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Mechteld ter Horst[1], Aaldrik Tiktak[2], Paulien Adriaanse[1], Henk-Jan Holterman[3], Jan van de Zande[3] & Louise Wipfler[1]

1 Wageningen Environmental Research (WENR)

2 Netherlands Environmental Assessment Agency (PBL)

3 Wageningen Plant Research (WPR)

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In dit rapport wordt een voorstel gedaan voor een getrapte benadering voor de beoordeling van de blootstelling van waterorganismen aan gewasbeschermingsmiddelen in oppervlaktewateren in Nederland. Deze getrapte benadering is ontwikkeld voor op- en zijwaartse spuittechnieken. De betrapte benadering bestaat uit drie trappen en een pre-beoordelingstrap. Het (gerepareerde) FOCUS oppervlaktewater scenario (FOCUS SW D3) vormt de eerste trap (Tier-1). Naar verwachting zullen de gerepareerde FOCUS-oppervlaktewater scenario's binnenkort onderdeel worden van EU beoordeling van actieve stoffen. De Europese commissie moet nog een besluit nemen over welk temporeel percentiel moet worden gebruikt in de risicobeoordeling. Daarna en na acceptatie van de software tools, zullen de gerepareerde FOCUS scenario's naar verwachting worden geaccepteerd. Dit betekent dat de berekende blootstellingsconcentraties van dit scenario dan kunnen worden gebruikt in de Nederlandse toelatingsprocedure. Om consistentie tussen de voorgestelde trappen te garanderen, wordt voorgesteld om de berekende blootstellingsconcentraties in de eerste trap voor groot fruit te vermenigvuldigen met een veiligheidsfactor van 1.2. Voor laanbomen en klein fruit is een veiligheidsfactor niet nodig. De in dit rapport voorgestelde getrapte benadering geldt alleen voor de berekening van oppervlaktewaterconcentraties en alleen voor spuittoepassingen.

In this report, we propose a tiered approach for the exposure assessment of aquatic organisms in Dutch surface waters. The tiered approach has been developed for upwards and sideways spraying techniques. The tiered approach consists of three tiers and a pre-assessment tier. In anticipation of the acceptance of the repaired FOCUS surface water scenarios in the risk assessment of active substances by the EU, the (repaired) FOCUS surface water scenario (FOCUS SW D3) is used in Tier-1. Currently, a decision on the temporal percentile to be used in the risk assessment still needs to be taken by the European Commission. Once this decision is taken and the software tools are accepted, we expect that the repaired FOCUS surface water scenarios will be adopted for use in the EU risk assessment. The concentrations calculated for the selected scenario (FOCUS SW D3) can then be used in the Dutch procedure. To guarantee consistency of the tiered approach, an assessment factor of 1.2 is proposed for Tier-1 simulations when performing an exposure assessment for surface water adjacent to large fruit crops. For avenue trees and for small fruit, an assessment factor is not necessary. The tiered approach proposed in this report is only valid for surface water concentrations and for spray applications.

Keywords: pesticides; authorisation; fruit; exposure assessment; avenue trees; tiered approach

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Approved reviewer who stated the appraisal,

This report is a product of and has been reviewed by all members of the working group on the development of exposure scenarios for aquatic organisms to plant protection products in the Netherlands

Approved team leader responsible for the contents,

name: Ivo Roessink

date: 24.01.2022

Summary

For efficiency of the evaluation process as part of the national authorisation of plant protection products, the Dutch ministries of LNV and I&W asked to develop a tiered approach for the exposure assessment of aquatic organisms in Dutch surface waters, in which results from the Central Zone assessment could be used as a lower tier, before moving towards Dutch specific scenarios.

In this report, we propose such a tiered approach. The tiered approach has been developed for upwards and sideways spraying techniques. In this tiered approach the lower tiers are more simple and conservative (higher PECs) and in the higher tier the exposure estimates are refined, to attain a higher level of realism.

The proposed tiered approach consists of three tiers and a pre-assessment tier. In developing the tiered approach it is anticipated that the repaired FOCUS surface water scenarios will be accepted soon to be used in the risk assessment of active substances at EU level. This means that the *repaired* FOCUS surface water scenarios are considered in the approach:

- The pre-assessment tier is FOCUS SW Step-2.
- The first tier (Tier-1) is the FOCUS SW D3 scenario parameterised for pome/stone fruit.
- The DRAINBOW scenarios described in Boesten et al. (2021) and Holterman et al. (2021) are Tier-2.
- In Tier-3 further refinements are added to the scenarios of Tier-2 (e.g. mitigation of spray drift).

In the Central Zone core assessment calculations of the exposure concentration are already available for the FOCUS SW D3 scenario. We selected the FOCUS SW D3 because it is relevant for the Central zone, it is a ditch scenario (and not a stream or a pond) and upward and sideways spraying could be selected. Using these results may improve the efficiency of the registration process. However, until the FOCUS repair scenarios are accepted, the proposed tiered approach cannot be used. The DRAINBOW scenarios can however be used also without a tiered approach in place.

We tested the consistency of the tiered approach by performing a series of example simulations for Tier-1 and Tier-2. Model simulations were performed for upward and sideways spray applications in large fruit, small fruit and avenue trees and for different combinations of substances and timing and number of applications. We compared the Maximum Predicted Environmental Concentration (PEC_{max}) in surface water, because this is the most relevant concentration in the risk assessment. We considered the tiered approach consistent if results from the Tier-2 simulations were lower than those generated by the Tier-1 simulations. For most of the example situations the concentrations calculated in Tier-2 were lower than in Tier-1. For a few cases in large fruit the Tier-2 simulations resulted in higher PECs than the Tier-1 simulations, but the ratio between the simulated concentrations for Tier-2 and the PEC simulated for Tier 1 is always below 1.2.

To guarantee consistency of the tiered approach, an assessment factor of 1.2 is therefore proposed for Tier-1 simulations when performing an exposure assessment for surface water adjacent to large fruit crops. For avenue trees and for small fruit, an assessment factor is not necessary.

It should be noted that the tiered approach is specifically developed for exposure as result of upwards and sideways spraying of pesticides in large and small fruit crops and avenue trees and for the concentration (PEC_{max} only) in the water layer of the water body. For all other situations it is advised to directly use the DRAINBOW scenarios, which are part of Tier-2 in the presented tiered-approach.

Samenvatting

Met het oog op een efficiënt evaluatieproces als onderdeel van de toelatingsprocedure van gewasbeschermingsmiddelen op nationaal niveau, hebben de ministeries van LNV en I&W gevraagd om een getrapte benadering te ontwikkelen voor de blootstellingsbeoordeling voor waterorganismen. Daarbij worden de uitkomsten van de Centrale Zone beoordeling gebruikt als een eerste of lagere trap, voordat de Nederlandse scenario's worden toegepast.

In dit rapport wordt een voorstel gedaan voor zo'n getrapte benadering. De getrapte benadering geldt voor op- en zijwaartse bespuitingen in fruitbomen en in laanbomen. In deze getrapte benadering zijn de lagere trappen versimpelde benaderingen van de werkelijkheid maar met een conservatieve schatting van de blootsteling. Dit betekent dat de lagere trappen in hogere bloostellingsconcentraties resulteren dan de hogere trap die een hoger realiteitsgehalte van de blootstelling beoogd.

De voorgestelde getrapte benadering bestaat uit drie trappen en een pre-evaluatie trap. Bij de ontwikkeling van de benadering is verondersteld dat de gerepareerde FOCUS oppervlakte water scenario's in gebruik zullen worden genomen voor de risicobeoordeling van actieve stoffen op EU niveau. De gerepareerde scenario's zijn daarom gekozen bij de uitwerking van de benadering:

- De pre-evaluatie trap is FOCUS SW Step-2.
- De eerste trap is het FOCUS SW D3 scenario voor pit- en steenvruchten.
- De DRAINBOW scenario's beschreven in Boesten et al. (2021) en Holterman et al. (2021) vormen trap 2.
- Trap 3 zijn de scenario's van trap 2, maar dan met verfijningen zoals het gebruik van mitigerende maatregelen om de spray drift te beperken.

Het FOCUS SW D3 scenario voor pit- en steenvruchten is gekozen omdat het een relevant scenario is voor de Centrale Zone; het is een sloot scenario en het is geparameteriseerd voor op- en zijwaartse bespuitingen. Doorgaans zijn er de blootstellingsconcentraties beschikbaar in de zogenaamde 'core assessment' van de Centrale Zone. Het gebruiken van deze concentraties in de getrapte benadering verbetert daarmee de efficiëntie van het registratieproces.

De getrapte benadering is getest aan de hand van een serie berekeningen voor trap 1 en trap 2. Er zijn model simulaties gedaan voor op- en zijwaartse bespuitingen in groot fruit, klein fruit en laanbomen en voor verschillende combinaties van stoffen, aantal toedieningen en toedieningstijdstippen. Maximale concentraties (PEC_{max} waarden) van trap 1 en 2 zijn met elkaar vergeleken om te controleren of de trap 2 concentraties lager waren dan die van trap 1. Voor bijna alle berekende concentraties was dit het geval, alleen voor groot fruit werden enkele hogere waarden gevonden voor trap 2 dan voor trap 1. De concentraties berekend in trap 2 is echter nooit meer dan een factor 1.2 hoger dan die van trap 1. Om consistentie tussen de voorgestelde trappen te garanderen, wordt voorgesteld om de berekende blootstellingsconcentraties in de eerste trap voor groot fruit te vermenigvuldigen met een veiligheidsfactor van 1.2. Voor laanbomen en klein fruit is een veiligheidsfactor niet nodig.

Deze getrapte benadering is specifiek ontwikkeld voor op- en zijwaartse spuittechnieken en voor de concentraties in de waterlaag (alleen de PEC_{max}). Voor alle andere situaties wordt voorgesteld om de DRAINBOW scenario' s te gebruiken uit trap 2 van de getrapte benadering.

1 The proposed tiered-approach

Boesten et al. (2021) and Holterman et al. (2021) describe scenarios for upwards and sideways spray applications in large fruit crops, small fruit crops and avenue trees. We propose to use these scenarios as part of a tiered exposure assessment scheme consisting of three tiers and a pre-assessment tier. Section 1 of this report gives a description of the tiered-approach. To guarantee that lower tiers are more conservative than lower tiers, calibration of higher tiers is necessary. This calibration is described in Section 2 of this report. Section 3 summarises the most important conclusions.

1.1 Overview of the tiered-approach

The general set-up of the tiered-approach is shown in Figure 1. The tiered approach consists of a conservative pre-assessment tier followed by three tiers with increasing realism and decreasing conservatism (see EFSA (2010) for the general principles of tiered approaches). The tiered approach is specifically developed for the concentration (PEC_{max} only) in the water body. It has, however, not been developed for Time Weighted Average concentrations (TWA) nor the concentration in the sediment (PEC_{sed}), which implies that the user must go directly to Tier-2 if the TWA or the PEC_{sed} is to be assessed.

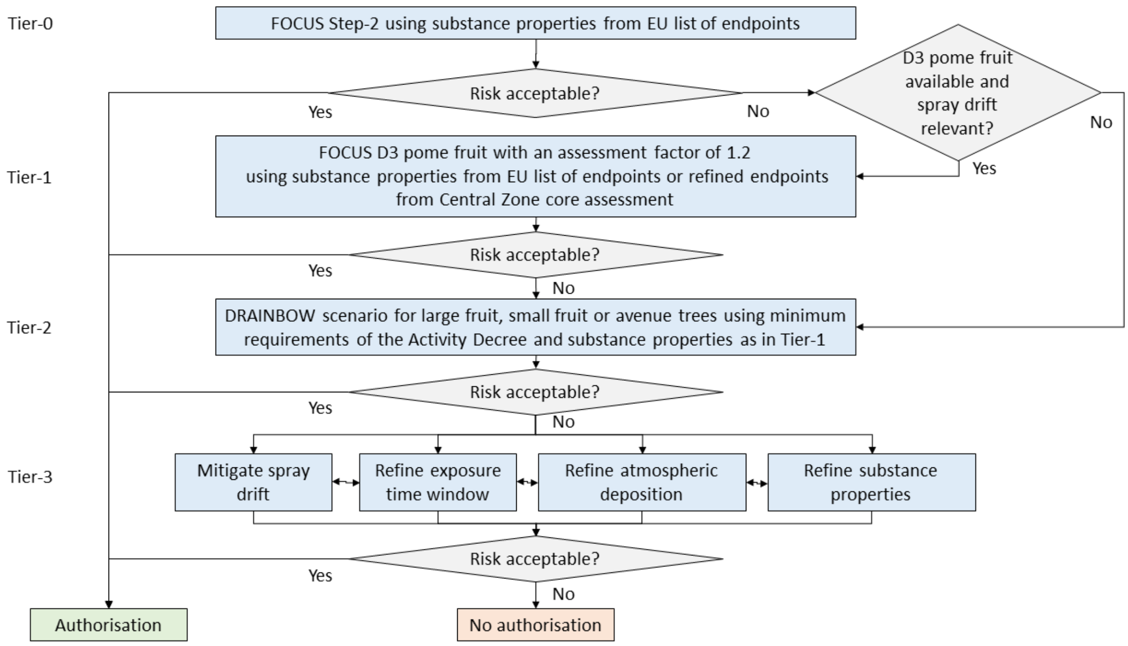

Figure 1 *Tiered scheme for the exposure assessment of aquatic organisms in the Dutch pesticide registration procedure. The flow chart applies both to peak concentrations and to TWA concentrations. The arrows between the boxes in Tier 3 imply that it is possible to move between the boxes.*

1.2 The pre-assessment tier (Tier-0)

FOCUS Step-2 is considered to be a pre-assessment conservative tier in the Dutch exposure scheme. The use of this step is possible for all substances, including substances for which spray drift is not a relevant exposure route such as soil metabolites (see FOCUS, 2010 for guidance). This step should be used in combination with substance properties from the official EU list of endpoints (LoEP). EFSA (2020) demonstrated, however, that the current FOCUS surface Step 2 approach is not always conservative enough when compared to the repaired FOCUS surface water scenarios. FOCUS Step 2 must therefore be calibrated at the EU-level[1] (e.g. by EFSA) before this step can be accepted for use in the Dutch exposure assessment scheme.

1.3 Tier 1 – one of the FOCUS scenarios

To profit from existing exposure assessments in the Central Zone core assessment, one of the repaired FOCUS surface water Step 3 scenarios as described in EFSA (2020) has been selected for use at Tier-1. Requirements for this scenario are:

- The scenario must be one of the six FOCUS Step 3 surface water scenarios based on input via drainage (D1 to D6);
- The scenario cannot be a stream scenario because scenarios are not conservative enough for the Netherlands. First, the water depth in stream scenarios can be up to 1.50 m, which could give too low PEC-values in the water body. Second, the flow velocity is too high for Dutch conditions;
- The scenario must be relevant for the Central Zone and be parameterised for upward and sideways spraying techniques.

The only scenario that meets these requirements is the FOCUS D3 scenario parameterised for pome/stone fruit. For avenue trees and small fruits, there are no relevant drainage-ditch scenarios available for the Central Zone, so also for these crops, pome stone fruit must be used. To guarantee conservativeness of Tier-1, the scenarios must be used in combination with reference spraying techniques as described in FOCUS (2001). Spray drift mitigation is only possible at Tier-3, i.e. in the national modelling.

If FOCUS D3 results are not available in the Central Zone core assessment, the user must directly go from Tier-0 to Tier-2. The user must also go directly to Tier-2 when spray drift does not occur after application. This is the case for soil metabolites and for substances that are incorporated or injected into the soil. Also, in the case of granules and seed treatments, the user must go directly to Tier-2.

The substance parameters at Tier-1 are the same as those used in the Central Zone core assessment. These are based on the agreed EU list of endpoints (LoEP). According to Section 8 of the Working document of the Central Zone, refinement of substance properties is possible, but this should be agreed upon in the Central Zone core assessment. An option would be to include microbial degradation rates measured in surface water samples and use of outdoor mesocosms to estimate the degradation rate in water (Deneer et al., 2015; Adriaanse et al., 2017, Adriaanse et al., 2021). Another parameter refinement option is to include long-term sorption kinetics in the soil system (see EC (2021) for guidance on the assessment of these kinetic parameters).

To guarantee that Tier-1 is always more conservative than Tier-2, an assessment factor of 1.2 must be applied to the results of Tier-1 simulations for pesticide applications in large fruit. This assessment factor results from the calibration of Tier-1 as described in Section 2.

1.4 Tier-2 – the DRAINBOW scenarios

The DRAINBOW scenarios described in Boesten et al. (2021) are Tier-2 of the Dutch exposure assessment scheme for aquatic organisms. These scenarios are used with four assumptions:

1. Substance parameters are the same as those used in the Central Zone core assessment.

[1] The following suggestions were provided by the FOCUS Surface Water Repair working group for revision of FOCUS SW Steps 1 and 2:
- reconsidering the parameterisation at FOCUS SW Steps 1 and 2, with respect to:
  - default entries into the waterbody by drainage/run-off.
  - the period from (last) application to drainage/run-off event (currently 4 days in FOCUS SW Step 2).
- take care of the new proposed drift percentile setting (for multiple applications).

2. The spray drift values are based on the minimum requirements of the Dutch Activity Decree[2]. These requirements are:
   a. For large fruit crops: Drift reducing technologies that reduce the spray drift by at least 75% in combination with a crop-free buffer zone of 4.5 meters[3];
   b. For small fruit crops: Drift reducing technologies that reduce the spray drift by at least 75% in combination with a crop-free buffer zone of 3.0 meters;
   c. For avenue trees: Drift reducing technologies that reduce the spray drift by at least 75% in combination with a crop-free buffer zone of 5.0 meters.
3. The whole calendar year is used for assessing the annual peak concentration or the annual maximum TWA value. This is the default approach in the ecotoxicological effect assessment proposed by Brock et al. (2011).
4. Atmospheric deposition is based on default values taken from the FOCUS Air report (FOCUS, 2008).

1.5 Tier-3 – DRAINBOW scenarios with refinements

Tier-3 uses the same scenarios as those in Tier-2. However, refinements are possible:
1. A first refinement is to mitigate spray drift using the matrix approach described in Tiktak et al. (2012) and Boesten et al. (2021).
2. The second refinement in Tier-3 is to restrict the time window for the ecotoxicological effect assessment to part of the calendar year (for example spring and summer). This should be justified on the basis of ecotoxicological considerations.
3. The third option is to refine the default atmospheric deposition with calculations using the PEARL model for simulating volatilisation from soil and plants and using the OPS model for simulating the transport in the atmosphere and the deposition on surface water (Jacobs et al. 2011). Admittedly, this procedure has not yet been developed so this box in the scheme is not yet operational. It is also somewhat uncertain whether a more sophisticated PEARL-OPS approach will result in lower atmospheric deposition for all substances.
4. The fourth refinement is the use of new active substance data submitted as part of the authorisation or re-registration. This is possible if the new active substance data leads to a more favourable risk assessment compared to the endpoint listed in the LoEP AND a safe use can only be demonstrated by using the new endpoint[4]. So, if a safe use can be demonstrated using different refinements options, substance parameters should not be refined at this stage. If substance properties are refined, the assessment of the new end-points must be made available to other Member States via CIRCA. The LoEP will, however, not be updated before the approval is renewed and the refined substance parameters only apply for the applicant supplying the data.

[2] See wetten.nl - Regeling - Activiteitenbesluit milieubeheer - BWBR0022762 (overheid.nl) (https://wetten.overheid.nl/BWBR0022762/2021-01-01; last visited on 21 October 2021).

[3] According to the Activity Decree, a crop-free zone of 3 meters in combination with 90% drift reducing technologies is allowed as well. Because this combination always results in a lower spray drift deposition, we consider this combination as part of spray-drift refinement at Tier-3.

[4] Brief summary of the Expert Group meeting to discuss re-registration post Annex I inclusion (europa.eu).

2 Calibration of Tier-1

2.1 Methods

In a tiered approach, lower tiers must be more conservative than higher tiers. A thorough comparison of Tier-1 and Tier-2 is therefore needed. If Tier-1 gives lower PEC-values than Tier-2, an assessment factor (AF) has to be used to guarantee consistency of the tiered approach (see for example the EFSA PECs in soil guidance (EFSA 2017)). We recommend basing the assessment factor on a comparison between the Tier-2 scenarios and the repaired FOCUS surface water D3 scenario as described in EFSA (2020). In this comparison, spray drift deposition has been based on reference spraying techniques (FOCUS scenario) and minimum requirements in the Dutch Activity Decree (DRAINBOW scenarios). Figure 2 shows that if spray drift is calculated using these assumptions, the FOCUS scenario always gives higher spray drift values.

Figure 2 *Spray drift deposition as a function of application date according to FOCUS compared with spray drift deposits in Tier-2 for large fruit, small fruit and high avenue trees (for one application). In the FOCUS scenario, reference spraying techniques have been used. In the Dutch scenario, spray drift deposits have been calculated using the minimum requirements of the Activity Decree.*

We have based the assessment factor on the maximum concentration of the selected target year because this is considered the most important parameter for the ecotoxicological effect assessment. In upwards and sideways spraying, this concentration is primarily affected by the spray drift input; however, other parameters such as water depth and flow velocity and – in the case of multiple applications – the degradation rate in water may be important as well. Therefore, the assessment factor has been based on calculations using the respective models (SWASH and DRAINBOW for respectively Tier-1 and Tier-2).

The calibration has been conducted for 6 substances, 5 application windows and for 1, 3 and 9 annual applications (table 1 and table 2). At Tier-1, one scenario is used (FOCUS D3 pome fruit), whereas the number of scenarios at Tier-2 is 3 (one scenario for large fruit, one scenario for small fruit and one scenario for high avenue trees. The model runs used the FOCUS example substances A, B, C, D, F and

I (Annex 4 or table 6.1-1 in FOCUS 2001). These substances are hypothetical substances covering the typical range of key parameters influencing losses via drainage and fate in surface water. Substance A, B and C have a short half-life time in soil (3 days), so it is expected that these substances are very sensitive to the day of application. Substances D and F have a longer half-life time in soil (30 days), so the leaching of these substances will be less dependent on this day. Substance I is persistent and has a high sorption coefficient in soil. Because of time constraints, simulations have not been carried out for substances E, G and H.

Table 1 *Building blocks of the Tier-1 model runs. The total number of building blocks is 6 (number of substances) x 3 (annual number of applications) x 5 (application window) = 90.*

Scenario	Substance	Number of applications per year	BBCH-interval	Description of BBCH stage
D3, pome fruit, air blast	FOCUS_SW_A	1	0-9	Without leaves
	FOCUS_SW_B	3	10-69	Flowering
	FOCUS_SW_C	9	70-75	Early fruit development
	FOCUS_SW_D		76-89	Full canopy
	FOCUS_SW_F		90-97	More than 50% of leaves fallen
	FOCUS_SW_I			

Table 2 *Building blocks of the Tier-2 model runs. The total number of building blocks is 3 (number of scenarios) x 6 (number of substances) x 3 (annual number of applications) x 5 (application window) = 270.*

Scenario	Substance	Number of applications per year	BBCH-interval	Description of BBCH stage
Large fruit[1]	FOCUS_SW_A	1	0-9	Without leaves
Small fruit[1]	FOCUS_SW_B	3	10-69	Flowering
High avenue trees [1]	FOCUS_SW_C	9	70-75	Early fruit development
	FOCUS_SW_D		76-89	Full canopy
	FOCUS_SW_F		90-97	More than 50% of leaves fallen
	FOCUS_SW_I			

1) DRAINBOW simulations were carried out with minimum requirements Dutch Activity Decree as described in section 2.3.

2.2 Results

2.2.1 Annual maximum PEC (PEC_{max})

Results of the comparison are shown in Figure 3 for substance D and Figure 4 for substance A. We selected the 52.5th-temporal percentile of the FOCUS simulations, because the European Commission (EC) did not yet decide upon the temporal percentile to be used in the FOCUS surface assessment. The alternative would have been to select the 87.5th-temporal percentile; however, differences between the 52.5th and the 87.5th percentile are very small for the FOCUS D3 ditch (see the raw results in Annex 2). So this choice is rather trivial. The other substances show comparable results (Annex 1).

In the case of substance D, Tier-1 gives a higher PEC-value than Tier-2 in all simulated cases (Figure 3). This means that the tiered approach appears to be consistent for substance D. For all other substances (including substance A shown in Figure 4), there is one situation for which the PEC at Tier-2 for large fruit is higher than the PEC at Tier-1. This implies that the tiered approach is not fully consistent for large fruit. Closer inspection reveals that this situation occurs more often for applications schemes with application timings in the BBCH-range 70-75 (see also the raw results in Annex 2). For applications in this range, there is an almost instantaneous decrease in drift deposits in

FOCUS and a more gradual decrease of drift deposits in DRAINBOW (Figure 2). For substance D is, this problem does not occur, because for this substance drainage is an important exposure route.

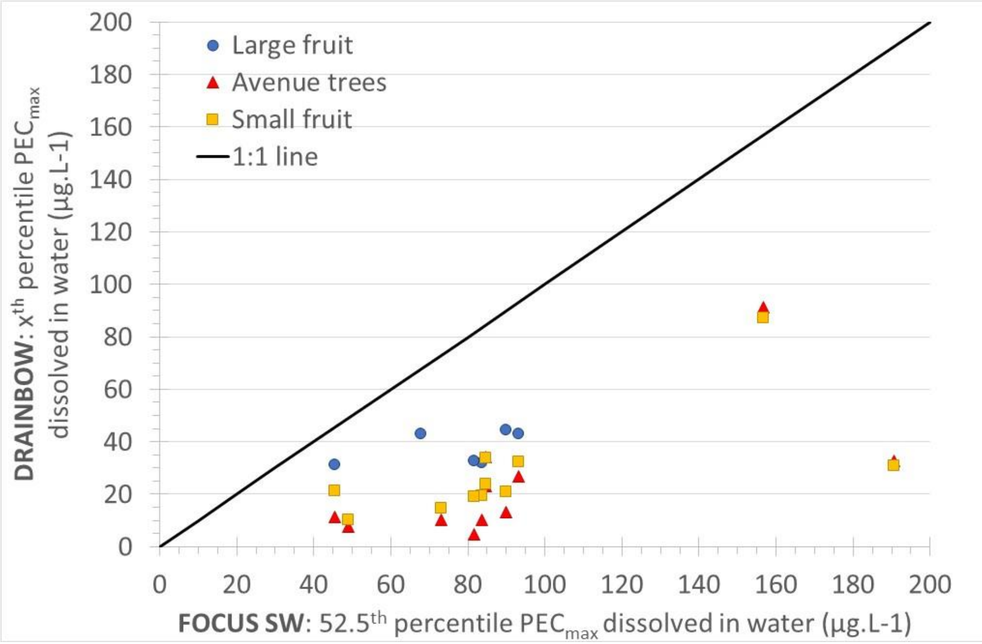

Figure 3 *Comparison of the PEC simulated at Tier-1 (FOCUS-D3, horizontal axis) and the PEC simulated at Tier-2 (DRAINBOW, vertical axis) for substance D.*

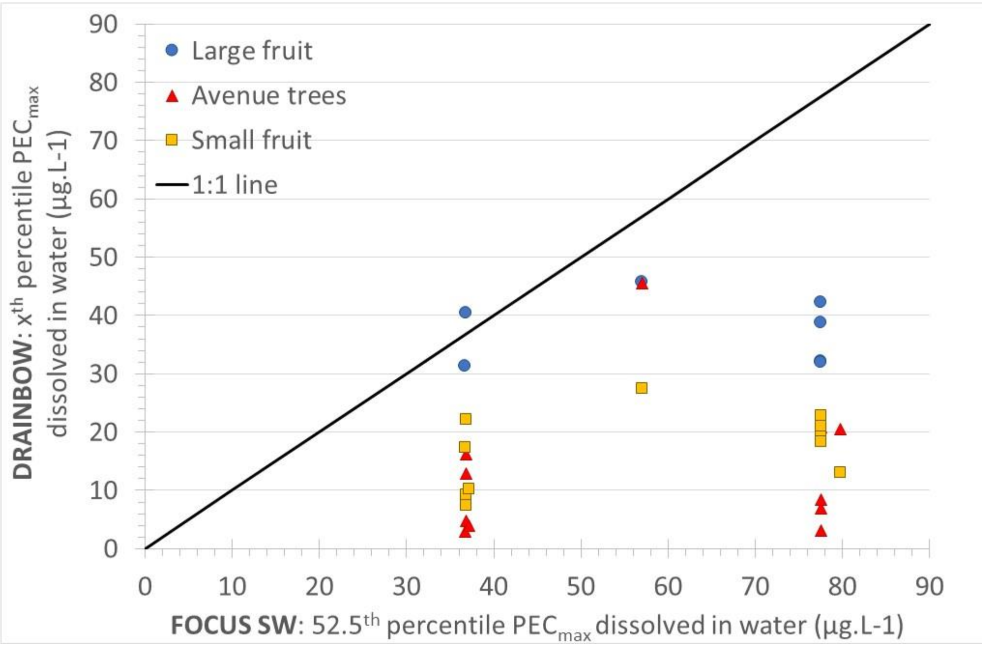

Figure 4 *Comparison of the PEC simulated at Tier-1 (FOCUS-D3, horizontal axis) and the PEC simulated at Tier-2 (DRAINBOW, vertical axis) for substance A.*

The inconsistency primarily occurs with multiple applications in the BBCH-range 70-75. This is caused by the fact that with multiple applications, FOCUS (2001) assumes lower drift deposits. This becomes critical in the BBCH-range 70-75. There are, however, additional reasons for these differences. For example, also the geometry of the ditch is an important factor. These differences are further explained in Annex 3.

Figure 4 shows the ratio between the simulated PEC for the DRAINBOW (large fruit) and the PEC simulated for the FOCUS D3 (pome fruit) scenario. The figure shows that the ratio is always below 1.2, which means that an assessment factor of 1.2 would be sufficient to guarantee consistency of the tiered approach. Notice that this assessment factor is only needed for large fruit because the PEC simulated with DRAINBOW for small fruit and high avenue trees is always smaller than the PEC simulated with FOCUS D3 (pome stone fruit). Notice that the assessment factor of 1.2 should also be used for the pre-assessment tier (Tier-0) when used in combination with a large fruit exposure assessment.

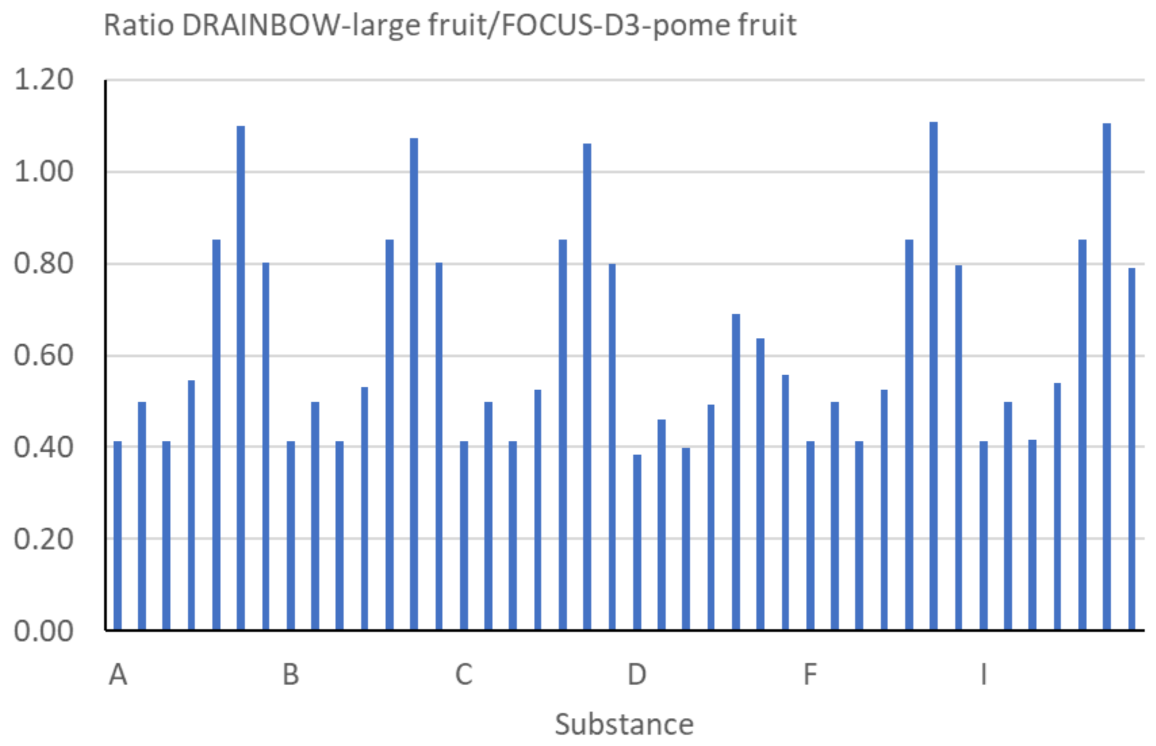

Figure 5 *Ratio of the PEC simulated with DRAINBOW and the PEC simulated for the FOCUS D3 ditch scenario. Simulations are for the large fruit scenario.*

2.2.2 Time Weighted Average concentration (TWA)

Results of the target percentile Time Weighted Average concentrations in water over 7 days (TWA7d) are provided in tables B4-B6 in Annex 2. The TWA7d was selected because this type of TWA concentration is proposed by EFSA (2013) for use in the chronic risk assessment if the TWA concentration approach is considered appropriate.

The target percentile TWA7d concentrations are determined by ranking annual maximum TWA7d concentrations in increasing order and by extracting the TWA7d of the target percentile (52.5th and 87.5th percentile for the FOCUS simulations and a variable target percentile for the DRAINBOW simulations). Note that the consequence of this method is that the target percentile TWA7d can found in another year than the target percentile PEC_{max}.

The results presented in tables B4-B6 in Annex 2 show that the tiered approach is consistent for all substances and all situations tested for small fruit. For large fruit and for substance A, several situations (analogous to the PEC_{max}, all with applications dates in the range BBCH 70-75) result in TWA concentrations that are higher at Tier-2 than at Tier-1. This implies that the tiered-approach is inconsistent for these situations. For high avenue trees, the test showed consistency of the tiered approach for the PEC_{max}. This is not the case for the TWA7d. For both substance A and B, several situations for high avenue trees result in TWA7d concentrations that are higher at Tier-2 than at

Tier-1, with a maximum ratio between the simulated TWA for the DRAINBOW (Tier-2) and the PEC simulated for the FOCUS D3 scenario (Tier 1) of 3 (i.e. an assessment factor of 3 would be needed to guarantee consistency of the tiered approach). For these situations the temporal percentile selected for the Tier-2 (DRAINBOW) simulations was the 90^{th} percentile, meaning that a TWA in the upper range of the distribution is selected. Furthermore, these were all situations in which the TWA7d was found in a period with continuous drain flow during the TWA period. In Annex 3 it was shown that a larger influence of the drainage route in the DRAINBOW simulations is one of the explanations of inconsistency of the tiered approach for the PEC_{max}; i.e. for the DRAINBOW simulations substance entries in to the ditch by drain flow add up to entries by spray drift. This is not the case for the FOCUS SW D3 ditch scenarios, where the influence of the drain on the concentration in the ditch is very limited. For the TWA the influence of the drainage route is even more relevant as all concentrations of the period considered are used for calculating the TWA. If ditch concentrations are high during the entire TWA period as result of drainage, then the TWA may be relatively high compared to the PEC_{max}. This is further explained in Annex 5 5.

Testing of the tiered approach was only done for the TWA over a 7 day period. It is unlikely that the tiered approach is consistent for TWA concentrations over another, longer time period (e.g. 14 or 21 days).

Because of the high assessment factor that would be needed to guarantee consistency of the tiered-approach for the TWA-concentration, it is proposed that Tier-1 is not used if the TWA is to be assessed. We except that this decision will not lead to a huge increase of the workload for regulators and industry. The reason is that in chronic risk assessments of aquatic organisms, the default recommendation by EFSA (2013) is to use the PEC_{max}, and only under certain conditions, a TWA concentration may be used for the risk assessment. In practice this means that the TWA-concentration will be frequently used for chronic risk assessments.

3 Conclusions

Boesten et al. (2021) and Holterman et al. (2021) describe scenarios for upwards and sideways spray applications in large fruit crops, small fruit crops and avenue trees. We propose to use these scenarios as part of a tiered exposure assessment scheme consisting of three tiers and a pre-assessment tier. In anticipation of the acceptance of the repaired FOCUS surface water scenarios in the risk assessment of active substances at EU level, the (repaired) FOCUS surface water scenario D3 is used in Tier-1.

The tiered approach is specifically developed for exposure as result of upwards and sideways spraying of pesticides in large and small fruit crops and avenue trees and for the concentration (PEC_{max} only) in the water layer of the water body.

This means that the proposed tiered approach is not developed for e.g. non-spray applications such as seed treatments, injection and granules. Also for soil metabolites the tiered approach cannot be used. For these situations we propose to use the Dutch scenarios, which are part of Tier-2 in this document. Also for Time Weighted Average concentrations (TWA) and/or concentrations in the sediment (PEC_{sed}) we propose to use directly the Dutch scenarios, which are all part of the software tool DRAINBOW.

A tiered approach starts with a simple conservative assessment and idea is to only do additional more complex work if necessary. An important requirement for a tiered approach is that lower tiers are more conservative (higher PECs) than higher tiers (more realistic, hence lower PECs than the simple conservative lower tiers). Simulations with the Tier-1 and Tier-2 models and scenarios for upward and sideways spray applications in large fruit, small fruit and avenue trees and for different combinations of substances and timing and number of applications revealed that this is true for most cases. However, in the case of large fruit, sometimes Tier-2 gives higher PEC-values than Tier-1. To make the tiered approach consistent, we propose to use an assessment factor of 1.2 at Tier-1 for all large fruit simulations. In the case of small fruit and avenue trees, the simulations at Tier-2 always give lower concentrations than the simulations at Tier-1 so an assessment factor is not needed for these situations. Notice that the assessment factor of 1.2 would also be needed at the pre-assessment tier when used in combination with large fruit simulations.

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Annex 1 Scatterplots for all substances

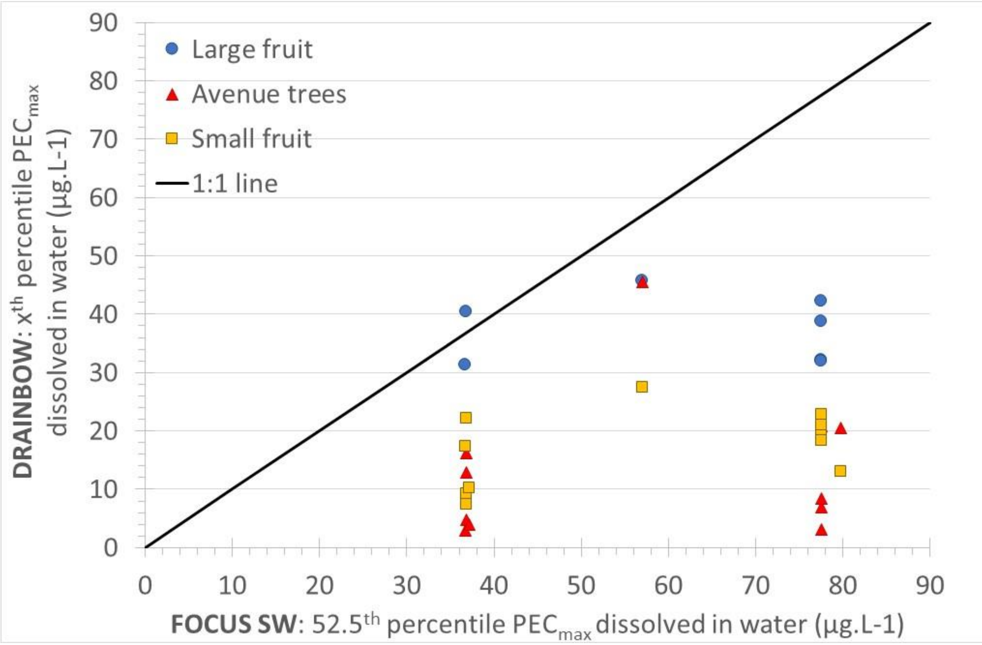

Figure A1.1 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance A.*

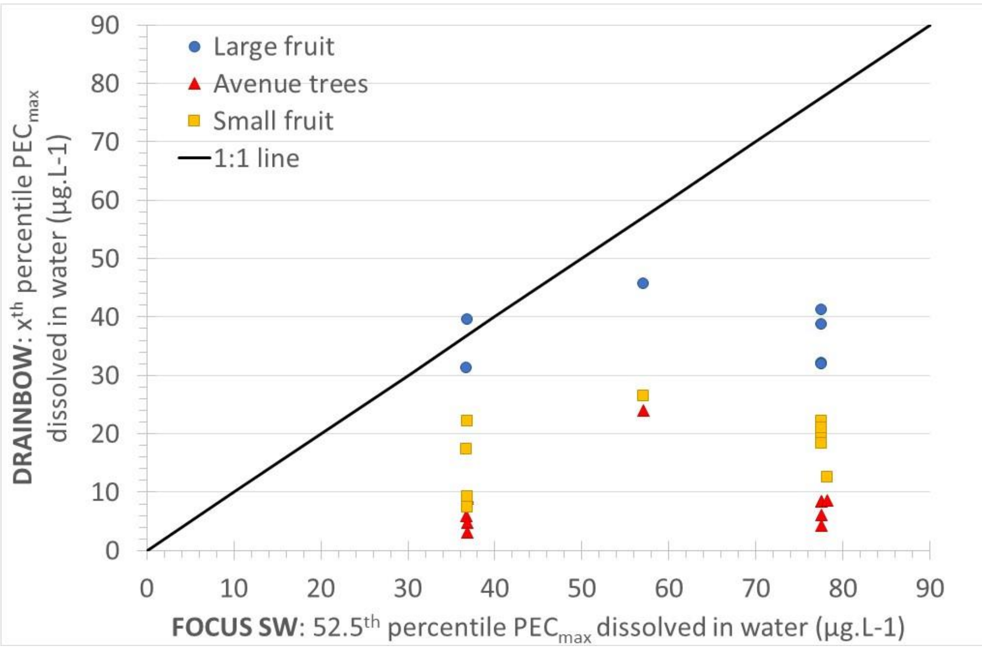

Figure A1.2 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance B.*

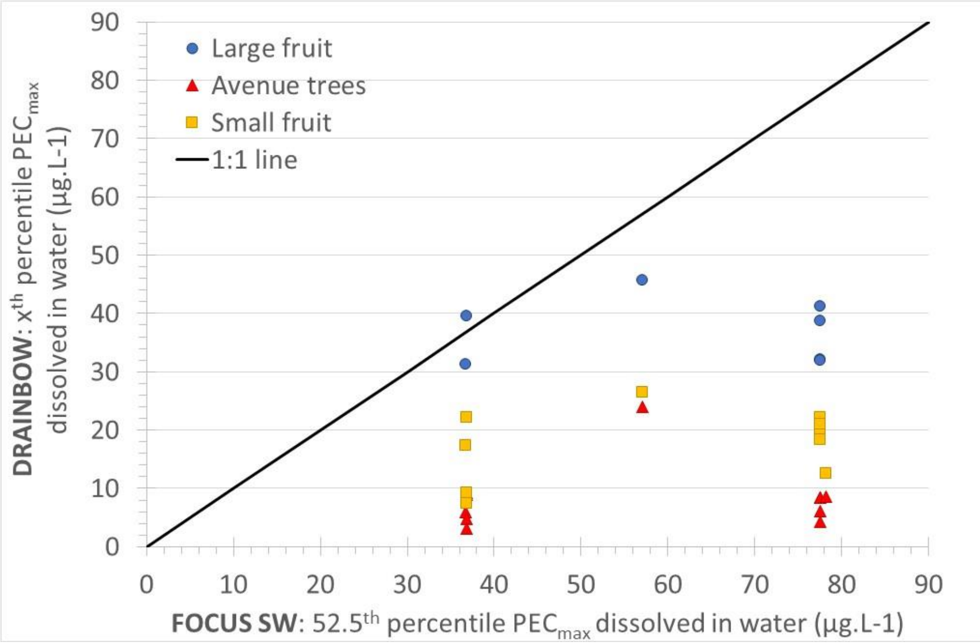

Figure A1.3 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance C.*

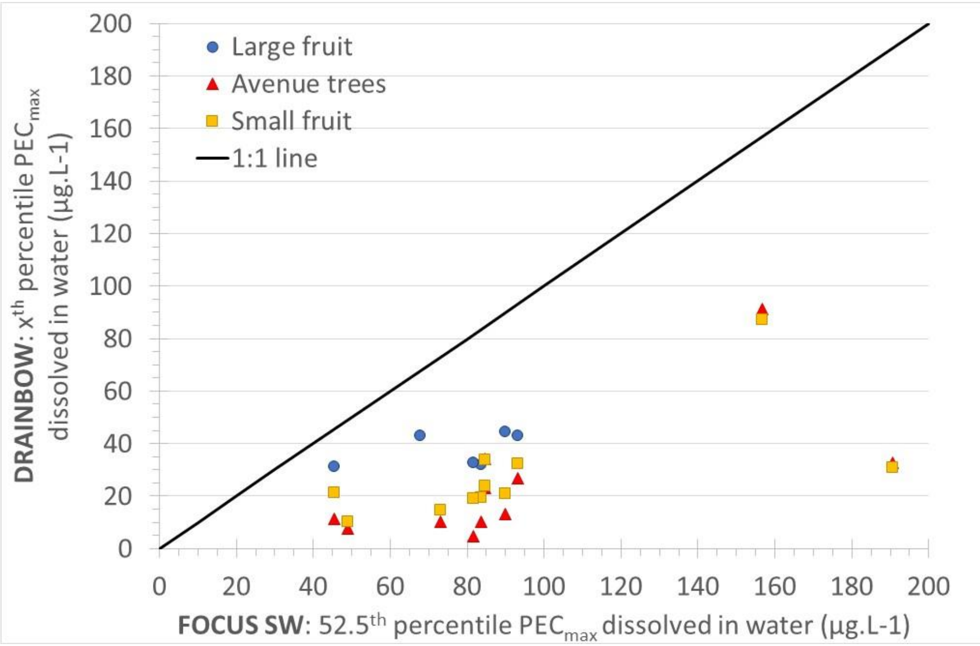

Figure A1.4 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance D.*

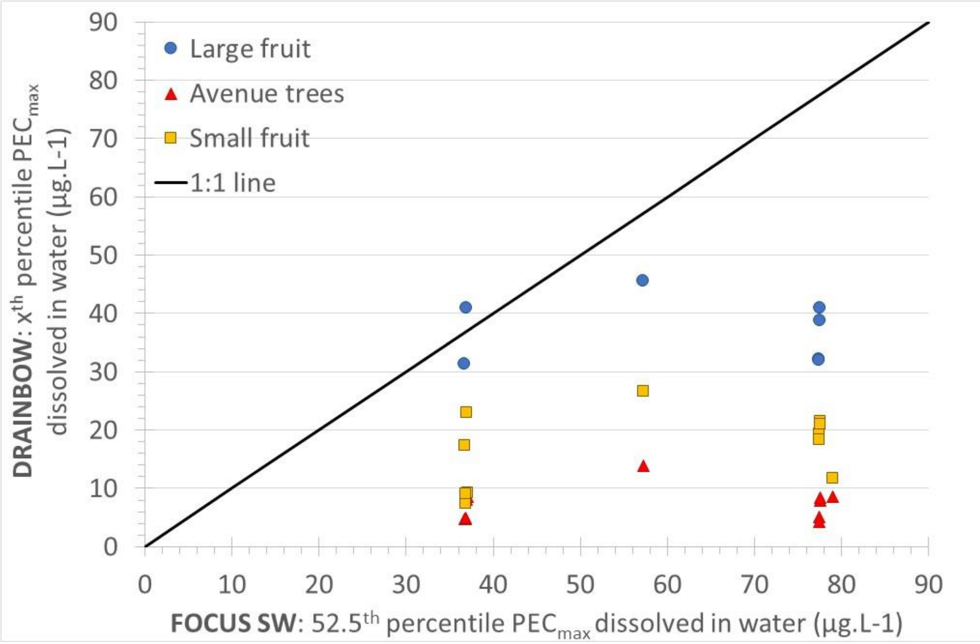

Figure A1.5 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance F.*

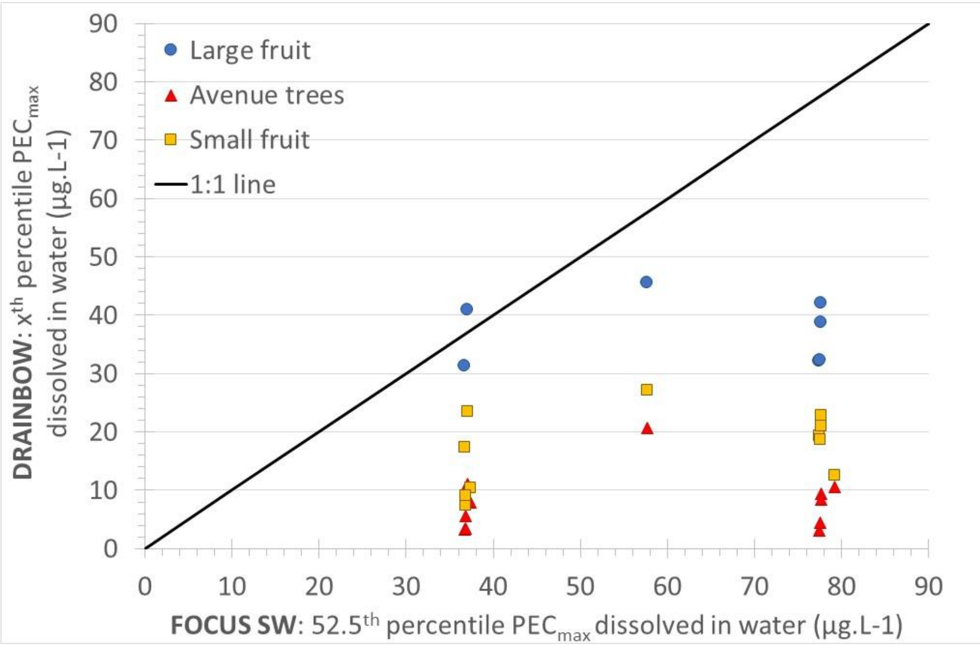

Figure A1.6 *Comparison of the PEC simulated at Tier-1 (horizontal axis) and the PEC simulated at Tier-2 (vertical axis) for substance I.*

Annex 2 Raw results of the simulations

This annex shows the raw results of the simulations for large fruit (Table A2.1 and A2.4), high-avenue trees (Table A2.2 and A2.5) and small fruit (Table A2.3 and A2.6). We carried out simulations for all building blocks in Table 1 and Table 2 with a few exceptions. First, for large fruit and the application schemes with 1 and 3 applications, DRAINBOW simulations were only done for applications in the BBCH range 0-9, 10-69 and 70-75. Simulations for the BBCH range 76-89 and 90-97 were not carried out for large fruit, because these are covered by the simulations for small fruit. The reason for this is that the drift deposition for small fruit in the DRAINBOW scenario is slightly larger than the drift deposition for large fruit (Figure 2). Second, in the case of 9 applications, simulations were only performed for one BBCH-range, i.e. 60-75. In the Netherlands, only captan has an authorisation with so many applications, and the BBCH-range 60-75 best covers the actual application schedule of this particular substance. Notice that the comparison has been done for 9 instead of 15 applications per year. The reason is that the MACRO version in SWASH at the time of performing simulations for testing the tiered approach could not handle more than 9 applications per year.

Additional simulations were performed with substance A to get more insight into the results for the BBCH range of applications for which the tiered approach is not fully consistent for large fruit (i.e. the PEC at Tier-2 is higher than the PEC at Tier-1).

Table A2.1 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (large fruit)[1]; target percentile PEC_{max}.*

	Application Scheme	DRAINBOW Large fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water ($\mu g.L^{-1}$)	52.5th_Perc PEC_{max} dissolved in water ($\mu g.L^{-1}$)	87.5th_Perc PEC_{max} dissolved in water ($\mu g.L^{-1}$)
Sub_A	BBCH 0-9, 1 application	60.10th	32.08	77.49	77.73
	BBCH 0-9, 3 applications	47.40th	38.72	77.51	77.77
	BBCH 10-69, 1 application	60.10th	31.99	77.5	77.74
	BBCH 10-69, 3 applications	47.40th	42.26	77.55	77.81
	BBCH 70-75, 1 application	60.10th	31.33	36.76	36.83
	BBCH 70-75, 3 applications	47.40th	**40.43**	36.8	36.86
	BBCH 60-75, 9 applications	42.60th	45.7	57.03	57.15
	BBCH 72-75, 1 application	60.1th	34.27	36.78	36.84
	BBCH 72-75, 3 applications	47.4th	33.63	36.81	36.88
	BBCH 70-75, 5 applications	45.8th	39.17	36.82	36.88
	BBCH 71-74, 3 applications	47.7th	38.13	36.80	36.86
	BBCH 69-75, 5 applications	45.8th	39.88	60.21	60.32
	BBCH 70-75, 2 applications	53.7th	**41.12**	36.78	36.84
	BBCH 71-74, 2 applications	53.7th	**39.58**	36.78	36.84
	BBCH 80-90, 3 applications	43.3th	7.51	36.94	37.17
	BBCH 92-95, 1 application	63rd	10.26	37.20	37.40
	BBCH 89-94, 3 applications	41.1th	57.44	79.33	80.06
	BBCH 87-92, 3 applications	43.3th	9.112	37.34	37.95
	BBCH 93-95, 1 application	63rd	14.08	37.21	37.45
	BBCH 93-95, 3 applications	47.4th	27.52	79.91	81.96
Sub_B	BBCH 0-9, 1 application	60.10th	32.08	77.48	77.72
	BBCH 0-9, 3 applications	47.40th	38.71	77.51	77.77
	BBCH 10-69, 1 application	60.10th	31.97	77.49	77.73
	BBCH 10-69, 3 applications	47.40th	41.24	77.56	77.82
	BBCH 70-75, 1 application	60.10th	31.33	36.76	36.83
	BBCH 70-75, 3 applications	47.40th	**39.52**	36.8	36.86

	Application Scheme	DRAINBOW Large fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water (µg.L^{-1})	52.5th_Perc PEC_{max} dissolved in water (µg.L^{-1})	87.5th_Perc PEC_{max} dissolved in water (µg.L^{-1})
	BBCH 60-75, 9 applications	42.60th	45.7	57.03	57.15
Sub_C	BBCH 0-9, 1 application	60.10th	32.05	77.43	77.67
	BBCH 0-9, 3 applications	47.40th	38.69	77.46	77.73
	BBCH 10-69, 1 application	60.10th	31.94	77.44	77.68
	BBCH 10-69, 3 applications	47.40th	40.72	77.53	77.84
	BBCH 70-75, 1 application	60.10th	31.3	36.73	36.8
	BBCH 70-75, 3 applications	47.40th	**39.02**	36.79	36.84
	BBCH 60-75, 9 applications	42.60th	45.57	57.04	57.15
SUB_D	BBCH 0-9, 1 application	60.10th	32.08	83.73	84.88
	BBCH 0-9, 3 applications	47.40th	42.84	93.26	97.5
	BBCH 10-69, 1 application	60.10th	32.54	81.58	82.96
	BBCH 10-69, 3 applications	47.40th	44.44	90.04	92.78
	BBCH 70-75, 1 application	60.10th	31.33	45.4	47.39
	BBCH 70-75, 3 applications	47.40th	43.06	67.75	73.04
	BBCH 60-75, 9 applications	63.00th	87.15	156.7	174.2
Sub_F	BBCH 0-9, 1 application	60.10th	32.05	77.43	77.67
	BBCH 0-9, 3 applications	47.40th	38.69	77.49	77.8
	BBCH 10-69, 1 application	60.10th	31.97	77.44	77.68
	BBCH 10-69, 3 applications	47.40th	40.83	77.56	77.94
	BBCH 70-75, 1 application	60.10th	31.3	36.73	36.8
	BBCH 70-75, 3 applications	47.40th	**40.91**	36.92	37.24
	BBCH 60-75, 9 applications	42.60th	45.58	57.26	57.87
Sub_I	BBCH 0-9, 1 application	60.10th	32.05	77.47	77.88
	BBCH 0-9, 3 applications	47.40th	38.69	77.66	78.44
	BBCH 10-69, 1 application	60.10th	32.3	77.51	77.86
	BBCH 10-69, 3 applications	47.40th	41.98	77.69	78.38
	BBCH 70-75, 1 application	60.10th	31.3	36.76	36.94
	BBCH 70-75, 3 applications	47.40th	**40.92**	37.06	37.9
	BBCH 60-75, 9 applications	42.60th	45.58	57.67	59.58

1) In situations where the selected DRAINBOW target percentile PEC_{max} values are higher than the FOCUS values, the DRAINBOW values are indicated in bold font.

Table A2.2 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (high avenue trees); target percentile PEC_{max}.*

	Application Scheme	DRAINBOW high avenue trees upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water (µg.L^{-1})	52.5th_Perc PEC_{max} dissolved in water (µg.L^{-1})	87.5th_Perc PEC_{max} dissolved in water (µg.L^{-1})
Sub_A	BBCH 0-9, 1 application	63.00th	6.979	77.49	77.73
	BBCH 0-9, 3 applications	90.00th	20.79	77.51	77.77
	BBCH 10-69, 1 application	63.00th	3.094	77.5	77.74
	BBCH 10-69, 3 applications	90.00th	8.482	77.55	77.81
	BBCH 70-75, 1 application	63.00th	2.983	36.76	36.83
	BBCH 70-75, 3 applications	90.00th	16.26	36.8	36.86
	BBCH 76-89, 1 application	79.10th	4.72	36.82	36.87
	BBCH 76-89, 3 applications	90.00th	12.91	36.86	36.93
	BBCH 90-97, 1 application	63.00th	3.904	37.18	37.36
	BBCH 90-97, 3 applications	90.00th	20.51	79.73	81.42
	BBCH 60-75, 9 applications	90.00th	45.46	57.03	57.15
Sub_B	BBCH 0-9, 1 application	79.10th	6.179	77.48	77.72
	BBCH 0-9, 3 applications	90.00th	8.44	77.51	77.77
	BBCH 10-69, 1 application	79.10th	4.298	77.49	77.73

	Application Scheme	DRAINBOW high avenue trees upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water ($\mu g.L^{-1}$)	52.5^{th}_Perc PEC_{max} dissolved in water ($\mu g.L^{-1}$)	87.5^{th}_Perc PEC_{max} dissolved in water ($\mu g.L^{-1}$)
	BBCH 10-69, 3 applications	90.00th	8.399	77.56	77.82
	BBCH 70-75, 1 application	79.10th	6.001	36.76	36.83
	BBCH 70-75, 3 applications	90.00th	9.27	36.8	36.86
	BBCH 76-89, 1 application	79.10th	4.72	36.81	36.87
	BBCH 76-89, 3 applications	90.00th	8.861	36.86	36.94
	BBCH 90-97, 1 application	63.00th	3.157	36.85	36.94
	BBCH 90-97, 3 applications	90.00th	8.553	78.18	80.54
	BBCH 60-75, 9 applications	90.00th	23.97	57.03	57.15
Sub_C	BBCH 0-9, 1 application	79.10th	5.023	77.43	77.67
	BBCH 0-9, 3 applications	90.00th	7.947	77.46	77.73
	BBCH 10-69, 1 application	79.10th	4.214	77.44	77.68
	BBCH 10-69, 3 applications	90.00th	8.393	77.53	77.84
	BBCH 70-75, 1 application	79.10th	4.713	36.73	36.8
	BBCH 70-75, 3 applications	90.00th	8.087	36.79	36.84
	BBCH 76-89, 1 application	79.10th	4.713	36.79	36.84
	BBCH 76-89, 3 applications	90.00th	8.123	36.85	36.95
	BBCH 90-97, 1 application	79.10th	4.946	36.82	36.91
	BBCH 90-97, 3 applications	90.00th	8.349	78.34	80.92
	BBCH 60-75, 9 applications	90.00th	10.27	57.04	57.15
SUB_D	BBCH 0-9, 1 application	63.00th	10.15	83.73	84.88
	BBCH 0-9, 3 applications	63.00th	26.68	93.26	97.5
	BBCH 10-69, 1 application	63.00th	4.626	81.58	82.96
	BBCH 10-69, 3 applications	63.00th	13.21	90.04	92.78
	BBCH 70-75, 1 application	63.00th	11.36	45.4	47.39
	BBCH 70-75, 3 applications	63.00th	34.09	84.72	92.81
	BBCH 76-89, 1 application	63.00th	7.48	49.09	53.4
	BBCH 76-89, 3 applications	63.00th	22.94	84.72	92.81
	BBCH 90-97, 1 application	63.00th	10.06	73.11	80.96
	BBCH 90-97, 3 applications	63.00th	32.74	190.6	215.1
	BBCH 60-75, 9 applications	63.00th	91.09	156.7	174.2
Sub_F	BBCH 0-9, 1 application	79.10th	5.035	77.43	77.67
	BBCH 0-9, 3 applications	90.00th	7.947	77.49	77.8
	BBCH 10-69, 1 application	79.10th	4.23	77.44	77.68
	BBCH 10-69, 3 applications	90.00th	8.393	77.56	77.94
	BBCH 70-75, 1 application	79.10th	4.714	36.73	36.8
	BBCH 70-75, 3 applications	90.00th	8.087	36.92	37.24
	BBCH 76-89, 1 application	79.10th	4.732	36.79	36.84
	BBCH 76-89, 3 applications	90.00th	8.509	37.1	38.39
	BBCH 90-97, 1 application	79.10th	4.946	36.82	36.91
	BBCH 90-97, 3 applications	90.00th	8.552	78.99	86.68
	BBCH 60-75, 9 applications	90.00th	13.84	57.26	57.87
Sub_I	BBCH 0-9, 1 application	60.50th	19.43	77.47	77.88
	BBCH 0-9, 3 applications	37.90th	22.77	77.66	78.44
	BBCH 10-69, 1 application	60.50th	18.75	77.51	77.86
	BBCH 10-69, 3 applications	37.90th	21.05	77.69	78.38
	BBCH 70-75, 1 application	60.50th	17.42	36.76	36.94
	BBCH 70-75, 3 applications	37.90th	23.46	37.06	37.9
	BBCH 76-89, 1 application	60.50th	7.446	36.81	36.99
	BBCH 76-89, 3 applications	37.90th	10.4	37.44	39.39
	BBCH 90-97, 1 application	60.50th	9.159	36.86	37.07
	BBCH 90-97, 3 applications	37.90th	12.58	79.18	87.73
	BBCH 60-75, 9 applications	30.30th	27.21	57.67	59.58

Table A2.3 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (small fruit); target percentile* PEC_{max}.

	Application Scheme	DRAINBOW Small Fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water (µg/L)	52.5^{th}_Perc PEC_{max} dissolved in water (µg/L)	87.5^{th}_Perc PEC_{max} dissolved in water (µg/L)
Sub_A	BBCH 0-9, 1 application	60.50th	19.45	77.49	77.73
	BBCH 0-9, 3 applications	37.90th	22.78	77.51	77.77
	BBCH 10-69, 1 application	60.50th	18.43	77.5	77.74
	BBCH 10-69, 3 applications	37.90th	21.06	77.55	77.81
	BBCH 70-75, 1 application	60.50th	17.44	36.76	36.83
	BBCH 70-75, 3 applications	37.90th	22.1	36.8	36.86
	BBCH 76-89, 1 application	60.50th	7.452	36.82	36.87
	BBCH 76-89, 3 applications	37.90th	9.223	36.86	36.93
	BBCH 90-97, 1 application	63.00th	10.29	37.18	37.36
	BBCH 90-97, 3 applications	37.90th	12.99	79.73	81.42
	BBCH 60-75, 9 applications	30.30th	27.47	57.03	57.15
Sub_B	BBCH 0-9, 1 application	60.50th	19.45	77.48	77.72
	BBCH 0-9, 3 applications	37.90th	22.19	77.51	77.77
	BBCH 10-69, 1 application	60.50th	18.41	77.49	77.73
	BBCH 10-69, 3 applications	37.90th	21.06	77.56	77.82
	BBCH 70-75, 1 application	60.50th	17.43	36.76	36.83
	BBCH 70-75, 3 applications	37.90th	22.1	36.8	36.86
	BBCH 76-89, 1 application	60.50th	7.451	36.81	36.87
	BBCH 76-89, 3 applications	37.90th	9.223	36.86	36.94
	BBCH 90-97, 1 application	60.50th	9.164	36.85	36.94
	BBCH 90-97, 3 applications	37.90th	12.59	78.18	80.54
	BBCH 60-75, 9 applications	30.30th	26.48	57.03	57.15
Sub_C	BBCH 0-9, 1 application	60.50th	19.43	77.43	77.67
	BBCH 0-9, 3 applications	37.90th	21.53	77.46	77.73
	BBCH 10-69, 1 application	60.50th	18.38	77.44	77.68
	BBCH 10-69, 3 applications	37.90th	21.05	77.53	77.84
	BBCH 70-75, 1 application	60.50th	17.42	36.73	36.8
	BBCH 70-75, 3 applications	37.90th	22.11	36.79	36.84
	BBCH 76-89, 1 application	60.50th	7.446	36.79	36.84
	BBCH 76-89, 3 applications	37.90th	9.216	36.85	36.95
	BBCH 90-97, 1 application	60.50th	9.157	36.82	36.91
	BBCH 90-97, 3 applications	37.90th	11.69	78.34	80.92
	BBCH 60-75, 9 applications	30.30th	26.46	57.04	57.15
SUB_D	BBCH 0-9, 1 application	60.50th	19.45	83.73	84.88
	BBCH 0-9, 3 applications	63.00th	32.33	93.26	97.5
	BBCH 10-69, 1 application	60.50th	18.98	81.58	82.96
	BBCH 10-69, 3 applications	37.90th	21.06	90.04	92.78
	BBCH 70-75, 1 application	60.50th	21.41	45.4	47.39
	BBCH 70-75, 3 applications	63.00th	33.8	84.72	92.81
	BBCH 76-89, 1 application	63.00th	10.17	49.09	53.4
	BBCH 76-89, 3 applications	63.00th	23.98	84.72	92.81
	BBCH 90-97, 1 application	63.00th	14.58	73.11	80.96
	BBCH 90-97, 3 applications	63.00th	30.77	190.6	215.1
	BBCH 60-75, 9 applications	63.00th	87.15	156.7	174.2
Sub_F	BBCH 0-9, 1 application	60.50th	19.43	77.43	77.67
	BBCH 0-9, 3 applications	37.90th	21.58	77.49	77.8
	BBCH 10-69, 1 application	60.50th	18.41	77.44	77.68
	BBCH 10-69, 3 applications	37.90th	21.05	77.56	77.94
	BBCH 70-75, 1 application	60.50th	17.42	36.73	36.8
	BBCH 70-75, 3 applications	37.90th	22.95	36.92	37.24
	BBCH 76-89, 1 application	60.50th	7.446	36.79	36.84
	BBCH 76-89, 3 applications	37.90th	9.216	37.1	38.39

	Application Scheme	DRAINBOW Small Fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	PEC_{max} dissolved in water (µg/L)	52.5^{th}_Perc PEC_{max} dissolved in water (µg/L)	87.5^{th}_Perc PEC_{max} dissolved in water (µg/L)
	BBCH 90-97, 1 application	60.50th	9.157	36.82	36.91
	BBCH 90-97, 3 applications	37.90th	11.69	78.99	86.68
	BBCH 60-75, 9 applications	30.30th	26.72	57.26	57.87
Sub_I	BBCH 0-9, 1 application	60.50th	19.43	77.47	77.88
	BBCH 0-9, 3 applications	37.90th	22.77	77.66	78.44
	BBCH 10-69, 1 application	60.50th	18.75	77.51	77.86
	BBCH 10-69, 3 applications	37.90th	21.05	77.69	78.38
	BBCH 70-75, 1 application	60.50th	17.42	36.76	36.94
	BBCH 70-75, 3 applications	37.90th	23.46	37.06	37.9
	BBCH 76-89, 1 application	60.50th	7.446	36.81	36.99
	BBCH 76-89, 3 applications	37.90th	10.4	37.44	39.39
	BBCH 90-97, 1 application	60.50th	9.159	36.86	37.07
	BBCH 90-97, 3 applications	37.90th	12.58	79.18	87.73
	BBCH 60-75, 9 applications	30.30th	27.21	57.67	59.58

Table A2.4 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (large fruit)[1]; target percentile TWA7d.*

	Application Scheme	DRAINBOW Large fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	TWA7d dissolved in water ($\mu g.L^{-1}$)	52.5th_Perc TWA7d dissolved in water ($\mu g.L^{-1}$)	87.5th_Perc TWA7d dissolved in water ($\mu g.L^{-1}$)
Sub_A	BBCH 0-9, 1 application	60.10th	2.158	9.075	11.46
	BBCH 0-9, 3 applications	47.40th	4.911	8.608	11.85
	BBCH 10-69, 1 application	60.10th	0.8609	9.033	11.86
	BBCH 10-69, 3 applications	47.40th	1.692	9.337	12.63
	BBCH 70-75, 1 application	60.10th	2.019	5.213	6.652
	BBCH 70-75, 3 applications	47.40th	**6.058**	6.007	6.764
	BBCH 60-75, 9 applications	42.60th	8.914	9.528	11.35
	BBCH 72-75, 1 application	60.1th	5.377	5.442	6.473
	BBCH 72-75, 3 applications	47.4th	**5.886**	5.764	6.875
	BBCH 70-75, 5 applications	45.8th	**6.44**	5.802	6.593
	BBCH 71-74, 3 applications	47.7th	5.248	6.007	6.764
	BBCH 69-75, 5 applications	45.8th	5.052	9.639	11.02
	BBCH 70-75, 2 applications	53.7th	5.658	118	155.2
	BBCH 71-74, 2 applications	53.7th	**6.252**	5.618	6.542
	BBCH 80-90, 3 applications	43.3th	1.524	8.056	10.73
	BBCH 92-95, 1 application	63rd	1.681	10.67	15.2
	BBCH 89-94, 3 applications	41.1th	2.708	22.2	32.92
	BBCH 87-92, 3 applications	43.3th	1.451	10.76	13.79
	BBCH 93-95, 1 application	63rd	2.375	10.62	14.99
	BBCH 93-95, 3 applications	47.4th	3.254	23.47	32.6
Sub_B	BBCH 0-9, 1 application	60.10th	0.7967	9.051	11.42
	BBCH 0-9, 3 applications	47.40th	1.917	8.583	11.81
	BBCH 10-69, 1 application	60.10th	0.4459	9.006	11.81
	BBCH 10-69, 3 applications	47.40th	0.5585	9.31	12.58
	BBCH 70-75, 1 application	60.10th	1.519	5.179	6.612
	BBCH 70-75, 3 applications	47.40th	5.044	5.962	6.71
	BBCH 60-75, 9 applications	42.60th	4.367	9.467	11.28
Sub_C	BBCH 0-9, 1 application	60.10th	0.4207	8.957	11.26
	BBCH 0-9, 3 applications	47.40th	0.6648	8.492	11.63
	BBCH 10-69, 1 application	60.10th	0.3191	8.906	11.63
	BBCH 10-69, 3 applications	47.40th	0.3536	9.212	12.39

	Application Scheme	DRAINBOW Large fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	TWA7d dissolved in water (µg.L^{-1})	52.5th_Perc TWA7d dissolved in water (µg.L^{-1})	87.5th_Perc TWA7d dissolved in water (µg.L^{-1})
	BBCH 70-75, 1 application	60.10th	1.38	5.068	6.473
	BBCH 70-75, 3 applications	47.40th	2.716	5.845	6.527
	BBCH 60-75, 9 applications	42.60th	3.79	9.29	11.01
SUB_D	BBCH 0-9, 1 application	60.10th	14.82	16.45	18.99
	BBCH 0-9, 3 applications	47.40th	3.193	27.49	29.27
	BBCH 10-69, 1 application	60.10th	7.046	14.19	18.38
	BBCH 10-69, 3 applications	47.40th	14.82	23.41	27.98
	BBCH 70-75, 1 application	60.10th	7.912	17.55	20.38
	BBCH 70-75, 3 applications	47.40th	22.33	40.77	45.45
	BBCH 60-75, 9 applications	63.00th	56.25	112.7	129.2
Sub_F	BBCH 0-9, 1 application	60.10th	0.4273	9.821	13.61
	BBCH 0-9, 3 applications	47.40th	0.9295	9.963	14.63
	BBCH 10-69, 1 application	60.10th	0.3222	9.866	13.93
	BBCH 10-69, 3 applications	47.40th	0.5618	10.59	15.5
	BBCH 70-75, 1 application	60.10th	1.504	8.803	10.98
	BBCH 70-75, 3 applications	47.40th	3.141	9.752	13.21
	BBCH 60-75, 9 applications	42.60th	6.879	13.3	17.74
Sub_I	BBCH 0-9, 1 application	60.10th	1.649	9.95	14.08
	BBCH 0-9, 3 applications	47.40th	3.394	10.13	15.38
	BBCH 10-69, 1 application	60.10th	0.9172	9.972	14.39
	BBCH 10-69, 3 applications	47.40th	2.679	10.75	16.24
	BBCH 70-75, 1 application	60.10th	2.297	9.176	12.67
	BBCH 70-75, 3 applications	47.40th	6.424	10.48	14.95
	BBCH 60-75, 9 applications	42.60th	6.879	14.31	21.36

1) In situations where the selected DRAINBOW target percentile TWA_{7d} values are higher than the FOCUS values, the DRAINBOW values are indicated in bold font.

Table A2.5 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (high avenue trees)[1]; target percentile TWA7d.*

	Application Scheme	DRAINBOW high avenue trees upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	TWA7d dissolved in water (µg.L^{-1})	52.5th_Perc TWA7d dissolved in water (µg.L^{-1})	87.5th_Perc TWA7d dissolved in water (µg.L^{-1})
Sub_A	BBCH 0-9, 1 application	63.00th	2.517	9.075	11.46
	BBCH 0-9, 3 applications	90.00th	**12.02**	8.608	11.85
	BBCH 10-69, 1 application	63.00th	0.8872	9.033	11.86
	BBCH 10-69, 3 applications	90.00th	3.339	9.337	12.63
	BBCH 70-75, 1 application	63.00th	1.825	5.213	6.652
	BBCH 70-75, 3 applications	90.00th	**9.645**	6.007	6.764
	BBCH 76-89, 1 application	79.10th	0.7486	5.817	6.903
	BBCH 76-89, 3 applications	90.00th	3.916	6.462	7.7
	BBCH 90-97, 1 application	63.00th	1.12	10.64	14.91
	BBCH 90-97, 3 applications	90.00th	15.07	21.77	33.08
	BBCH 60-75, 9 applications	90.00th	**27.79**	9.528	11.35
Sub_B	BBCH 0-9, 1 application	79.10th	0.8574	9.051	11.42
	BBCH 0-9, 3 applications	90.00th	3.387	8.583	11.81
	BBCH 10-69, 1 application	79.10th	0.4173	9.006	11.81
	BBCH 10-69, 3 applications	90.00th	1.166	9.31	12.58
	BBCH 70-75, 1 application	79.10th	1.28	5.179	6.612
	BBCH 70-75, 3 applications	90.00th	5.141	5.962	6.71
	BBCH 76-89, 1 application	79.10th	0.4081	5.778	6.848
	BBCH 76-89, 3 applications	90.00th	2.137	6.402	7.635

	Application Scheme	DRAINBOW high avenue trees upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	TWA7d dissolved in water (µg.L^{-1})	52.5th_Perc TWA7d dissolved in water (µg.L^{-1})	87.5th_Perc TWA7d dissolved in water (µg.L^{-1})
	BBCH 90-97, 1 application	63.00th	0.2903	10.06	14.47
	BBCH 90-97, 3 applications	90.00th	4.402	20.26	30.21
	BBCH 60-75, 9 applications	90.00th	**12.25**	9.467	11.28
Sub_C	BBCH 0-9, 1 application	79.10th	0.1435	8.957	11.26
	BBCH 0-9, 3 applications	90.00th	0.4889	8.492	11.63
	BBCH 10-69, 1 application	79.10th	0.06188	8.906	11.63
	BBCH 10-69, 3 applications	90.00th	0.4333	9.212	12.39
	BBCH 70-75, 1 application	79.10th	0.3646	5.068	6.473
	BBCH 70-75, 3 applications	90.00th	1.471	5.845	6.527
	BBCH 76-89, 1 application	79.10th	0.3996	5.657	6.666
	BBCH 76-89, 3 applications	90.00th	1.599	6.242	7.418
	BBCH 90-97, 1 application	79.10th	0.2954	9.751	13.78
	BBCH 90-97, 3 applications	90.00th	1.761	19.76	28.98
	BBCH 60-75, 9 applications	90.00th	2.098	9.29	11.01
SUB_D	BBCH 0-9, 1 application	63.00th	6.572	16.45	18.99
	BBCH 0-9, 3 applications	63.00th	17.72	27.49	29.27
	BBCH 10-69, 1 application	63.00th	2.83	14.19	18.38
	BBCH 10-69, 3 applications	63.00th	8.623	23.41	27.98
	BBCH 70-75, 1 application	63.00th	7.691	17.55	20.38
	BBCH 70-75, 3 applications	63.00th	21.52	40.77	45.45
	BBCH 76-89, 1 application	63.00th	4.042	23.52	27.03
	BBCH 76-89, 3 applications	63.00th	13.53	58.83	67.29
	BBCH 90-97, 1 application	63.00th	6.772	52.53	58.42
	BBCH 90-97, 3 applications	63.00th	22.82	144.3	157.7
	BBCH 60-75, 9 applications	63.00th	58.33	112.7	129.2
Sub_F	BBCH 0-9, 1 application	79.10th	0.359	9.821	13.61
	BBCH 0-9, 3 applications	90.00th	0.9729	9.963	14.63
	BBCH 10-69, 1 application	79.10th	0.2185	9.866	13.93
	BBCH 10-69, 3 applications	90.00th	0.7225	10.59	15.5
	BBCH 70-75, 1 application	79.10th	0.7121	8.803	10.98
	BBCH 70-75, 3 applications	90.00th	2.206	9.752	13.21
	BBCH 76-89, 1 application	79.10th	0.8367	10.78	13.84
	BBCH 76-89, 3 applications	90.00th	3.335	12.72	16.1
	BBCH 90-97, 1 application	79.10th	0.4757	13.65	21.14
	BBCH 90-97, 3 applications	90.00th	2.826	25.63	45.16
	BBCH 60-75, 9 applications	90.00th	4.728	13.3	17.74
Sub_I	BBCH 0-9, 1 application	60.50th	1.596	9.95	14.08
	BBCH 0-9, 3 applications	37.90th	5.595	10.13	15.38
	BBCH 10-69, 1 application	60.50th	1.046	9.972	14.39
	BBCH 10-69, 3 applications	37.90th	3.584	10.75	16.24
	BBCH 70-75, 1 application	60.50th	2.021	11.83	15.9
	BBCH 70-75, 3 applications	37.90th	7.103	10.48	14.95
	BBCH 76-89, 1 application	60.50th	2.068	9.176	12.67
	BBCH 76-89, 3 applications	37.90th	4.652	14.18	19.03
	BBCH 90-97, 1 application	60.50th	1.936	14.07	22.62
	BBCH 90-97, 3 applications	37.90th	8.779	26.54	47.02
	BBCH 60-75, 9 applications	30.30th	9.389	14.31	21.36

1) In situations where the selected DRAINBOW target percentile TWA7d values are higher than the FOCUS values, the DRAINBOW values are indicated in bold font.

Table A2.6 *Comparison of DRAINBOW (Tier-2) and FOCUS (Tier-1) simulations (small fruit); target percentile TWA7d.*

	Application Scheme	**DRAINBOW Small Fruit upward and sideways spraying**		**FOCUS SW D3 ditch, pome stone fruit, air blast**	
		Temporal percentile selected	**TWA7d dissolved in water (µg.L^{-1})**	**52.5th_Perc TWA7d dissolved in water (µg.L^{-1})**	**87.5th_Perc TWA7d dissolved in water (µg.L^{-1})**
Sub_A	BBCH 0-9, 1 application	60.50th	2.158	9.075	11.46
	BBCH 0-9, 3 applications	37.90th	2.509	8.608	11.85
	BBCH 10-69, 1 application	60.50th	0.7243	9.033	11.86
	BBCH 10-69, 3 applications	37.90th	0.5089	9.337	12.63
	BBCH 70-75, 1 application	60.50th	1.835	5.213	6.652
	BBCH 70-75, 3 applications	37.90th	3.37	6.007	6.764
	BBCH 76-89, 1 application	60.50th	0.7299	5.817	6.903
	BBCH 76-89, 3 applications	37.90th	1.273	6.462	7.7
	BBCH 90-97, 1 application	63.00th	0.8584	10.64	14.91
	BBCH 90-97, 3 applications	37.90th	1.478	21.77	33.08
	BBCH 60-75, 9 applications	30.30th	4.704	9.528	11.35
Sub_B	BBCH 0-9, 1 application	60.50th	0.773	9.051	11.42
	BBCH 0-9, 3 applications	37.90th	0.8294	8.583	11.81
	BBCH 10-69, 1 application	60.50th	0.3624	9.006	11.81
	BBCH 10-69, 3 applications	37.90th	0.2767	9.31	12.58
	BBCH 70-75, 1 application	60.50th	1.04	5.179	6.612
	BBCH 70-75, 3 applications	37.90th	1.778	5.962	6.71
	BBCH 76-89, 1 application	60.50th	0.4362	5.778	6.848
	BBCH 76-89, 3 applications	37.90th	0.7645	6.402	7.635
	BBCH 90-97, 1 application	60.50th	0.4173	10.06	14.47
	BBCH 90-97, 3 applications	37.90th	0.7458	20.26	30.21
	BBCH 60-75, 9 applications	30.30th	3.494	9.467	11.28
Sub_C	BBCH 0-9, 1 application	60.50th	0.2235	8.957	11.26
	BBCH 0-9, 3 applications	37.90th	0.3451	8.492	11.63
	BBCH 10-69, 1 application	60.50th	0.1848	8.906	11.63
	BBCH 10-69, 3 applications	37.90th	0.1668	9.212	12.39
	BBCH 70-75, 1 application	60.50th	0.8156	5.068	6.473
	BBCH 70-75, 3 applications	37.90th	1.233	5.845	6.527
	BBCH 76-89, 1 application	60.50th	0.4291	5.657	6.666
	BBCH 76-89, 3 applications	37.90th	0.7277	6.242	7.418
	BBCH 90-97, 1 application	60.50th	0.4122	9.751	13.78
	BBCH 90-97, 3 applications	37.90th	0.378	19.76	28.98
	BBCH 60-75, 9 applications	30.30th	1.936	9.29	11.01
SUB_D	BBCH 0-9, 1 application	60.50th	6.324	16.45	18.99
	BBCH 0-9, 3 applications	63.00th	16.83	27.49	29.27
	BBCH 10-69, 1 application	60.50th	2.941	14.19	18.38
	BBCH 10-69, 3 applications	37.90th	3.065	23.41	27.98
	BBCH 70-75, 1 application	60.50th	7.912	17.55	20.38
	BBCH 70-75, 3 applications	63.00th	21.81	40.77	45.45
	BBCH 76-89, 1 application	63.00th	4.213	23.52	27.03
	BBCH 76-89, 3 applications	63.00th	13.28	58.83	67.29
	BBCH 90-97, 1 application	63.00th	6.307	52.53	58.42
	BBCH 90-97, 3 applications	63.00th	21.35	144.3	157.7
	BBCH 60-75, 9 applications	63.00th	56.25	112.7	129.2
Sub_F	BBCH 0-9, 1 application	60.50th	0.3623	9.821	13.61
	BBCH 0-9, 3 applications	37.90th	0.597	9.963	14.63
	BBCH 10-69, 1 application	60.50th	0.2294	9.866	13.93
	BBCH 10-69, 3 applications	37.90th	0.2663	10.59	15.5
	BBCH 70-75, 1 application	60.50th	0.892	8.803	10.98
	BBCH 70-75, 3 applications	37.90th	1.411	9.752	13.21
	BBCH 76-89, 1 application	60.50th	0.617	10.78	13.84
	BBCH 76-89, 3 applications	37.90th	0.9563	12.72	16.1

	Application Scheme	DRAINBOW Small Fruit upward and sideways spraying		FOCUS SW D3 ditch, pome stone fruit, air blast	
		Temporal percentile selected	**TWA7d dissolved in water (µg.L[-1])**	**52.5th_Perc TWA7d dissolved in water (µg.L[-1])**	**87.5th_Perc TWA7d dissolved in water (µg.L[-1])**
	BBCH 90-97, 1 application	60.50th	0.5315	13.65	21.14
	BBCH 90-97, 3 applications	37.90th	0.7586	25.63	45.16
	BBCH 60-75, 9 applications	30.30th	2.633	13.3	17.74
Sub_I	BBCH 0-9, 1 application	60.50th	1.649	9.95	14.08
	BBCH 0-9, 3 applications	37.90th	2.776	10.13	15.38
	BBCH 10-69, 1 application	60.50th	0.9122	9.972	14.39
	BBCH 10-69, 3 applications	37.90th	1.797	10.75	16.24
	BBCH 70-75, 1 application	60.50th	2.297	11.83	15.9
	BBCH 70-75, 3 applications	37.90th	4.851	10.48	14.95
	BBCH 76-89, 1 application	60.50th	1.856	9.176	12.67
	BBCH 76-89, 3 applications	37.90th	3.713	14.18	19.03
	BBCH 90-97, 1 application	60.50th	1.72	14.07	22.62
	BBCH 90-97, 3 applications	37.90th	3.235	26.54	47.02
	BBCH 60-75, 9 applications	30.30th	9.389	14.31	21.36

Annex 3 Possible explanations for the differences for BBCH 70-75

For the target percentile PEC_{max}, the inconsistency of the tiered approach primarily occurs with multiple applications in the BBCH-range 70-75. The main reason is that with multiple applications, FOCUS (2001) assumes lower drift deposits and this becomes critical in the BBCH-range 70-75. There are, however, additional reasons for these differences. These differences will be explained in the more detail in this annex.

Spray drift

For multiple applications in the BBCH-range 70-75, for some of the applications DRAINBOW results in higher spray drift deposits. For instance, for three applications in the BBCH-range 70-75 DRAINBOW calculates spray drift percentages varying between 0 to 13.4, whereas FOCUS calculates spray drifts of 7.9% for the first two applications and 11.13% for the last application.

Water depth and drainage

Difference in concentration in water due to differences in water depth and drainage are illustrated by showing concentration profiles in the FOCUS D3 ditch (Figure A3.1) and in the target stretch of the DRAINBOW ditch (Figure A3.2).

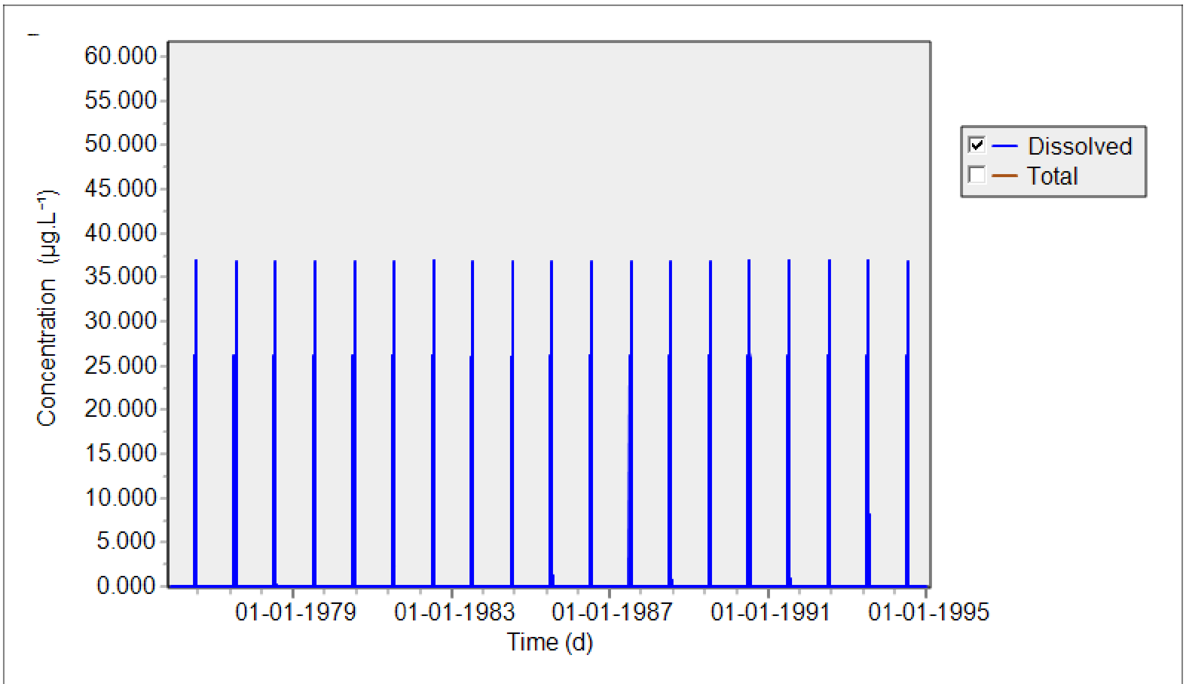

Figure A3.1 *Concentration of substance A in the water layer of the FOCUS D3 ditch as function of time for the simulation with 3 applications in pome stone fruit in the BBCH range 70-75 (7 days interval between the applications).*

Both figures are the result of a simulation for substance A and 3 applications (interval of 7 days) in the BBCH range 70-75 in pome stone fruit for FOCUS and in large fruit for DRAINBOW. Substance A was selected for this example, because it covers most of the other substances. Figure A3.1 shows that the maximum annual concentrations are almost equal in each year for the simulation with the FOCUS D3 ditch scenario. This is due to the minimal variation in water depth (around 30 cm; see also Table 4.4.3-4 in FOCUS, 2001) in the ditch and the limited influence of drainage (i.e. FOCUS, 2001 shows that there is for the D3 ditch scenario a continual low flux of water of ca 0.5 to 2 mm/day from the drain). Figure A3.2 shows much more variation in the concentration peaks in the DRAINBOW ditch than in the FOCUS D3 ditch. This is for the following reasons: i) variation in spray drift (between 0 – 13.4%), ii) a larger variation in water depth in the DRAINBOW ditch (between 26 – 43 cm; see ter Horst et al. (2020)) and iii) a larger influence of the drainage route in the DRAINBOW simulation (like e.g. in autumn 1998 and spring 1999 where emission from the drain causes a significant increase in concentrations in the ditch and subsequently contributes to a larger annual maximum concentration in the ditch).

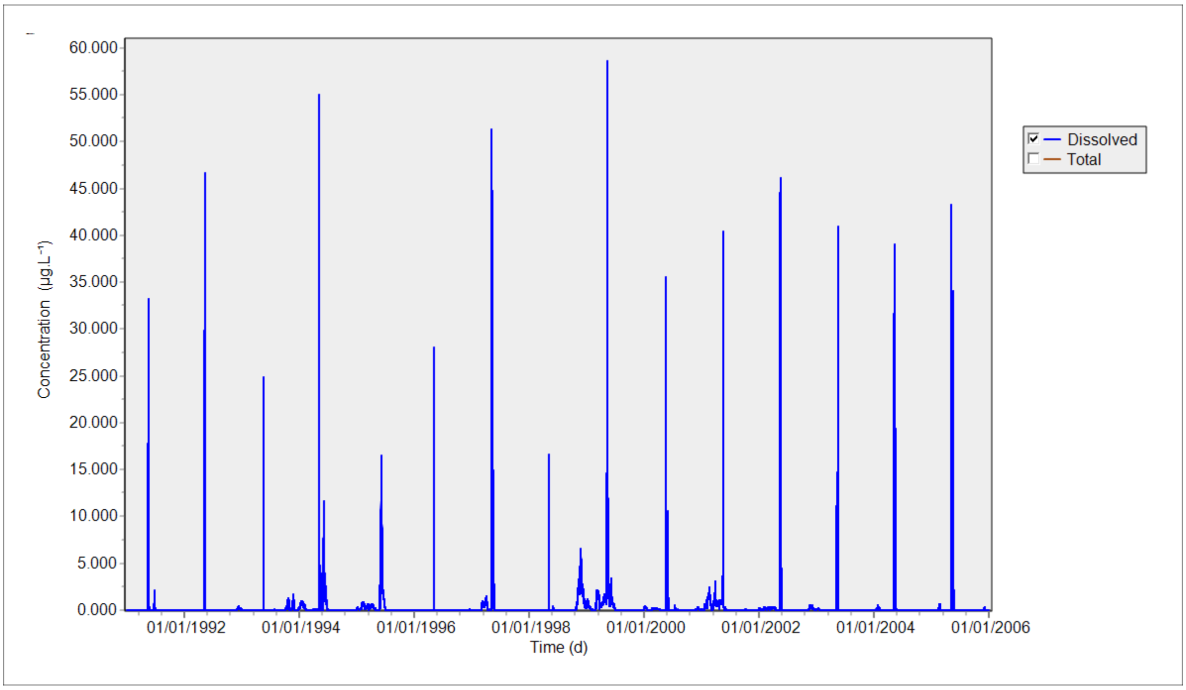

Figure A3.2 *Concentration of substance A in the target stretch of the DRAINBOW ditch as function of time for the simulation with 3 applications in pome stone fruit in the BBCH range 70-75 (7 days interval between the applications).*

Ditch geometry

Furthermore, another reason for the Tier-2 (DRAINBOW) PEC_{max} values exceeding the Tier-1 (FOCUS) PEC_{max} values is the difference in ditch geometry. The FOCUS ditch has a rectangular profile (section 4.4.3. in FOCUS, 2001) whereas the DRAINBOW ditch has a trapezoidal profile (see Figure 3.1 in ter Horst et al., 2020). The ratio between water surface and ditch volume is larger for the DRAINBOW ditch with its trapezoidal profile than for the FOCUS ditch with its rectangular profile, which means that in relative terms, the same drift deposition leads to a higher concentration in the DRAINBOW ditch. This can be illustrated by the following calculation example which is based on the results of the simulations for substance A and the application scheme with three applications in the BBCH range 70-75.

The endpoint for the evaluation for the DRAINBOW simulation for this case results in an annual PEC_{max} value of 40.3 µg.L^{-1} on 18 May 2001 (the selected target year – the 47.4 percentile of 15 years). This PEC_{max} value is predominantly caused by a spray drift event (9.67%) and the water depth in the DRAINBOW ditch is 0.283 m at the time of this annual PEC_{max} value. The PEC_{max} value of FOCUS for the same case is 36.8 µg.L^{-1} (on 20 July 1989; the 52.5th percentile year). This peak concentration is predominantly caused by a spray drift event of 11.13%. At the time of this annual PEC_{max} value the water depth in the FOCUS D3 ditch is 0.303 m. Based on the difference in spray drift and the small difference in water depth a higher PEC_{max} would be expected for the FOCUS simulation.

In case it is assumed that the concentration in water of the DRAINBOW ditch on this date is fully caused by spray drift (9.67%) and a rectangular ditch profile is assumed as well, the concentration in the ditch is calculated to be 32.5 µg.L^{-1} (Table A3.1). This concentration is lower than the 36.8 µg.L^{-1} for the FOCUS simulation for the same case. However, if the trapezoidal profile of the DRAINBOW ditch (1.74 m bottom width, 0.283 m water depth, side slope = 1) is used, the calculated concentration in water is 39.0 µg.L^{-1} i.e. a higher concentration than the 36.8 µg.L^{-1} for the FOCUS simulation for the same case.

Table A3.1 *Example calculations based on the results of the simulations for substance A and the application scheme with three applications in the BBCH range 70-75.*

	Spray drift (%)	Drift deposition on the ditch of 1 an application of 1 kg ha^{-1} (mg.m^{2})	Water depth (m)	Width of the water surface (m)	Mass in the ditch per linear meter (mg)	Volume ditch (1 m length) (m^{3})	Concentration in water (µg.L^{-1})
DRAINBOW ditch rectangular profile	9.67	9.67	0.283	1.74	16.0	0.492	32.5
DRAINBOW trapezoidal profile	9.67	9.67	0.283	2.306	22.3	0.573	39.0
FOCUS D3 ditch	11.13	11.13	0.303	1	11.13	0.303	36.7

Annex 4 Properties of the FOCUS Surface Water test compounds A to I

Table A4.1 *Properties of the test compounds A to I relevant for the simulations for testing the tiered approach (modified from table 6.1-1 in FOCUS, 2001).*

	Example Compound:								
	A	B	C	D	E	F	G	H	I
Molar mass (g/mol)	300 for all compounds								
Vapour pressure (Pa @ 20°C)	1.0×10^{-7} for all compounds								
Water solubility (mg/L @ 20°C)	1.0 for all compounds								
Soil half-life (days)	3	3	3	30	30	30	300	300	300
Koc ($cm^3 . g^{-1}$)	10	100	1000	10	100	1000	10	100	1000
Freundlich 1/n	1								
Surface water half-life (days)	1	1	1	10	10	10	100	100	100
Sediment half-life (days)	3	3	3	30	30	30	300	300	300

Annex 5 Explanation of the influence of the drainage route for calculation of the TWA concentration

The inconsistency in the tiered approach for the TWA7d that was found for several cases of simulations for high avenue trees were all cases were the 90th temporal percentile was selected for the DRAINBOW simulations i.e. the target percentile concentration was found in the upper range of the concentrations in the ditch. Most of these concentrations are caused by a drainage event. For the FOCUS D3 ditch scenario the drainage route is of lesser importance for the same case. This and the consequence for the TWA7d is explained below using the case of substance A applied 9 times in the BBCH period 60-75 (See Table A5.1 for the target percentile PEC_{max} and TWA7d values and corresponding dates of the DRAINBOW And FOCUS SW D3 ditch simulations for this particular case).

Table A5.1 *90th percentile PEC_{max} and TWA7d values and corresponding dates for the DRAINBOW simulation and 87.5th PEC_{max} and TWA7d values and corresponding dates for the FOCUS SW D3 ditch simulation, both for the case of 9 applications in the BBCH period 60-85.*

90th percentile PEC_{max} DRAINBOW (high avenue trees)	90th percentile TWA7d DRAINBOW (high avenue trees)	87.5th percentile PEC_{max} FOCUS SW D3 ditch (pome stone fruit, air blast)	87.5th percentile TWA7d FOCUS SW D3 ditch (pome stone fruit, air blast)
45.46	27.79	57.15	11.35
05-Jun-1994-23h00	10-Jun-1994-09h00	06-Jul-1991-09h00	06-Jul-1991-09h00

For the repaired FOCUS D3 ditch scenario drain flow into the ditch is almost continuous, but drainage fluxes are rather small (usually between 0.5 – 2 mm d^{-1}) (Figure A5.1), as are the drainage substance fluxes (Figure A5.2) and the concentrations in the drain water (Figure A5.3). For the case discussed here, the maximum concentration in the drain water is about 0.3 μg/L, whereas annual PEC_{max} values are around 57 μg/L. The peak concentrations are thus caused by spray drift and input of substance via the drain is almost negligible. The concentration is the ditch quickly decreases after a spray drift event (figures E4 and E5), resulting in, compared to the PEC_{max}, relatively lower values of the TWA7d.

For the DRAINBOW scenario, the drainage fluxes (water and substance) and concentration in the drain water are much larger than for the FOCUS SW D3 ditch scenario, however not continuous (Figures A5.6 – A5.8). Concentrations in the DRAINBOW ditch are lower than in the FOCUS SW D3 ditch (compare Figure A5.9 with Figure A5.4). During some drainage events the concentration in the ditch is largely determined by contaminated drain flow into the ditch and thus much higher than the concentration in the FOCUS SW D3 caused by drainage only. Figure A5.10 illustrates the case where the 90th percentile TWA7d is found in a period where concentrations in the ditch are both caused by drainage and spray drift (the annual PEC_{max} for this year is found on 5 July 23:00). In periods both before and after the annual PEC_{max} concentrations in the ditch are high due to drain flow. Calculating the TWA7d for a moving time frame, allocating the TWA concentration to the last moment of the 7 day period as done in TOXSWA, results then compared to the PEC_{max} in a relatively high value of the TWA7d.

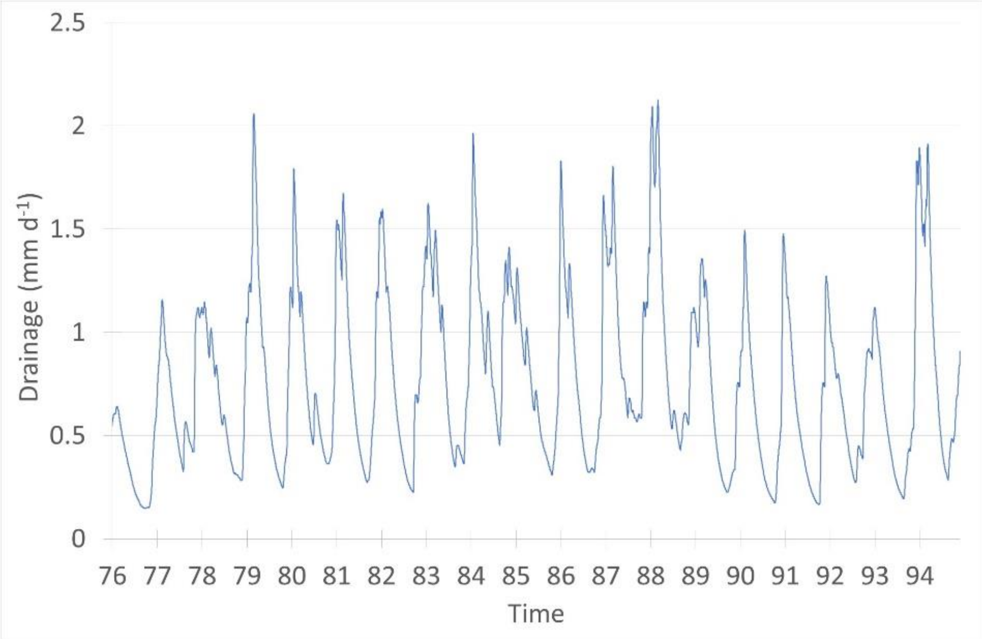

Figure A5.1 *Drain flow (mm d^{-1}) of the repaired FOCUS SW D3 scenario.*

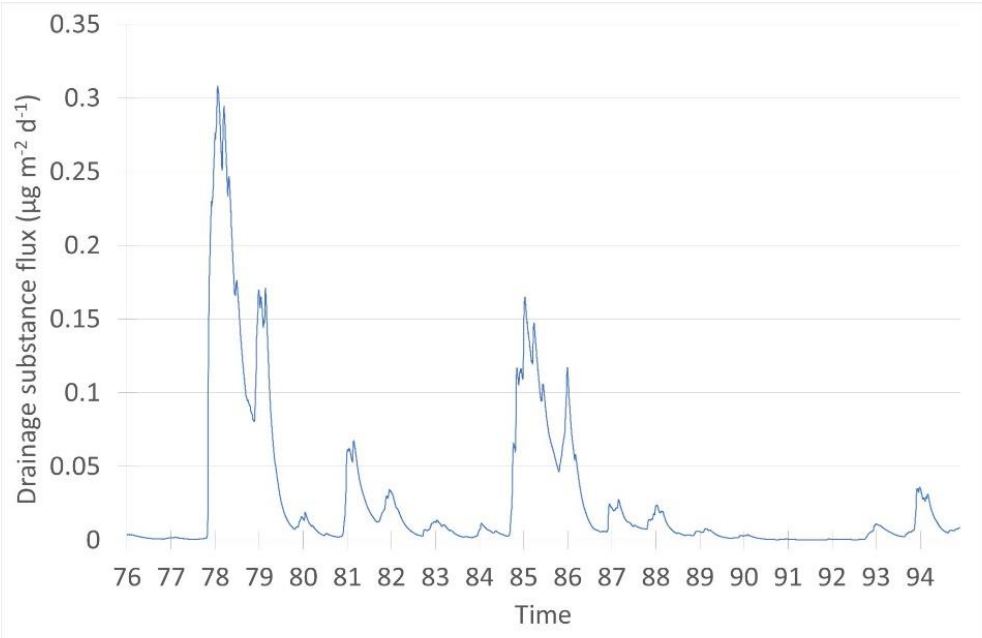

Figure A5.2 *Substance mass flux in drainage (µg m^{-2} d^{-1}) of a simulation with the repaired FOCUS SW D3 ditch scenario for the case of substance A and 9 applications in pome stone fruit (air blast) in the period BBCH 60-75.*

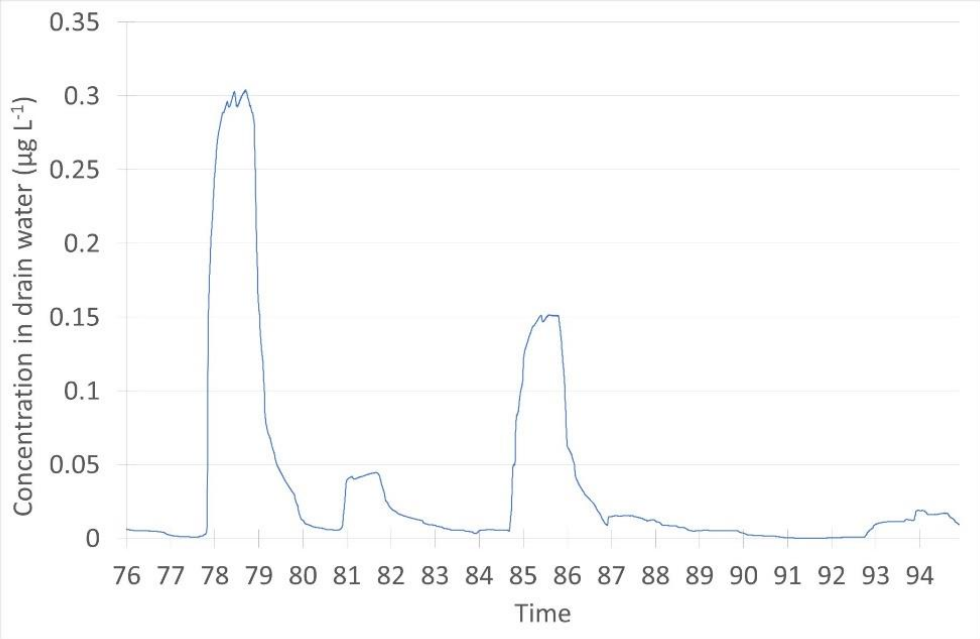

Figure A5.3 *Substance concentration in the drain water (µg L^{-1}) of a simulation with the repaired FOCUS SW D3 ditch scenario for the case of substance A and 9 applications in pome stone fruit (air blast) in the period BBCH 60-75.*

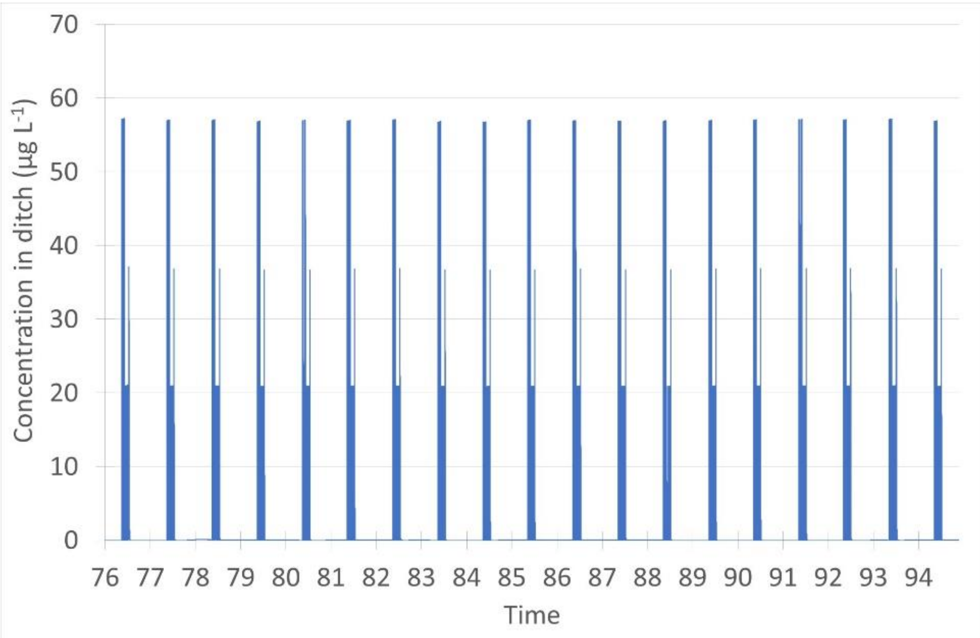

Figure A5.4 *Substance concentration in the ditch (µg L^{-1}) for the period 1976-1994 of a simulation with the repaired FOCUS SW D3 ditch scenario for the case of substance A and 9 applications in pome stone fruit (air blast) in the period BBCH 60-75.*

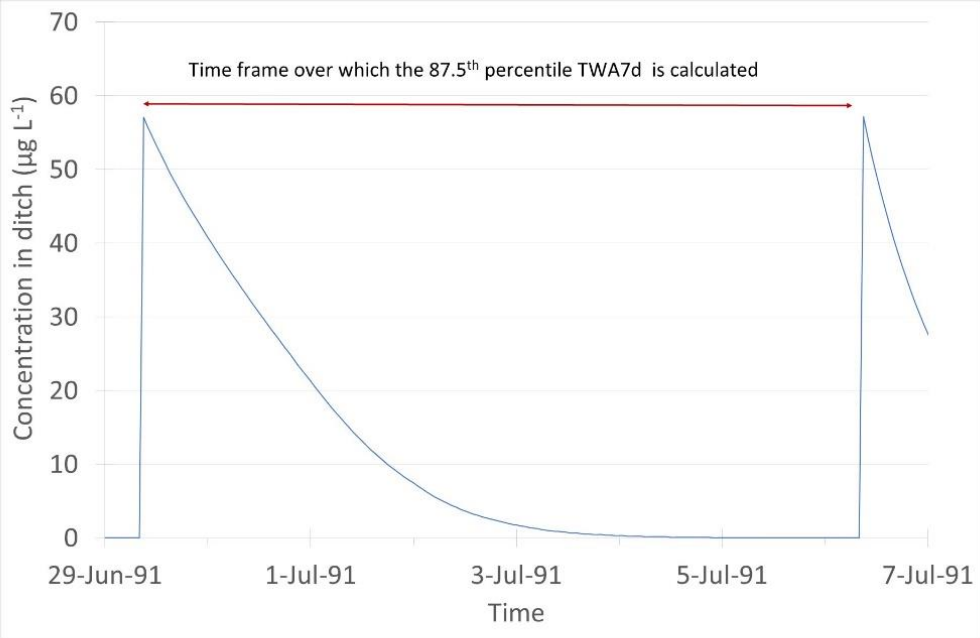

Figure A5.5 *Substance concentration in the ditch (µg L^{-1}) for the period 29 June – 7 July 1991 (i.e the 87.5th percentile TWA7d[5] is found on 6 July 1991) of a simulation with the repaired FOCUS SW D3 ditch scenario for the case of substance A and 9 applications in pome stone fruit (air blast) in the period BBCH 60-75. Note that the peak concentration is caused by spray drift.*

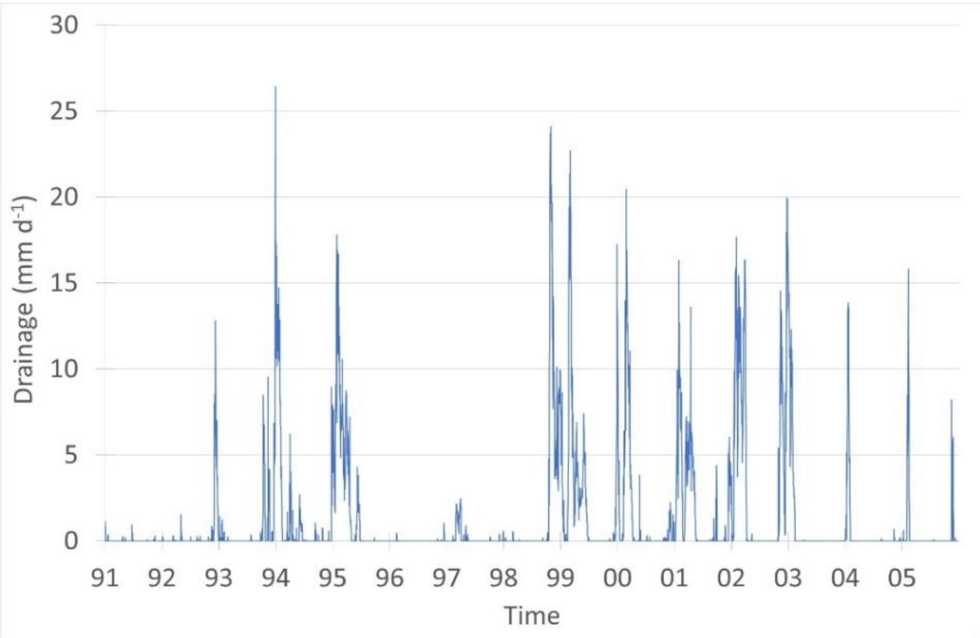

Figure A5.6 *Drain flow (mm d^{-1}) of DRAINBOW scenario.*

5 In TOXSWA, Time Weighted Average Exposure Concentrations are calculated for a moving time frame and are allocated to the last moment of the period considered.

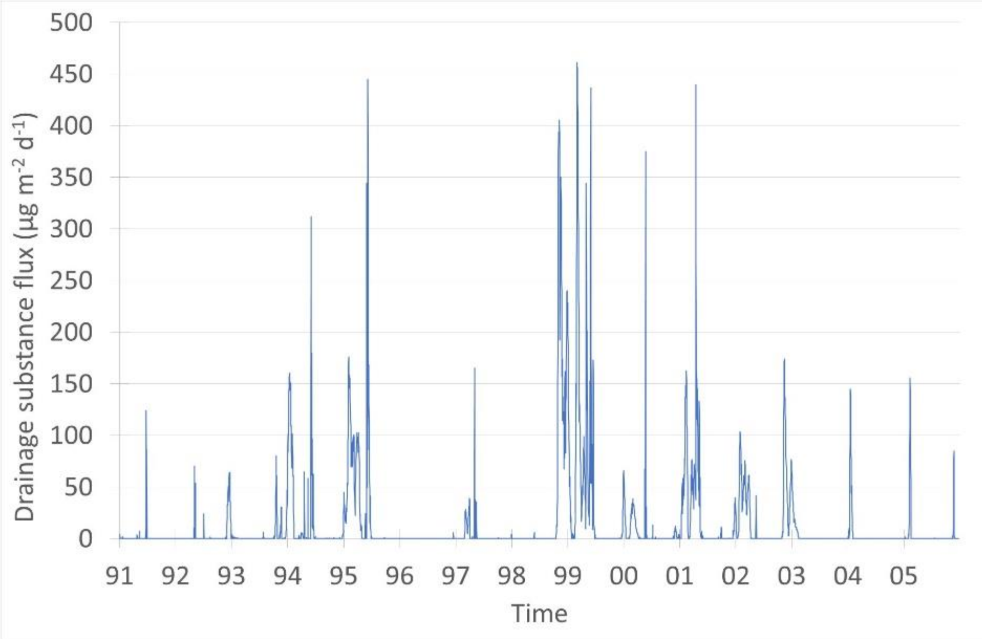

Figure A5.7 *Substance mass flux in drainage (µg m^{-2} d^{-1}) of a simulation with DRAINBOW scenario for high avenue trees for the case of substance A and 9 applications in high avenue trees in the period BBCH 60-75.*

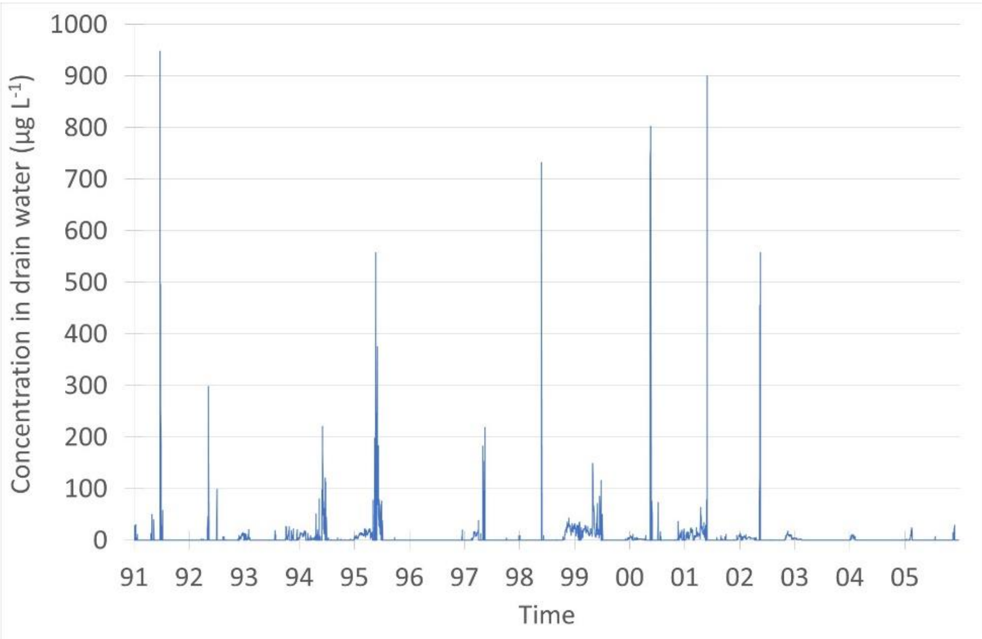

Figure A5.8 *Substance concentration in the drain water (µg L^{-1}) of a simulation with DRAINBOW scenario for high avenue trees for the case of substance A and 9 applications in high avenue trees in the period BBCH 60-75.*

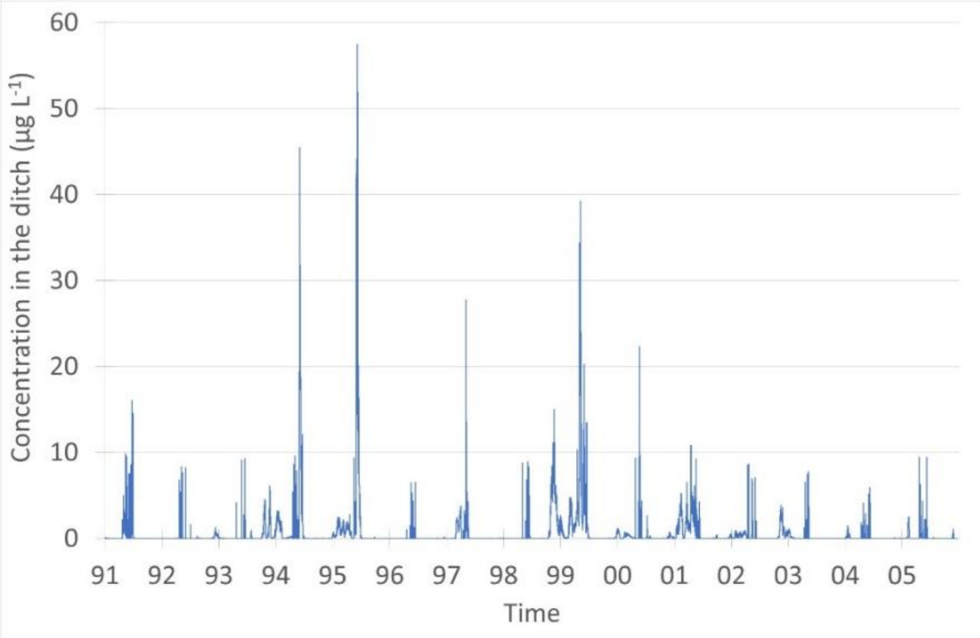

Figure A5.9 *Substance concentration in the ditch (µg L^{-1}) for the period 1991-2005 of a simulation with DRAINBOW scenario for high avenue trees for the case of substance A and 9 applications in high avenue trees in the period BBCH 60-75.*

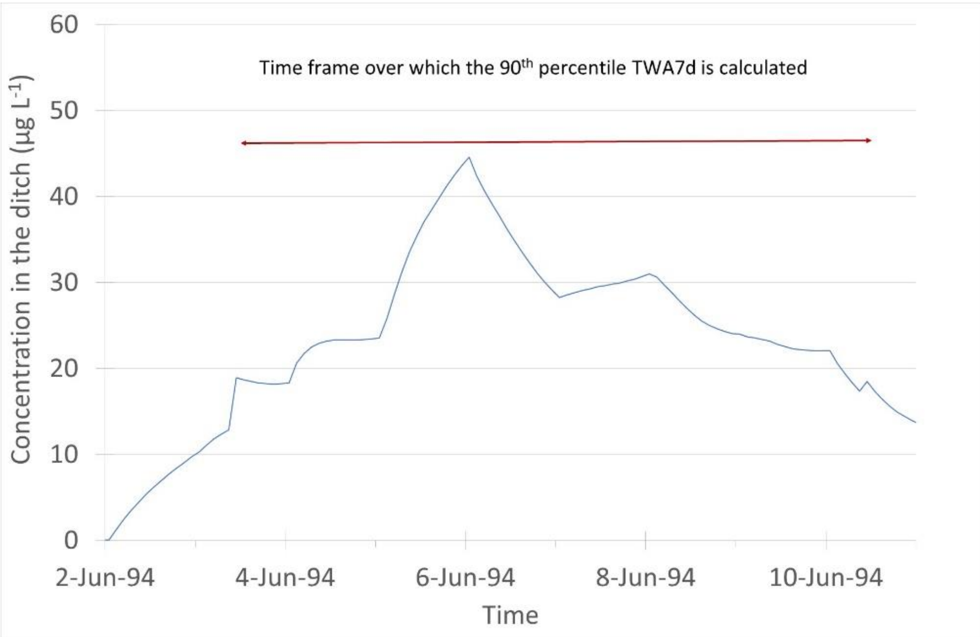

Figure A5.10 *Substance concentration in the ditch (µg L^{-1}) for the period 2 – 11 July 1994 (i.e the 90th percentile TWA7d[6] is found on 10 June 1994) of a simulation with DRAINBOW scenario for high avenue trees for the case of substance A and 9 applications in high avenue trees in the period BBCH 60-75. Note that the peak concentration is caused by drainage.*

[6] In TOXSWA, Time Weighted Average Exposure Concentrations are calculated for a moving time frame and are allocated to the last moment of the period considered.

Wageningen Environmental Research
P.O. Box 47
6700 AA Wageningen
The Netherlands
T +31 (0)317 48 07 00
www.wur.nl/environmental-research

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Wageningen Environmental Research
P.O. Box 47
6700 AB Wageningen
The Netherlands
T +31 (0) 317 48 07 00
www.wur.eu/environmental-research

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