Simulation of the environmental fate of the fungicide Penconazole and its transformation products in a vineyard-terraces catchment

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Motivation

Problem:
• High usage of fungicides in viticulture common
• Frequently detection of concentrations of Penconazole (max: 0.64 µg/L) and TPs in study area
• Model ZIN-AgriTra used successfully for simulation of herbicides (GASSMANN et al., 2013) → gap for catchment models for fungicides + TP

Aim:
• Adaption of the model for fungicides (general more persistent, application on plants)
• Simulation of spraying period as first step for simulation of mitigation measures
• Identification of critical source areas and export pathways
• Information for the development of water pollution control strategies
Modell ZIN-AgriTra

10x10 m cells, time step: 10 min

meteorology

transformation: half time + formation fraction

sorption: linear isotherm + kinetic

outflow

Penconazole concentrations
TP concentrations
Study site: Loechernbach catchment (180 ha)
Hydrograph (01.03.2016 – 15.10.2016)

R² = 0.85
NSE = 0.79
PBIAS = 22.6 %

n = 41409

correlation:

[Graph showing precipitation, outflow (obs), and outflow (sim) with correlation data points and line of best fit.]
Penconazole transport: outlet

application: 40 g/ha
spray end
harvest

dissolved
adsorbed
observation


dissolved adsorbed
Export processes (01.03.2016 – 15.10.2016):

- Penconazole
- TP: 1,2,4-triazole
- Outflow

- Drainage (macro)
- Drainage (matrix)
- Macropore flow
- Matrix flow
- Overland flow
Critical source areas

- Different critical source areas for PC & TP
- Major street contribution for PC export (80%)
Scenario: non-target street application

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Precipitation [mm]

Outflow [L/s]

Penconazole [μg/L]

0.1 g/ha × observation 0.3 g/ha 0 g/ha
Conclusion

Successful simulation of spraying period 2016:

- Most of applied fungicides remains in catchment
- TP & PC have different export pathways
- Main export of Penconazole via street and of TP via field release
- Next step: validation of TP export