We investigated how each of the FOCUS groundwater models (PEARL 4.4.4, PELMO 4.4.3, PRZM 3.5.2 and MACRO 5.5.3) model wash-off and whether they would result in consistent PECgw calculations in the light of recent recommendations detailed by EFSA (2012, 2013). To understand how the models worked we consulted model developers, official model documentation and model source code (where available). Model runs were also used to test our findings.

Results and Discussion

None of the models has the potential to incorporate tabulated FOCUS crop interception values into the wash-off process.

Table 1: Comparison of existing FOCUS models considering wash-off in combination with FOCUS tabulated crop interception values as proposed by EFSA (2012, 2013).

<table>
<thead>
<tr>
<th>Process implementation</th>
<th>PEARL</th>
<th>PELMO</th>
<th>PRZM</th>
<th>MACRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Can model calculate wash-off for a user-specified crop interception value?</td>
<td>NO*</td>
<td>NO*</td>
<td>NO*</td>
<td>NO*</td>
</tr>
<tr>
<td>2) Internal plant growth model consistent with FOCUS tabulated crop interception values?</td>
<td>NO*</td>
<td>NO*</td>
<td>NO*</td>
<td>NO*</td>
</tr>
</tbody>
</table>

*Crop interception can be user-specified but wash-off is calculated with internal plant growth model (via LAI).

Table 2 shows how each model simulates the wash-off process. The issue of whether a model treats wash-off as a linear or exponential process is important for parameterizing models from experimental data and means that different models will give different results, even if the same wash-off value is input into the model (Figure 2). The model results may also not agree with experiment in which the same wash-off parameter was determined.

The models simulated wash-off during irrigation (Figure 1). It is extremely unlikely that farming practice would be to apply crop protection products and then risk washing them off by irrigating shortly afterwards.

Models were also inconsistent in the way that they develop the crop in that the Leaf Area Indices (LAI) are scenario specific whereas the FOCUS crop interception values are not. Similarly interception of rainfall by the crop is defined differently by each model and are inconsistent with the LAI.

Models predict wash-off during irrigation

The models simulated wash-off during irrigation events (Figure 1). It is extremely unlikely that farming practice would be to apply crop protection products and then risk washing them off by irrigating shortly afterwards.

Conclusions

The existing FOCUS models use different concepts to simulate the wash-off process and need different parameterization from experimental data. Without care severe deviations in the model calculation of wash-off can result between models which undermines the harmonisation process undertaken by FOCUS (2009). In particular the following stipulations are critical for a consistent incorporation of wash-off into the FOCUS groundwater models:

- A harmonised and consistent wash-off process description
- An agreed process for parameterizing individual models
- Adjustment of some scenario-specific parameters (e.g. max LAI, max water interception, irrigation scheme, growth models)

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