For over 80 years the scientists around the world have been conducting laboratory experiments to help understand the fate and the behaviour of pesticides in the ecosystem. “Once upon the time” the research based on simple observations, simple measurements and analysis. “Once upon the time” the copper and its salts while today we have hundred pesticide and metabolites with huge profile in safety and plant health protection. Much has been learned over this time. Mathematical models, analytical chemistry, applied biology have advanced maintaining the pesticide science the most advanced science-based regulation allowing the implementation of pest strategies as well the achievement of food safety, human security and health protection goals. However there still remain many things that we don’t know, or are not able to predict but we are confident, and this collection of paper is the evidence, that such unbelievable science - and its community - will remain also in the future pioneer on-demand of the science, of the policy and of the stakeholder populations.

Ettore Capri, Marco Trevisan

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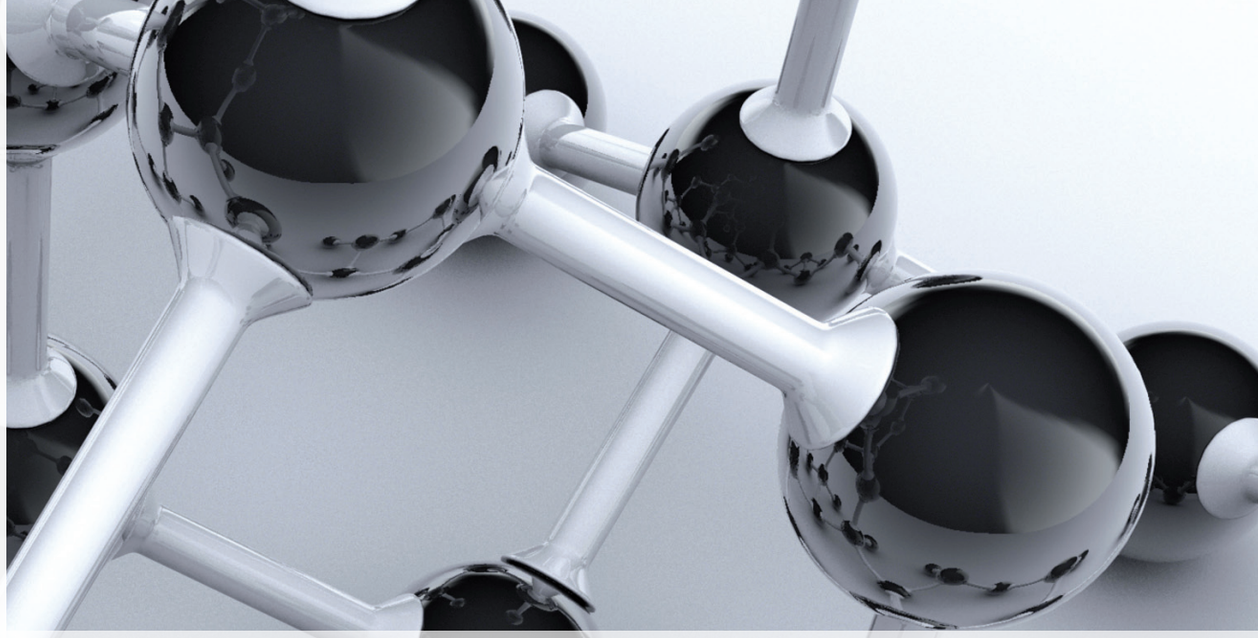
XVI SYMPOSIUM IN PESTICIDE CHEMISTRY

Mattioli 1885

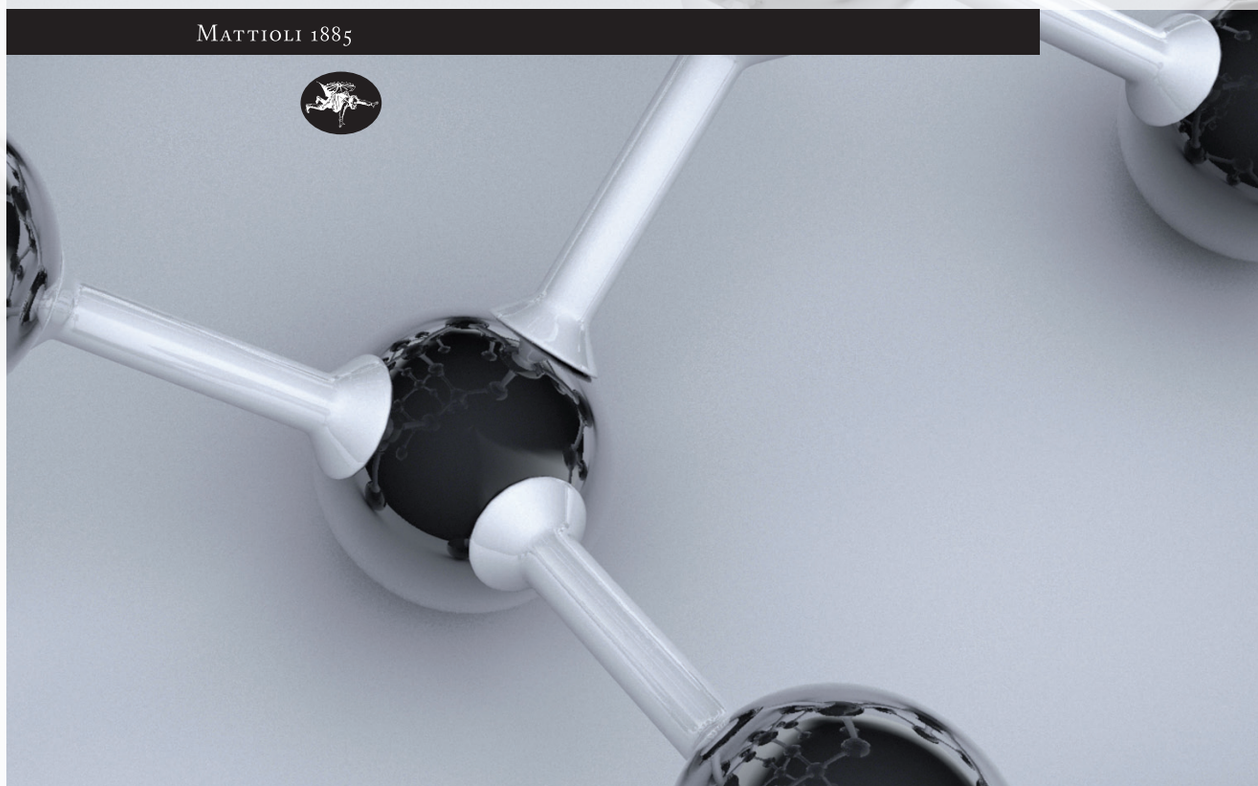


XVI SYMPOSIUM IN PESTICIDE CHEMISTRY

ADVANCES IN RISK ASSESSMENT AND MANAGEMENT

Editors: Nicoleta Alina Suciu, Begoña Maria Miras Moreno

Mattioli 1885



EDITORS: NICOLETA ALINA SUCIU, BEGOÑA MARIA MIRAS MORENO

XVI SYMPOSIUM IN PESTICIDE CHEMISTRY

ADVANCES IN RISK ASSESSMENT AND MANAGEMENT

editors
Nicoleta Alina Suciu, Begoña Maria Miras

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Session III - Environmental fate in air, soil and water

Session V - Ecotoxicology into fate in real world

PRESENTERS

INTRODUCTION

Humanity has recurred to use of products to defend crops since the beginning of domestication of plants and animals about 10.000 years ago. The Romans used ashes, crushed cypress leaves and diluted urines to protect their crops. Marcus Terentius Varro, known in his time as the most learned of all the Romans, is credited with discovering the first chemical weed killer in the first century B.C. He noted that amurca made from crushed olives was toxic to ants, moles, and weeds. He also spuriously noted that whenever amurca seeped from olive oil presses onto the ground, the ground became barren, although this was likely due to the addition of salt to the olives before they were pressed. In any case, Varro began recommending amurca application for all noxious weeds.

The development of modern pesticides began in the 1940s, when Europe faced food shortages and rationing in the wake of World War II and the protection of crop yields had heightened importance. The combination of technological advancements in machines together with the increased use of fertilizers and pesticides after World War II, allowed agricultural productivity to take another step forward. With the "Green revolution", a wide range and a bigger amount of synthetic products have been developed to give much safer, more targeted and effective control of pests and diseases. In terms of the rate in technological change, the Green Revolution was the first major radical innovation in agriculture for several centuries since the introduction of the plough.

Ancient olive press at Irtem, Morocco (by Mark Horrell).

The use of pesticides must be taken into account in order to have food and feed in sufficient quantity to ensure enough food for the increasing population in the light of a possible "sustainable intensification". However, the use of synthetic compounds in agriculture is subject of much debate in public and private institutional arenas in last decades. The use of pesticides became a clear matter of contention for the first time in 1962, when Rachel Carson published her book "Silent Spring", providing compelling evidence of the environmental effects of DDT, especially on the survival of bird species. Silent Spring made the potential environmental problems a social and political concern and its publication can be considered the origin of environmentalist movement.

To face the fears of citizens, governments developed

Spraying pesticide in California (by Charles O'Rear USDA).

Ibis eggs that failed to hatch as a result of DDT (by George Silk, TimePix).

pesticide policies starting from the 70's. The central purpose of pesticide policy is usually to place on the market pesticides that do not cause unacceptable risks to humans and the environment. It is policy of a technical nature, revolving around the registration of pesticides and the deliberations of scientific experts, but it also turns into a social policy, since when talking about risks and decisions have to be taken about risks, ethical implications are introduced.

The White Paper on governance was born to respond to the mistrust of many of the Union's citizens and to the increasing alienation from politics at global and local level. Its aim was to connect governance with food safety issues and argued that the food crisis had undermined consumer confidence in the safety of the food chain.

The creation of European Food Safety Authority (EFSA) was central in the governance reform initiated by the White Paper, as part of the search for good governance forms in the EU context, an organizational response to the food scandals which undermined consumer confidence in the safety of the food chain *("…a European Food Authority will enhance the Union's scientific capability, transparency and networking in the area of food safety")*

EFSA's role in pesticide regulation.

Even if "*the EU's Food Chain is the most stringent and controlled with respect to pesticides residues, is one that we are very serious about continuously improving*" declared Vytenis Andriukaitis, EU commissioner for Health and Food Safety.

In the context of a continuous improving for a safety food and a sustainable use of pesticide to reduce the risks and impacts on human health and the environment, the scope of the XVI Edition of Symposium in Pesticide Chemistry is to give insights towards:

- novel, effective and comprehensive approaches for the reliable and accurate monitoring of pesticides and their transformation products;
- risks and advantages in risk assessment including the use of models and integrated practices, spatial scale and multi-stress situations, as well as the connection to international policies;
- environmental fate of pesticides from laboratory to landscape level, including the assessment of the mechanisms determining the fate as well as the modelling of fate into environment;

- achievement of an effective involvement of the whole chain of actors involved in the adoption of sustainable uses of pesticides;
- advances in ecotoxicology concerning birds and mammals, tiered risk assessment for aquatic and terrestrial organisms, as well as assessment on relevant metabolites.

Nicoleta Alina Suciu
Begoña Maria Miras Moreno

PLENARY LECTURE

Dr. Richard Maycock, a scientist with a vast experience in the sector of pesticide science and near to retirement will open the Symposium on Pesticide Chemistry 2019 with a lecture on *"Historical, current & future perspectives in pesticide science"*. With this lecture, Dr. Maycock aims to introduce young scientists in the world of pesticide science, but also to provide to senior scientists his vision about the challenges and the future of this field.

Historical, Current and Future perspectives in Pesticide Science

Richard Maycock

Presenter Richard Maycock

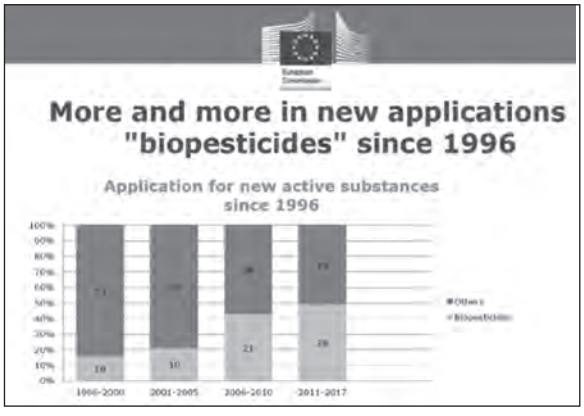
Corteva Agriscience
Route de Suisse 160
1290 Versoix
Geneva, Switzerland
E-mail: richard.maycock@corteva.com

Objectives

- Reference and reminder of the historical use of crop and non-crop pesticides
- Synthetic pesticide introduction – what did we learn?
- Today's challenges & constraints for pesticide development including biopesticides
- Future convergence of technologies & their impact on pesticide use and development

Highlights

- Historical evolution of pesticides to modern day; DDT, first synthetic insecticide with outstanding performance yet controversial impacts and learnings.
- Rapid rise of synthetic chemistry discovering new MOA's & subsequent yield gains
- Critical challenges today including new MOA's, resistance management, regulatory and political pressures
- Rise in biological control methods including biopesticides and perceived benefits over conventional chemistry



- Future convergence of innovative technologies will impact pesticide use as more holistic solution-based value propositions will emerge for the farmer

Graph Bio-pesticides in the EU: Main markets -Spain, -Italy, -France

SESSION I
MONITORING OF PESTICIDES AND THEIR METABOLITES

The definition of pesticide residues (including their metabolites) is essential for the evaluation of compliance to Maximum Residue Levels in food and drink and for surveillance programmes assessing compliance with these standards.
The recent advances in analytics, together with the evolution of regulatory needs and guidance documents have driven the development of monitoring approaches in both environmental and food/feed matrices. In fact, the achievement of such monitoring results is a fundamental step in authorization decisions although inborn challenges have been posed. With this regard, the guidance documents on pre- and post-registration pesticide monitoring pose several critical questions on fitness-for-purposes and demand for robust, effective and sensitive methods overcoming matrix effects and covering both parent compounds and their metabolites. In this framework, either target or untargeted approaches showed some limitation together with inherent advantages, still highlighting the need for future improvement.
This session focuses on novel, effective and comprehensive approaches towards the reliable and accurate monitoring of pesticides and their transformation products into environmental compartments or food/feed commodities.

Session Chairs
- Ingeborg Joris
- Nicoleta Alina Suciu

From plot to catchment scale: contamination of different water types with metazachlor- and flufenacet metabolites

Uta Ulrich, Fohrer Ulrich, Nicola Crosset, Jean-Baptiste Nannette, Marc Voltz

Presenter Uta Ulrich

Institute for Natural Resource Conservation
Dep. Hydrology and Water Resources Management,
Kiel University
Olshausenstr. 75
24118 Kiel- Germany
E-mail: uulrich@hydrology.uni-kiel.de

Objectives

- Monitoring of selected metabolites after application in different types of water bodies
- Comparison of behavior at different scale sizes
- Assessment of temporal dynamics of metabolite concentrations/loads
- Impact of hydrological conditions on metabolites' transport behavior

Highlights

- Selected metabolites were observed in all types of water bodies and at all scales, concentrations were considerably higher than those of the parent compounds
- Selected Metabolites were detected one year after application of parent compounds in concentrations of up to 1.2 µg L-1 in surface water bodies
- Coincidence of storm events during application periods showed strong impact on the metabolites' transport behavior
- So far, Environmental Quality Standards have not been defined for most metabolites in surface water

Conducting groundwater monitoring studies in Europe for pesticide active substances and their metabolites in the context of Regulation (EC) 1107/2009

The SETAC-EMAG GW group

Presenter Anne Louise Gimsing

The Danish Environmental Protection Agency
E-mail: anlgi@mst.dke

Highlights

Groundwater monitoring is recommended as a higher tier assessment in the regulatory groundwater assessment of plant protection products in the European Union, but little guidance has been provided to date on study designs. The SETAC EMAG-Pest GW group (composed of regulatory, academic, and industry scientists) was created in 2015 to establish scientific recommendations for conducting such studies. These recommendations have now been published https://link.springer.com/article/10.1007/s00003-019-01211-x.

The publication address study designs and how the design will depend on the exposure assessment options, vulnerability of monitoring sites, data quality considerations (e,g, sampling schedule, causes of outliers), the use of public monitoring data, information on further hydrological characterisation and information that should be included in reports providing results of groundwater studies.
The presentation will give an introduction to the publication.

Evaluation of the role of dissolved and particulate phases in Chlordecone contamination in rivers

Anatj Samouelian, Lise Ponchant, Patrick Andrieux, Thierry Bajazet, Mégane Crosset, Jean-Baptiste Nannette, Marc Voltz

Presenter Anatja Samouelian

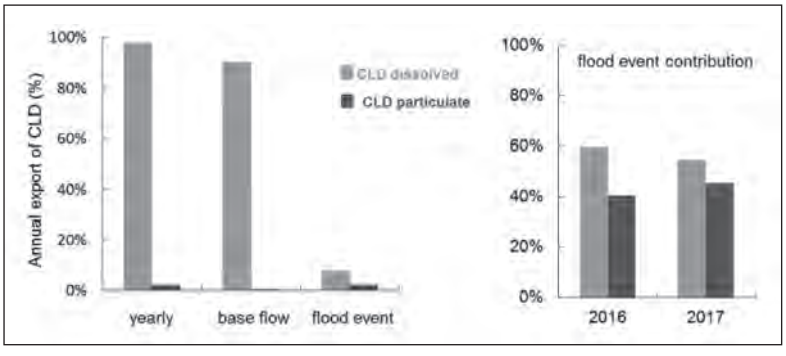
UMR LISAH, Univ Montpellier, INRA, IRD
2 place Pierre Viala
34060 Montpellier – France
E-mail: Anatja.Samouelian@inra.fr

Objectives

- Identification of the main contamination pathways of river flow in the French West Indies by chlordecone (CLD) according to different hydrological situations
- Estimation of the contributions of dissolved and particulate transport of CLD a molecule highly persistent with high sorption properties

Highlights

- CLD was applied in banana plantations from 1972 to 1993 and has led to permanent pollution of soils and rivers in the banana cropping areas.
- A large water sampling scheme over a wide range of flow rates was conducted at the outlet of a 12,8 km² catchment where soils are highly contaminated
- The variation of CLD concentrations proved to be highly non linear with large values for base flow and intense floods as related, for the former, to severe groundwater contamination due to soil leaching and, for the latter, to surface washoff.
- Estimation of CLD export on an annual scale shows a major contribution of the dissolved phase (98%) whereas contribution of the particulate phase is similar to the dissolved phase only for flood events.



Annual export balance in dissolved and particulate CLD according to contrasting hydrological situation -river Pérou, French West Indies

Biogenic residue formation from pesticides in soil: Determination of Dithiocarbamate Fungicides and of their Degradation Products in Fruits and Vegetables by a Multi-Approach Strategy

Alin C. Dirtu, Gwenaëlle Lavison-Bompard, Antoine Ducrocq, Chanthadary Inthavong, Thierry Guérin, Petru Jitaru

Presenter Alin C. Dirtu

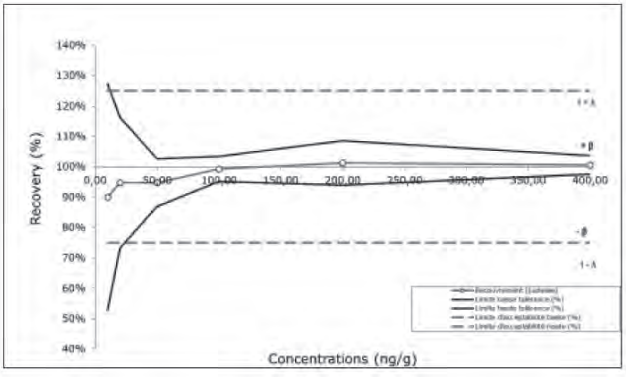
Paris-Est University, French Agency for Food, Environmental and Occupational Health & Safety, ANSES, Laboratory for Food Safety
14 Rue Pierre et Marie Curie
Maisons-Alfort – France
E-mail: alin.dirtu@anses.fr

Objectives

- determination of dithiocarbamate (DTCs) fungicides (per class) and of their degradation products, like ethylene- and propylene-thiourea from fruits and vegetables
- selective and simultaneous determination of the three individually EU regulated DTCs (thiram, ziram and propineb)

Highlights

- the use of the hydrophilic interaction liquid chromatography (HILIC) and reverse phase (RP) HPLC hyphenated to molecular or elemental mass spectrometry (MS) techniques allowed for the detection of organic DTCs, metals and/or sulfur moieties
- selective and simultaneous determination of the thiram, ziram and propineb as well as of the DTCs degradation products was possible by the use of HILIC-MS/MS



Example of the accuracy profile obtained for the in-house method validation for the determination of ethylene-thiourea from fruits and vegetables

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under the Marie Sklodowska-Curie Action. Grant Agreement No. 753053

HRAM-tools for studies of pesticide metabolites in the soil environment

Marit Almvik, Marianne Stenrød, Randi Bolli, Alice Budai, Ingvill Hauso, Olaug Bach, Steinar Haugse, Ole Martin Eklo

Presenter Marit Almvik

Norwegian Institute of Bioeconomy Research (NIBIO)
Høgskoleveien 7
Ås – Norway
E-mail: marit.almvik@nibio.no

Objectives

- Gain a better understanding of the fate of pesticides in the environment by also screening and detecting their metabolites
- Predict and detect pesticide metabolites in soils using high resolution accurate mass (HRAM) tools; Thermo Q Exactive orbitrap and Compound Discoverer™ software.

Highlights

- We present *in silico* metabolism simulation to predict fungicide metabolites in soil
- We present a screening method for 800 pesticides and metabolites in soil and food, exemplified with soil samples from strawberry field degradation studies (including fluopyram, boscalid and pyraclostrobin and others)
- We address the lack of molecular formulas for known metabolites in current databases as an obstacle in establishing HRAM screening methods

Strawberry fields were sprayed with a range of fungicides. The Compound Discoverer software generated a list of predicated and detected metabolites of the fungicides in the soils.

Long-term root uptake of trifluoroacetic acid (TFA) by winter wheat during a whole vegetation period

Marion Beckmann, Maximilian Küppers, Henning Schiedung, Marc Lamshöft, Gerald Reinken, Klaus Hammel

Presenter Marion Beckmann

Bayer AG, Crop Science Division, Environmental Safety
D-40789 Monheim, Germany
E-mail: marion.beckmann@bayer.com

Objectives

- measurement of root uptake of trifluoroacetic acid (TFA) by winter wheat under semi-field conditions in large soil mesocosms for a complete vegetation period
- comparison with 2018 study with respect to contrasting soil properties.

Highlights

- a long-term outdoor container study is conducted with ^{14}C-labeled trifluoroacetic acid (Na-salt) and two contrasting soils (Monheim 4 and Wurmwiese, both sandy loam soils, one alkaline and one acidic) The freely draining containers (1 m^2, 0.5 m deep, filled soil column), kept in a roofed vegetation hall, experience approximate outdoor weather conditions; natural rainfall was simulated by corresponding irrigation. TFA was soil applied at BBCH 12-14 of winter wheat and the uptake was determined for the whole vegetation period until harvest. Material balance of the applied radioactivity was determined (shoots, roots, percolate, soil). Dynamic root growth was characterized with a high-resolution in-situ root imager.

Set up of the outdoor container study in the roofed vegetation hall, devices for percolate sampling.

Advice and voluntary action help keep water clean

Steven Bailey, Antony Williamson

Presenter Steven Bailey

Catchment Sensitive Farming (CSF),
Natural England,
Telford
UK
TF3 4LR
E-mail: steven.bailey@naturalengland.org.uk

Objectives

- To provide monitoring evidence that catchment management through CSF is effective at reducing pesticide levels in rivers over time
- To investigate the changes in pesticide levels against a background of other macro-controlling factors, for example pesticide usage and river flow
- To assess a combination of indicators and examine the 'weight of evidence' for improvements brought about by CSF

Highlights

- River monitoring for 12 crop years shows CSF is delivering significant reductions in overall pesticide levels
- Taking the first three years as our baseline, the average of the subsequent nine years for the headline indicators shows a change of -37.8%
- Individual headline indicators show average reductions between -33.7% and -44.9%
- Within these average improvements, there is a wide range of positive and negative variation (+30.7% to -68.8%)

Headline indicators

Indicator of CSF influence	Average years 1-3	Average years 4-12	Average change	Range	
Annual % samples >0.1µg/l (5 pesticides)	5.9%	3.9%	-33.7%	30.7%	- 67.5%
Monthly % samples >0.1µg/l (10 pesticides)	5.4%	3.3%	-36.6%	-8.0%	-64.9%
Average annual conc. µg/l (5 pesticides)	0.0174	0.0096	-44.9%	7.0%	-68.8%
Average river load g/ha of catchment (5 pesticides, 4 sites)	1.8	1.1	-36.0%	-20.1%	-58.5%
Average headline change			-37.8%		

Pesticide Occurrence and Water Quality Assessment from an Agricultural Influenced Tropical Region

Juan S. Chin-Pampillo, Didier Ramírez-Morales, Marta E. Pérez-Villanueva, Paula Aguilar-Mora, Mario Masis-Mora, Victor Arias-Mora

Presenter Didier Ramírez Morales

Universidad de Costa Rica
Montes de Oca
San José – Costa Rica
E-mail: didier.ramirezmorales@ucr.ac.cr

Objectives

Develop a water quality and pesticide monitoring study in three agricultural influenced micro-catchments from Reventazón-Parismina basin in Costa Rica during 2012-2014

Highlights

The monitoring campaign detected eight different pesticides in the three micro-catchments with concentration from 0.037 µg/L to 13.49 µg/L. Physicochemical water quality was assessed according to the Canadian Council of Ministers of the Environment Water Quality Index, resulting in marginal and poor quality for over 60% of sampling sites. Results show vulnerability in the micro-catchment due the agricultural practices in the region.

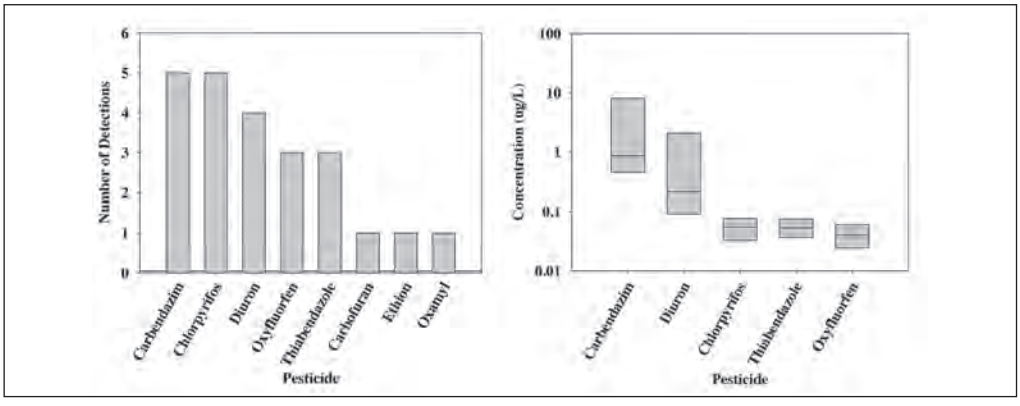


Figure 1. Detection frequency (left) and box plot of concentrations (right) for pesticides found in the monitoring campaign for three micro-cathment in the Reventazón-Parismina basin, Costa Rica.

Copper occurrence in groundwater of Tidone Valley, an area with intensive viticulture

Roberta Zambito Marsala, Ettore Capri, Nicoleta Suciu

Presenter Roberta Zambito Marsala

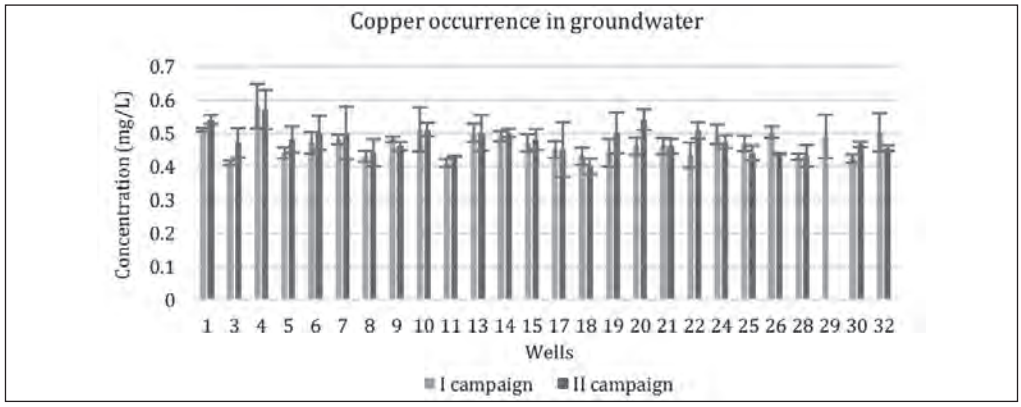
DISTAS
Università Cattolica del Scaro Cuore
Via Emilia Parmense, 84
Piacenza - Italy
E-mail: roberta.zambitomarsala@unicatt.it

Objectives

- This study is part of the *Ecoresiliente* project, which has as objective the development of the best practices, indicators and good policies supporting the preservation of ecosystem services
- Investigate the impact of the viticulture on groundwater quality in Tidone Valley, Northern Italy, through monitoring of Copper fungicides during 3 years project

Highlights

- The quality of groundwater in this area was never investigated before
- 26 wells have been selected for the monitoring network in Tidone Valley
- The monitoring results revealed that the copper occurrence did not exceed the EQSgw
- The copper presence in groundwater may depend on the characteristics of the soil of the study area



Copper occurrence in groundwater samples

Occurrence of pyrethroids and chlorpyrifos in various products representing Czech food basket

Mraz Petr, Kratky Frantisek, Drabova Lucie, Kocourek Vladimir, Hajslova Jana

Presenter Petr Mraz

University of Chemistry and Technology
Prague, Czech Republic
E-mail: mrazp@vscht.cz

Objectives

- To monitor pyrethroids and chlorpyrifos residues in a broad spectrum of food commodities available at the Czech market
- To estimate a Czech consumers dietary exposure

Highlights

- More than 1000 food samples of plant origin were analysed
- In 53 % samples was at least one pesticide residue detected.
- Chlorpyrifos and chlorpyrifos-methyl were detected in 94 (17 %) samples, mostly in teas, followed by citrus fruits and apples.
- Pyrethroids were detected mostly in teas, followed by citrus fruits, bananas and stone fruits.

Acknowledgement: This work was supported by METROFOOD-CZ research infrastructure project (MEYS Grant No: LM2018100) including access to its facilities, HBM4EU – European Human Biomonitoring Initiative (SC1-PM-05-2016, H2020-SC1-2016-RTD No. 733032) and by the project OPPC CZ.2.16/3.1.00/21537 and the project NPU I LO1601.

Work of a SETAC Group on Groundwater Monitoring: Vulnerability Assessment and Site Characterisation

Benedict Miles

Presenter Benedict Miles

BASF SE
Speyerer Strasse 2
Limburgerhof
Germany
E-mail: Benedict.miles@basf.com

Objectives

- Presenting aspects of the recently published work of the SETAC group EMAG Groundwater on conducting groundwater monitoring studies in Europe for pesticide active substances and their metabolites in the context of regulation (EC) 1107/2009
- Giving an overview of the concepts, methods and approaches used for groundwater vulnerability assessment and site characterisation

Highlights

- Application of groundwater vulnerability mapping in study design (targeting locations to monitor) and interpretation (context setting)
- Concept of site characterisation to address the questions of leaching vulnerability at the monitoring location and connectivity of the sampling point to treated fields

Work of a SETAC Group on Groundwater Monitoring: Monitoring Study Designs

Andrew Newcombe

Presenter Andrew Newcombe

Arcadis U.S. Inc.
824 Market Street
Wilmington, Delaware
USA 19801
E-mail: andy.newcombe@arcadis.com

Objectives

- Presenting aspects of the recently published work of the SETAC EMAG expert group on conducting groundwater monitoring studies in Europe for pesticide active substances and their metabolites in the context of regulation (EC) 1107/2009
- Giving an overview of the groundwater protection goals and monitoring study design approaches.

Highlights

- Definition of exposure assessment options.
- Presentation of representative groundwater monitoring study designs to address specific exposure assessment options.

Assessing Kinetics of Low-Level Metabolites

Simon Ford, Johannes Witt, David Patterson, Sabine Beulke, Dieter Schaefer, James Hingston, Russell Jones, Ian Hardy, Mark Thomas, Beate Erzgräber

Presenter Simon Ford

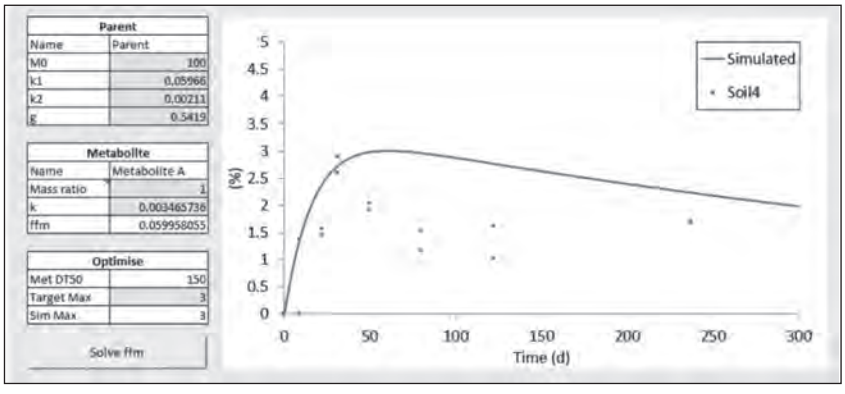
Battelle UK Ltd.
29 Springfield Lyons Approach
Chelmsford – UK
E-mail: s.ford@battelleuk.com

Objectives

- Develop guidance for "low-level" metabolites within update to FOCUS kinetics
- Provide framework and options for consistent assessment of "low-level" metabolites
- Allow for derivation of acceptable endpoints where robust free fitting not possible
- Combination of existing and new/developed methods in a harmonised approach

Highlights

- "Low-level" metabolite defined as typically less than 5% of applied parent equivalent
- Endpoints desirable where observed in lysimeter or another soil at significant levels
- Methods/guidance developed for two distinct scenarios where fitting is desirable
- Formation fractions calculated considering parent and metabolite applied study data
- Method included for situations where a metabolite is not observed in a particular soil
- Example assessments and tools developed for inclusion in FOCUS guidance update



Example output from tool calculating a formation fraction to provide max observed "low-level" metabolite occurrence combining parent DT50 and metabolite applied study DT50 from a matched soil

Lipophilicity matters - a new look at experimental TSCF data from literature

Carola Schriever, Marc Lamshoeft

Presenter Marion Beckmann

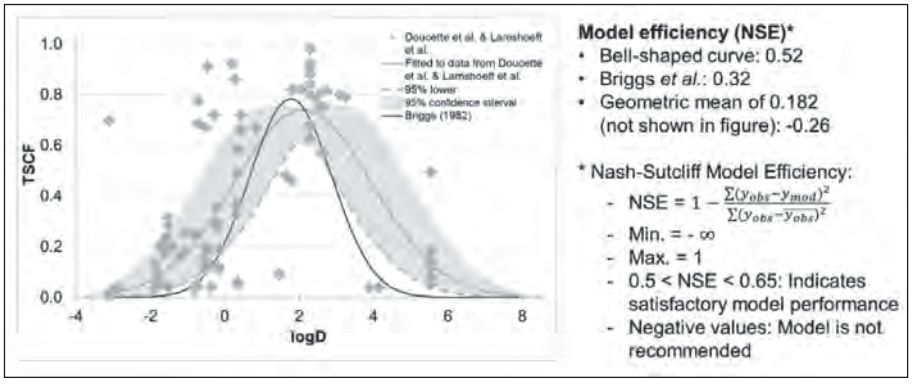
Bayer AG, Crop Science Division, Environmental Safety
D-40789 Monheim, Germany
E-mail: marion.beckmann@bayer.com

Objectives

- Analyse experimental Transpiration Stream Concentration Factor (TSCF) data reported in literature for the lipophilicity of the compounds during testing.
- Investigate if the empirical relationship between TSCF and logKow established by Briggs e*t al.* (1982) also applies for ionizable compounds and crops other than barley.

Highlights

- TSCF data from hydroponic experiments with non-ionised or ionised compounds and various crops (Doucette *et al.*, 2018; Lamshoeft *et al.*, 2018) were analysed for compound lipophilicity at test conditions (pH) (n = 97).
- TSCF values change with logD of compounds suggesting a bell-shaped relationship
- The curve by Briggs *et al.* (1982) overlaps or is lower than the 95% confidence interval (95% CI) of the presented fit.
- The lower limit of the 95% CI could be used as a conservative representation.



TSCF data from literature plotted over corresponding logD values (n=97): Fitted curve and 95% CI are compared to curve by Briggs et al. (1982).

Plant Uptake – Results and status of regulatory predictions and experiments

Herbert Resseler, Marc Lamshoeft, Carola Schriever, Robin Sur, Paul Sweeney, Petra Volz, Sarah Webb, Xiao Zhou, Mark Winter

Presenter Herbert Resseler

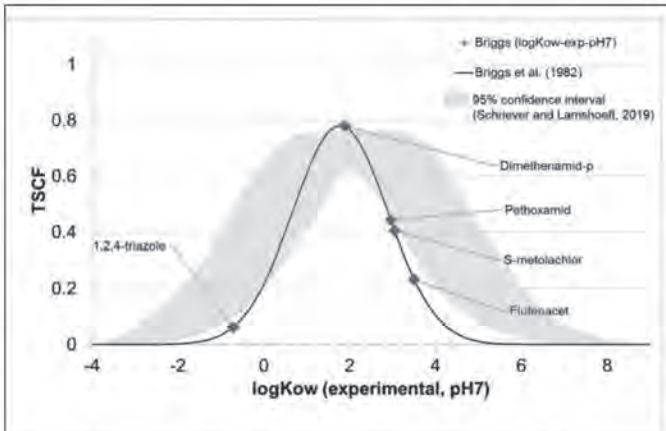
ECPA/IVA Working Group "Plant Uptake Factor"
German Crop Protection Industry Association (IVA), Frankfurt/Main, Germany
E-mail: herbert.resseler@syngenta.com

Objectives

Transpiration Stream Concentration Factor values for modelling compound uptake by plant roots can be i) predicted from log wwKow data or ii) determined in uptake experiments (EU Sanco/13144/2010, 2014). ECPA/IVA group re-evaluates published TSCF data regarding i) and supports OECD guideline development for ii).

Highlights

High and medium quality uptake experiments indicate that TSCF values change with logD suggesting a bell-shaped relationship (Schriever & Lamshoeft 2019). Results for substances of recent regulatory interest calculated with this relationship confirmed the applicability of Briggs' empirical relationship, which is shown to be within or largely below the confidence interval for TSCF proposed by S & L. Thus modelling using Briggs' TSCF provides conservative estimates for leaching assessments.



TSCF (Briggs) in line with independent TSCF data (S & L)

	TSCF	
	Briggs [1]	Mean * [2]
124t	0.06	0.24
Di-p	0.78	0.74
Pet	0.44	0.67
S-m	0.40	0.65
Flu	0.23	0.56

*only 95% confidence interval is shown in figure

[1] Briggs et al., 1982. Pestic. Sci. 1982. 13. 495-504.

[2] Schriever & Lamshoeft, 2019. SETAC Helsinki.

[3] Lamshoeft et al. 2018

Herbicide transformation in different agricultural soil types and depths

Sandra Willkommen, Jens Lange, Uta Ulrich, Nicola Fohrer

Presenter Willkommen, Sandra

Christian-Albrechts-University of Kiel,
Institute of Natural Resource Conservation,
Department of Hydrology and Water Resource Management
Olshausenstr. 75 - Kiel – Germany
E-mail: marion.beckmann@bayer.com

Objectives

- investigation of the herbicide flufenacet and its transformation products (F-OA and F-ESA) in different agricultural soils after herbicide application
- to gain a better understanding of herbicide transformation in soil depending on soil types and layers

Highlights

- flufenacet moved faster in sandy soils into the deeper soil layers (e.g. 30-60 cm after 15d of application) compared to loamy soils (30-60 cm after 57 d)
- displacement of transformation products to deeper layers depends on prevailing soil moisture conditions (e.g. F-ESA was leached down to 60-90 cm within 50d)
- maximum concentrations of transformation products were detected after 16 days during wet soil conditions and after 50 days of application during dry soil conditions

Two plot experiments with fluorescent tracer application on sandy and loamy soil sections were conducted on the same field (study is still ongoing)

Consideration of plant growth when deriving a foliar DT_{50} suitable as input for modelling

Gerald Reinken, Andrew Charles Chapple, Juliane Ziske

Presenter Gerald Reinken

Bayer AG, Crop Science Division,
Environmental Safety
D-40789 Monheim, Germany
E-mail: gerald.reinken@bayer.com

Objectives

- The foliar DT50 is a standard input parameter for FOCUSsw exposure modelling. The decline of washable foliar residues can be experimentally determined in dislodgeable foliar residue (DFR) studies. DFR studies are well established and regulatory accepted to refine the re-entry exposure of workers and bystanders.
- The potential impact of plant growth was assessed by targeted DFR studies suitable to derive a DT50 value as input for FOCUS modelling.

Highlights

- Dilution of foliar residues by plant growth is a suitable process for the re-entry exposure situation but plant growth should not be included as part of a foliar DT50 as input for modelling. Standard exposure modelling does not consider crop architecture; rather a very simplistic zero dimensional crop model is used. Only the total amount of residues on leaves is modelled without consideration of plant growth.
- Targeted DFR studies have been conducted suitable to derive a DT50 value as input for FOCUS modelling:
  a) Spring wheat plants are protected in the field against rain after foliar fungicide application in order to exclude potential losses via wash-off.
  b) The protective foil allows approx. 85% of UV light to penetrate and the tunnels are open to allow moderate air exchange.
  c) Plant growth is characterized by daily determination of the leaf area.
- Results from two European locations (France and Poland, cropping season 2018) are presented and discussed.
- The experimental data indicate that plant growth does not significantly influence the decline of foliar residues after fungicidal application to spring wheat during stem elongation and end of inflorescence development stage (BBCH 31 – 59).

Increasing the persistence of allelochemicals in soil for their potential use as biopesticides

Beatriz Gámiz, Gracia Facenda, Rafael Celis

Presenter Beatriz Gámiz

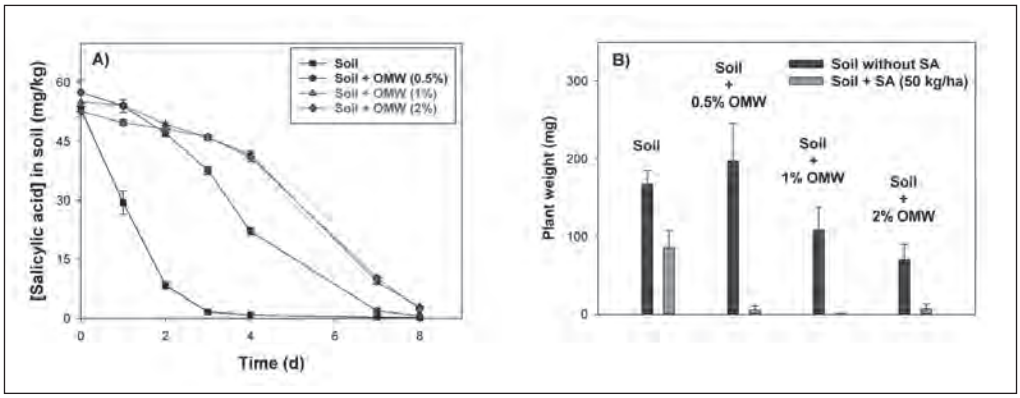
Instituto de Recursos Naturales y Agrobiología de Sevilla (IRNAS, CSIC)
Avda. Reina Mercedes, 10 Sevilla – Spain
E-mail: bgamiz@irnase.csic.es

Objectives

- assess how the addition of olive-mill waste (OMW) at a rate of 0.5, 1 and 2% (w/w) affects the bioavailability of salicylic acid (SA) in soil;
- assess the dissipation of SA and soil respiration in soil amended with OMW;
- evaluate the phytotoxic activity of SA in unamended and in OMW-amended soil.

Highlights

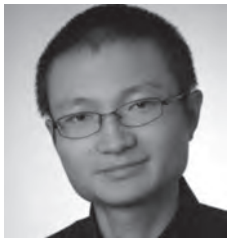
- The persistence of SA in the soil increased with OMW dose;
- The addition of OMW to the soil did not increase the adsorption of SA;
- Soil respiration was enhanced by the addition of OMW. The microorganisms were able to utilize OMW as supplemental C source;
- Bioassay experiments showed that the greater persistence of SA in OMW-amended soils resulted in greater SA phytotoxicity towards *Eruca vesicaria;*ww



A) Dissipation curves of SA after the addition of OMW to soil at 0.5, 1 and 2%, B)Effect of SA applied at 50 kg ha^{-1} to soil and OMW-amended soil on aerial biomass of Eruca vesicaria

Using a higher-tier coupled modelling approach to support the evaluation of monitoring studies

Wenkui He, Paul Edwards, Dirk Liss, Stefan Reichenberger, Sebastian Multsch, Markus Schneider, Paul Sweeney, Herbert Resseler



Presenter Wenkui He

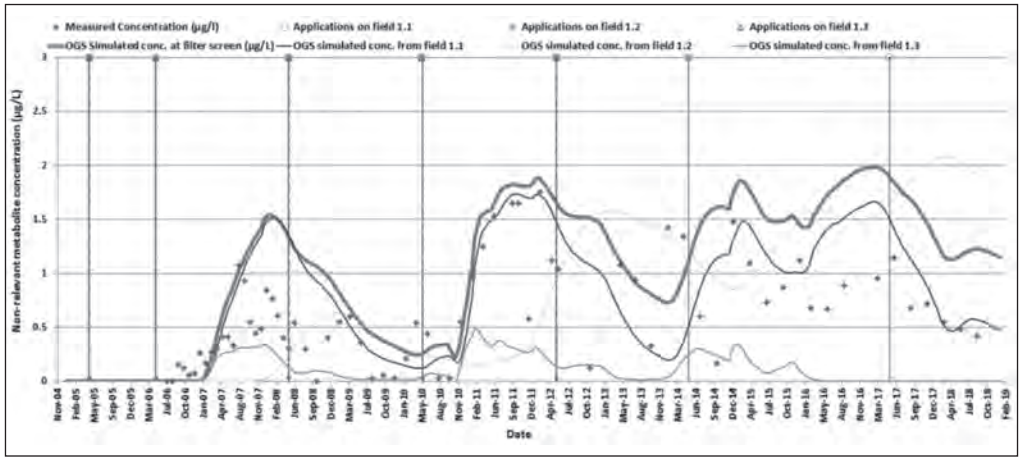
knoell Germany GmbH
Konrad-Zuse-Ring 25
68163 Mannheim – Germany
E-mail: whe@knoell.com

Objectives

To support the evaluation of groundwater monitoring data on a sub-catchment scale and address regulatory concerns with regard to representativeness of sampling, hydraulic connectivity and well/screen position using a higher-tier modelling approach (coupling 1D PEARL and the multi-dimensional groundwater model OpenGeoSys)

Highlights

- The modelled concentrations fit to the measured concentrations resulting at the well in catchments where up-gradient agricultural fields received multiple treatments.
- A sensitivity analysis was performed to evaluate the representativeness of the higher tier monitoring approach and to identify relevant factors for study assessments.



Comparisons of measured and simulated concentrations ("OGS simulated conc. at filter screen": applications on all fields simulated simultaneously; "OGS simulated conc. from field 1.1/1.2/1.3": applications from three different fields simulated individually)

Occurrence and context associated with monitoring of triflusulfuron methyl in groundwater in Italy

Neil Mackay, Cecilia Hirata, Frederico Ferrari, Gerco Hoogeweg

Presenter Neil Mackay

FMC Agro Limited
8 Cardale Court, Cardale Park
Beckwith Head Road
Harrogate, HG3 1RY
UK

Objectives

- Triflusulfuron methyl is a sulfonylurea herbicide used for selective post-emergence control of broadleaf and grass weeds in sugar and fodder beets.
- In 2016, the Italian authorities requested FMC perform retrospective groundwater monitoring for triflusulfuron-methyl and selected soil metabolites in representative, but vulnerable sugar beet production areas associated with triflusulfuron methyl use.
- This poster summarises site selection criteria, spatial vulnerability context and available monitoring results

Highlights

- Borehole selection was critical and achieved by obtaining documented triflusulfuron methyl end-use product application to up-gradient fields.
- The relevance of the monitored boreholes was confirmed by establishing a hydrological gradient from site of product application and or the relative transit time
- Additional criteria were considered including soil characteristics to groundwater depth in order to refine the final selection of boreholes.
- Results of analysis show measurable detections of triflusulfuron methyl across the twelve monitoring boreholes, confirming association with use
- The maximum concentrations detected were near the limit of detection.
- Soil metabolites were analyzed for, but not detected.
- Additional efforts to better understand the site relevance for risk assessment purposes included investigations with spatially distributed modelling for contextualization.

Development of a Method for the Determination of Pesticides in Avocado Fruit by QuEChERS and Liquid Chromatography-Mass. Analysis of Field Samples

Pilar Sandín-España, M. M. Mateo, C. López, M.J. Patiño-Ropero, J. L. Alonso

Presenter Pilar Sandín España

Unit of Plant Protection
Product, INIA
Crta. La Coruña Km. 7.5
Madrid – Spain
E-mail: sandin@inia.es

Objectives

- The determination of the residues in avocado fruits of dichlorprop-p, hexythiazox, fenpyroximate, etoxazole and spirodiclofen by a QuEChERS method followed for an analysis by liquid chromatography-tandem mass spectrometry (HPLC-MS/MS).
- The determination of dichlorprop-p includes its esters and conjugates.

Highlights

- QueChERS method used a citrate extraction kit followed by a purification step performed by a EMR lipid dSPE and a final polish EMR-Lipid was optimized.
- Studies at fortification levels of 0.03 mg/kg and 0.3 mg/kg gave mean recoveries ranging from 80 to 108% for all compounds
- Sensitivity and selectivity of the HPLC-MS/MS method allowed quantitation of the analytes in real samples of peel and pulp at low levels with a run time of 10 min.

Compound	Concentration Range (mg/kg) R^2	LOD (mg/kg)	LOQ (mg/kg)	Fortification level (mg/kg)	% Mean Recoveries (RSD%) Peel	% Mean Recoveries (RSD%) Pulp
Dichlorprop-p	(0.0075-0.15) 0.99	$3.9x10^{-1}$	0.03	0.03 0.3	108.4 (9.42) 85.17 (8.40)	88.3 (5.51) 100.9 (3.42)
Hexythiazox	(0.015-0.15) 0.99	$0.22x10^{-1}$	0.03	0.03 0.3	98.10 (4.08) 90.41 (3.89)	84.83 (4.42) 83.99 (6.27)
Fenpyroximate	(0.015-0.15) 0.99	$1.57x10^{-1}$	0.03	0.03 0.3	108.3 (3.86) 98.01 (2.65)	94.79 (2.75) 88.42 (6.23)
Etoxazole	(0.015-0.15) 0.99	$6.0x10^{-1}$	0.03	0.03 0.3	102.5 (3.71) 92.93 (2.56)	87.57 (2.99) 82.87 (6.28)
Spirodiclofen	(0.015-0.15) 0.99	$1.35x10^{-1}$	0.03	0.03 0.3	99.64 (3.83) 89.90 (1.81)	87.87 (6.19) 80.97 (6.61)

Determination, linearity, limits of detection (LOD), limit of quantification (LOQ), fortification level, and recovery and precision (% RSD) for the matrix avocado in peel and pulp.

Preliminary results from an in-depth study on pesticide exposure of children living in the rural Western Cape, South Africa

Céline Degrendele, Jiři Kohoutek, Mufaro Mugari, Petra Fišerová, Petr Šenk, Roman Prokeš, Martin Röösli, Mohamed Aqiel Dalvie, Jana Klánová, Samuel Fuhrimann

Presenter Céline Degrendele

Research Centre for Toxic Compounds in the Environment (RECETOX), Masaryk University
Kamenice 5
Brno, Czech Republic
E-mail: celine.degrendele@recetox.muni.cz

Objectives

- To evaluate pesticide levels in the environment (in air, soil and dust) and in the urine of children from two different agricultural areas during the pesticide spraying season
- To assess the temporal and spatial variations of pesticide levels in different matrices

Highlights

- More than 200 samples of air, soil, dust and urine were collected and analyzed for 38 pesticides and 13 pesticide metabolites using liquid chromatography and mass spectrometry
- In the air and soil samples, no clear temporal variations were generally found, while spatial variations were pesticide-specific
- The dialkyl phosphate metabolites were found in all urine samples from the 40 children participating in the study and revealed some spatial differences

Pesticides in the African air

Samuel Fuhrimann, Jiři Kohoutek, Martin Röösli, Mohamed Aqiel Dalvie, Petra Přibylová, Jana Klánová, Céline Degrendele

Presenter Céline Degrendele

Research Centre for Toxic Compounds in the Environment (RECETOX), Masaryk University
Kamenice 5
Brno, Czech Republic
E-mail: celine.degrendele@recetox.muni.cz

Objectives

- To provide novel data on pesticides in the atmosphere using passive sampling over 13 African countries between 2011 and 2017
- To compare the detection frequencies of 38 pesticides according to the type of site
- To assess the spatial and seasonal variations of the detected pesticides

Highlights

- More than 150 samples collected at 22 sampling sites from 13 African countries were analyzed for 38 pesticides over seven years
- Atrazine, chlorpyrifos, carbaryl, terbuthylazine and metolachlor showed the highest detection frequencies (>34%)
- For most pesticides, the highest pesticide levels were generally found around agricultural sites
- At one site where the sampling occurred from 2011 to 2017, the annual levels of atrazine and acetochlor significantly increased from 2011 to 2017

Pesticide monitoring and good agricultural practices evaluation in surface and ground water bodies focused on the pineapple production in northern Costa Rica

Greivin Pérez-Rojas, Elizabeth Carazo-Rojas, Laura Brenes-Alfaro, Paula Aguilar-Mora, Melvin Alpízar-Marín, Didier Ramírez-Morales, Juan Chin-Pampillo, Wilson Beita-Sandí, Marta Pérez-Villanueva, Mario Masís-Mora

Presenter Greivin Pérez-Rojas

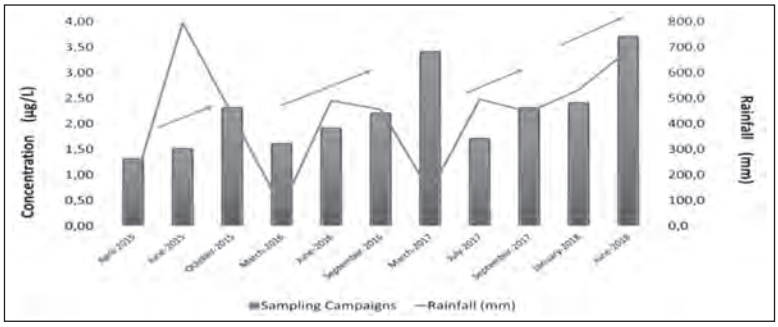
Centro de Investigación en Contaminación Ambiental,
Universidad de Costa Rica
San José, Costa Rica
E-mail: greperez@gmail.com/ greivin.perezr@ucr.ac.cr

Objectives

- Determine the use of agrochemicals and the levels of different contaminants in the pineapple production in northern Costa Rica to implement good agricultural practices and to promote the appropriate use and management of those products.

Highlights

A monitoring study investigated over 100 pesticide active ingredients in surface water, groundwater and sediment samples in northern Costa Rica during 2015-2018. This work was focused on agrochemicals used in pineapple production to implement good agricultural practices and to promote the appropriate use and management of those products. Besides pesticide residues, the study tested the water quality (e.g., emerging pollutants, heavy metals and other physicochemical and microbiological parameters) in 10 groundwater and 22 surface water sampling locations.



Seasonal behavior of bromacil detected in the surface water samples during the period 2015-2018 in northern Costa Rica.

Simulation of the long-term evolution of pesticide concentrations in the Zwischenscholle aquifer using the coupled soil-groundwater model MODFLOW-HYDRUS-MT3DMS

Sahila Beegum, Jan Vanderborght, Michael Herbst, and Jirka Simunek

Presenter Jan Vanderborght

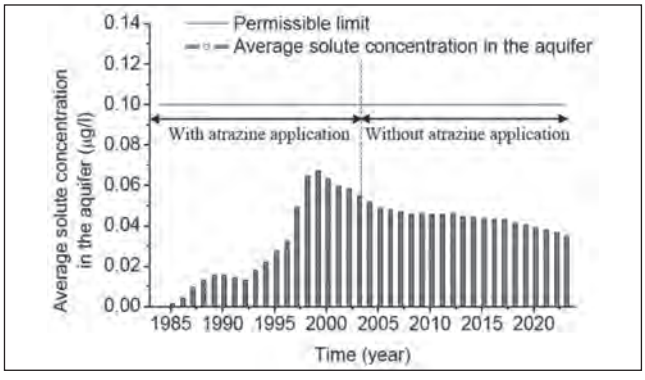
Agrosphere Institute, IBG-3
Forschungszentrum Jülich
Jülich – Germany
E-mail: j.vanderborght@fz-juelich.de

Objectives

We demonstrate the coupled soil-groundwater model MODFLOW-HYDRUS-MT3DMS to simulate spatial temporal evolutions of pesticide concentrations in groundwater. To represent inflow of pesticide from upstream areas, we implemented lopping boundary conditions.

Highlights

The simulation results confirmed a slow response of groundwater concentrations to changes in applications of the pesticide. The temporal stability of the concentration patterns in groundwater could also be confirmed by the simulation results. These results indicate that coupled soil-groundwater simulations can be used to relate groundwater monitoring data to application patterns but that this relation depends on the hydrogeology.



Simulated average annual atrazine concentration in the aquifer

Work of a SETAC group on groundwater monitoring: Use of publicly available groundwater monitoring data in risk assessment

Anne Louise Gimsing, Wolfram König, Arnaud Boivin, Andy Massey, Andy Newcomb, Dirk Liss, Ben Miles, Florian Hegler, Richard Gibson, Robin Sur

Presenter Anne Louise Gimsing

The Danish Environmental Protection Agency,
E-mail: anlgi@mst.dk

Highlights

Results from publicly available groundwater monitoring programs can provide important information to regulators on the current state and possible trends of active substances and their metabolites in groundwater.

In order to use the data for risk assessment purposes it should be characterised with regard to its source, the objective of the monitoring program, how well the data represent the area of interest, and the sampling and analytical methodology used. It is important to set the data in context with the protection goal used in the assessment, e.g. length and depth of the filter screens for sample collection and the age of the groundwater are parameters to classify and evaluate the data in this perspective. Risk assessors need to assess what portion of the available monitoring data is relevant to groundwater quality for the specific active ingredients and metabolites under consideration and for comparison with results from other risk assessment steps.

Both public monitoring data and targeted monitoring data have their value and should be considered for risk assessment purposes, when available. While targeted monitoring studies often provide more detailed information about the wells, the upstream area, the cultivated crops and the pesticide use, publicly available monitoring data usually cover a wider range of compounds and environmental conditions. In this context, information on the current presence of an active substance or metabolite in aquifers from previous uses is essential for decision making. Additionally, results drawn from both types of monitoring data should be compared with results of lower tier risk assessments in a weight of evidence approach.

Public monitoring data compilation for assessing fate and transport of plant protection products: insights, challenges, and opportunities

Andrew Newcombe, Gina Houck, and Leah Martineau

Presenter Andrew Newcombe

Arcadis U.S. Inc.
824 Market Street
Wilmington, Delaware
USA 19801
E-mail: andy.newcombe@arcadis.com

Objectives

- Present lessons learned on data acquisition, integration, evaluation, and reporting of large-scale public monitoring datasets.
- Compare bespoke monitoring data collection outputs to the data from European Environment Agency Waterbase Water Quality Disaggregated Data database.

Highlights

- Key lessons learned following the collection of more than five million individual public monitoring data records covering more than 45 active substances and metabolites.
- The challenges and important considerations when undertaking public monitoring data collection effort are presented.

Developing a long-term exposure monitoring for PPP residues in Swiss soils

Levke Godbersen, Daniel Wächter, Thomas D. Bucheli, Janine W.Y. Wong, Sophie Campiche, Florian Walder, Andreas Gubler

Presenter Levke Godbersen

Agroscope NABO
Reckenholz
Zürich - Switzerland
E-mail: Levke.godbersen@agroscope.admin.ch

Objectives

• develop a soil monitoring strategy for Plant Protection Products (PPP) residues
• complement the existing strategy and collection of Swiss soil monitoring sites
• optimize and extend an existing multiresidue method for chemical analysis
• develop bioindicators and ecotoxicological soil quality criteria

Highlights

To develop a strategy for long-term exposure monitoring of PPP residues in soils, we will define a list of relevant substances based on the following selection criteria: exposition (amount and frequency of usage, measured in soil), environmental-fate (persistence and mobility in soil), ecotoxicological relevance, analytical determinability and stakeholder interest. Furthermore, we will optimize and extend an existing multiresidue method to analyse the selected substances. The thus measured soil residue concentrations shall be paralleled with predicted exposure concentrations, modeled based on actual farmer's records. The goal is to provide a comprehensive inventory of PPP residues in intensively used agricultural soils in Switzerland, on which we will base the long-term monitoring strategy.

SESSION II
PESTICIDE RISK ASSESSMENT

Official bodies are posing a great attention toward the achievement of the holistic investigation of pesticides risk assessment. This implies a reliable assessment of the risk associated to pesticides use, in order to reduce their impact on the total environment. Focusing only on source (including dose) reduction would be rather limitant if the goal is to ameliorate the agriculture footprint. It is now accepted that simply decreasing the amounts of pesticides applied onto crops is not necessarily connected to a decrease in the risk to non-target species and water bodies supply. In fact, a reliable and accurate risk assessment must take into account environmental factors together with the specific pesticide chemical properties. In this framework, it is noteworthy to notice that EC has adopted the Commission Directive 2019/782 establishing Harmonised Risk Indicators to estimate trends in the risks from pesticide use.
Consequently, this session focuses on risks and advantages in risk assessment including the use of models and integrated practices, spatial scale and multi-stress situations, as well as the connection to international policies.

Session Chairs
- Colin Brown
- Lucrezia Lamastra
- Uta Ulrich
- Herbert Resseler

FOCUS Surface Water Repair: After the Repair is before the Repair?

Dieter Schaefer, Andrew Eatherall, Lucas Garcia, Dale Mason, Gregor Spickermann, Neil Mackay

Presenter Dieter Schaefer

Bayer AG, Crop Science Division, Environmental Safety
40789 Monheim, Germany
E-mail: dieter.schaefer@bayer.com

Objectives

- Review the modifications to regulatory aquatic exposure calculations for pesticides proposed by the EFSA WG on FOCUS Surface Water Repair;
- Analyze remaining open points and challenges of the proposals that may require further work;
- Discuss concrete proposals how to address these open points

Highlights

- The proposals of the EFSA Working Group will clearly improve the FOCUS Surface Water approach;
- The strongly event-driven character of aquatic exposure makes a comprehensive analysis of the proposals by means of example calculations difficult;
- A conceptual analysis of the proposals reveals several areas where further development and more realistic process descriptions are urgently needed;
- This includes, in particular (1) the selection of agronomically realistic application dates, (2) the consideration of crop development as a function of weather conditions, (3) the interpretation of exposure patterns in the context of aquatic protection goals;
- A targeted follow-up activity to address such remaining issues would be highly beneficial to ensure the robustness of the FOCUS Surface Water exposure assessment framework

Mitigation measures effectiveness evaluation: Long-term surface water monitoring of pesticides in an agricultural catchment in Belgium

Gisela Quaglia, Ingeborg Joris, Steven Broekx, Nele Desmet, Wesley Boënne, Kim Koopmans, Piet Seuntjens

Presenter Gisela Quaglia

VITO, Flemish Institute for Technological Research, Mol, Belgium
Department of Environment, Ghent University, Ghent, Belgium
E-mail: gisela.quaglia@vito.be

Objectives

- evaluation of the impact of mitigation measures on runoff and pesticide loads in surface water at catchment scale

Highlights

- A catchment in SE Flanders (Belgium) was studied for five years (2014-2018) in an area known for its intensive agriculture (>70%) and frequent detection of pesticides in water bodies
- A combination of time-based and event-based automatic sampling was used to distinguish between stormflow and baseflow conditions and the identification of point losses
- Glyphosate and its major metabolite AMPA were analysed for over 600 samples collected during the agricultural season
- The contribution of different pathways to the pesticide loads and the effectiveness of measures is investigated

Additional buffer strips implemented after risk evaluation of the catchment

Do the repaired FOCUS surface water scenarios result in robust exposure concentrations for the aquatic and sediment risk assessment?

Paulien I. Adriaanse, Michael Stemmer, Wim H.J. Beltman

Presenter Paulien Adriaanse

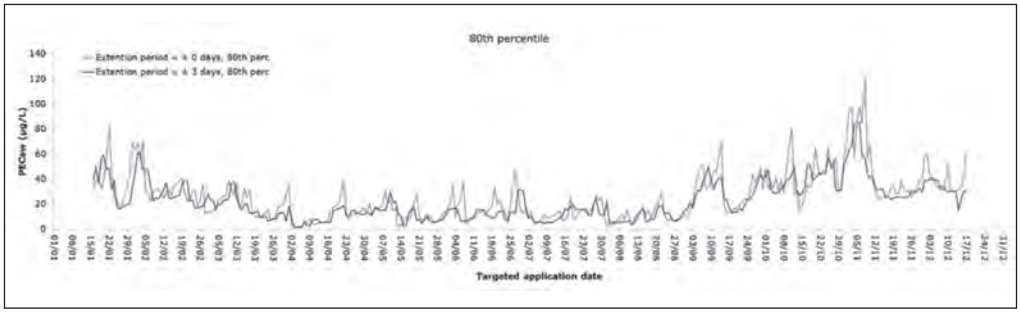
Wageningen Environmental Research (WEnR)
Wageningen University and Research (WUR)
P.O. Box 47
6700 AA Wageningen – The Netherlands
E-mail: paulien.adriaanse@wur.nl

Objectives

- Evaluate whether the repaired FOCUS surface water scenarios result in robust peak exposure concentrations in water (PEC_{sw}) and sediment (PEC_{sed});

Highlights

- A 20-year assessment period with applications positioned within one week of the intended day of application results in reasonably robust peak PEC_{sw};
- The meta model for FOCUS streams (Adriaanse et al, 2017) mimics well peak PEC_{sw} calculated by the TOXSWA model;
- Peak exposure concentrations in the standard FOCUS sediment are compared to those in sediments with higher organic matter contents.



PEC_{sw} (80th percentile of 20 annual peaks, µg/L) as a function of the intended day of application without PAT (blue line) and with proposed PAT (red line), R1 stream (winter cereals, K_{om}=10 L/kg, $DegT_{50,soil}$ = 3 d)

Spatially distributed groundwater modelling using LUCAS-topsoil data

Tim Häring

Presenter Tim Häring

BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: tim.haering@basf.com

Objectives

- Introduction of LUCAS topsoil database
- LUCAS data as a potential soil database for spatially distributed GW modelling in Europe.

Highlights

- •LUCAS topsoil data are soil inventory data of the EU commission and consist of > 22.000 soil samples from EU28 member states (except Croatia), thereof rd. 10.000 from agricultural areas.
- Data are publicly available from the JRC European soil data center and contain geographic coordinates and the values for several soil properties.
- In contrast to other available soil maps, soil properties have been determined by laboratory analysis, which makes LUCAS data a more reliable data source.
- R add-on package was developed for pre-processing the data, to set-up the modelling input files, to run the FOCUS GW model (PEARL or PELMO) and evaluate the output.

Evaluation of pesticide monitoring data for planning risk mitigation actions on the territory: the case of Po valley plain

Andrea Di Guardo, Antonio Finizio

Presenter Andrea Di Guardo

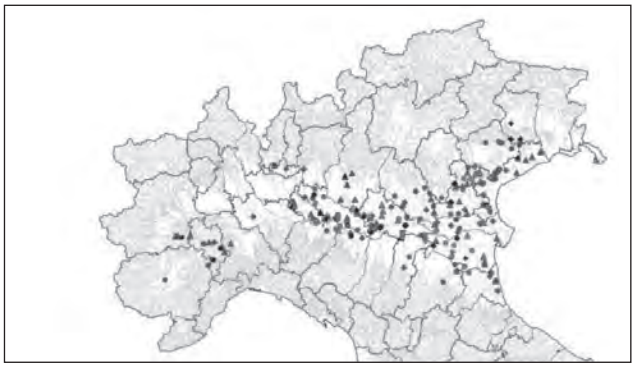
Università di Milano-Bicocca
P.zza della Scienza, 1
Milan - Italy
E-mail: andrea.diguardo@unimib.it

Objectives

- Identification of vulnerable areas to pesticides at landscape level
- Prioritisation on the implementation of risk mitigation measures on the basis of evidence
- Screening methodology for risk assessors using already available monitoring data
- Identification of trends of contamination on a spatial scale

Highlights

- Very large-scale application: 10 years of monitoring data of 1 active ingredient and 1 metabolite have been analysed for the entire Po valley in Northern Italy
- Two phases methodology for the evaluation of vulnerable areas to pesticides
- Phase 1 consists on the realization of maps of statistical analyses (mean, median and 95th percentile) of yearly distribution for each monitoring station compared to Environmental Quality Standards and Predicted No Effect Concentrations
- Phase 2 consists on the combination of trend analysis and risk (number of threshold exceedances): the resulting map provide useful information to identify areas where risk mitigation actions should be foreseen



Map of trend analysis for terbuthylazine in the Po Valley (2008 – 2017 monitoring data)

A novel hydrological model to support landscape-scale aquatic risk assessment

Sebastian Multsch, Florian Krebs, Stefan Reichenberger, Philipp Kraft, Lutz Breuer, Louise Wipfler, Wim Beltman, Thorsten Schad

Presenter Sebastian Multsch

knoell Germany GmbH
Konrad-Zuse-Ring 25
Mannheim – Germany
E-mail: smultsch@knoell.com

Objectives

- Simulate real world water and solute fluxes over landscapes with a fully parameterized hydrological model
- Allow for consistent risk characterization across temporal and spatial scales (poster No 200, Wipfler et al.)

Highlights

- Implementation of a model using the hydrological programming library CMF
- Presentation of stream hydrology of Rummen catchment (Belgium): intensive cultivation of orchards and pest management by using pyrethroides
- Provision of hydrological data for consecutive aquatic fate simulation, e.g. with Cascade_TOXSWA (presentation No 230, Beltman et al.) or STEPS1-2-3-4

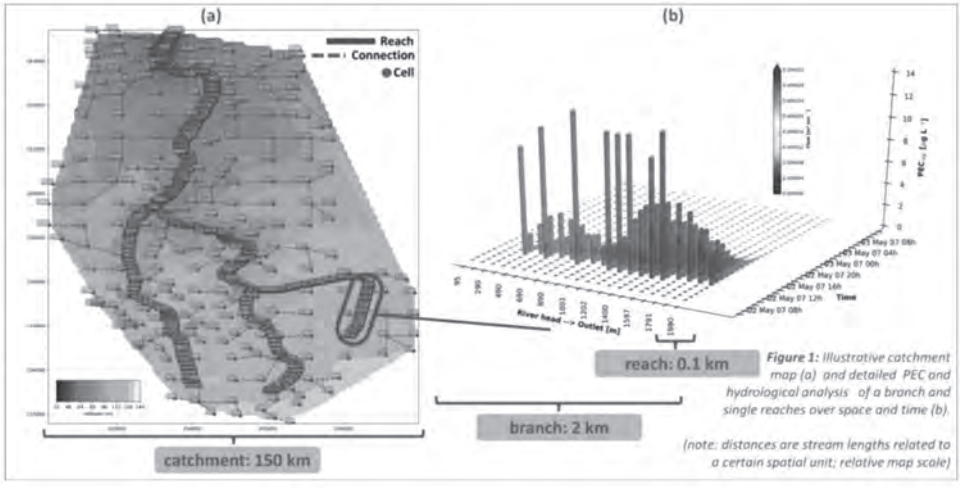


Figure 1: Illustrative catchment map (a) and detailed PEC and hydrological analysis of a branch and single reaches over space and time (b).

(note: distances are stream lengths related to a certain spatial unit; relative map scale)

Integrated assessment of plant uptake of TFA by inverse modelling of a long-term semi-field study with two soils and winter wheat

Klaus Hammel, Stephan Sittig, Gerald Reinken and Marion Beckmann

Presenter Klaus Hammel

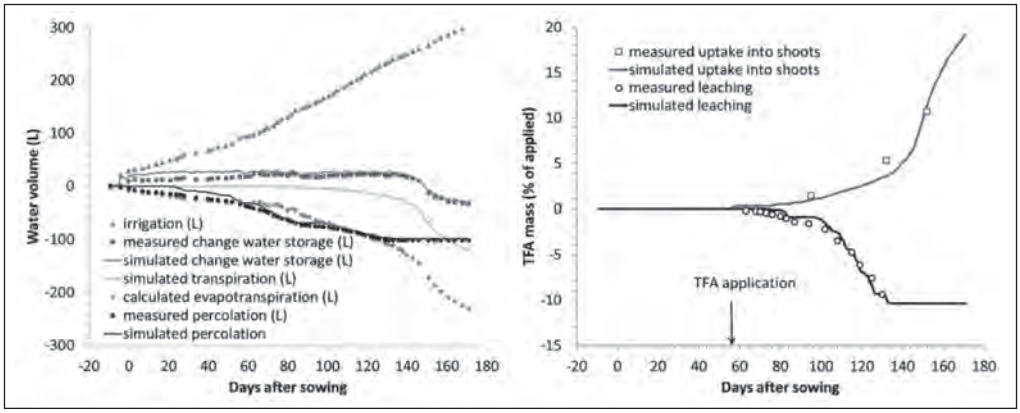
Bayer AG, Crop Science Division, Environmental Safety
D-40789 Monheim, Germany
E-mail: klaus.hammel@bayer.com

Objectives

- measure root uptake of ^{14}C-labeled trifluoroacetic acid (TFA) by winter wheat under semi-field conditions in large soil mesocosms for a complete vegetation period
- derive transpiration stream concentration factor (TSCF) of TFA under realistic environmental conditions by inverse modelling with SWAP and PEST

Highlights

- 8 - 11% of ^{14}C-labelled TFA applied was taken up 96 days after application
- by same time 9 - 30% of TFA applied leached out from soil column (0.55 m)
- water balance could be well reproduced by the model and was calibrated first
- uptake and leaching were fitted very well and a robust TSCF of 0.29±0.04 was obtained for the soil shown below



Water balance (measured and calibrated, left) and TFA mass flows (measured and simulated, left) for soil WW. Irrigated was twice a week resembling the rainfall of the FOCUS ground water scenario Hamburg.

Non professional uses – a new risk assessment approach

Luca Menaballi, Mara Luini, Cristian Riva, Sonia Ullucci, Giovanna Azimonti

Presenter Luca Menaballi

ICPS
Via G.B. Grassi, 74
Milano, Italy
E-mail: menaballi.luca@asst-fbf-sacco.it

Objectives

The actual risk assessment for non-professional uses follows the standard guidelines for professional use. ICPS developed a specific approach for the non-professional use, taking into account the different characteristics of this use (dimension of the treated areas, types of crops, types of application, duration of the application etc).

Highlights

A new calculation approach was developed for calculation of PEC_{SOIL}, PEC_{GW} and $PEC_{SW/SED}$, starting from the "standard" environmental risk assessment. Reduction in the application rate and in the target area is foreseen, based on consideration about the garden areas and their composition. Assumptions on the main routes of contamination are made in order to consider the available application equipment and techniques for non-professional uses. A Microsoft Excel tool has been created to help both the applicants and the assessors and to guide them through the risk assessment.

A closer look at Integrated Pest Management in the Netherlands

Aaldrik Tiktak, Daan Boezeman and Albert Bleeker

Presenter Aaldrik Tiktak

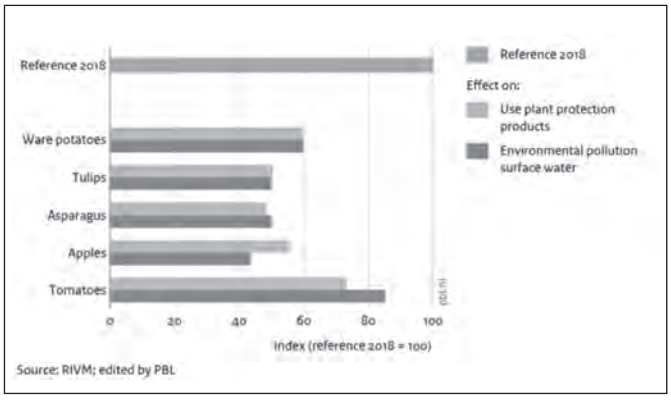
PBL Netherlands Environmental Assessment Agency
PO BOX 30314
2500 GH Den Haag
The Netherlands
E-mail: Aaldrik.tiktak@pbl.nl

Objectives

The European Union requires farmers to implement the principles of integrated pest management (IPM). This paper gives an overview of the adoption of IPM by Dutch farmers and its effectiveness to reduce the risk to aquatic organisms and non-target arthropods. We will further identify obstacles for Dutch farmers to switch from conventional farming to IPM and set out policies that facilitate better adoption of IPM.

Highlights

Results showed that most farmers have adopted some of the known IPM-measures; however, only half of them have systematically used all steps of the IPM-scheme. Of the measures investigated, emission reduction and substitution were more often used than prevention. We conclude that the shift towards IPM with less dependence on chemical crop protection has not been made. Interviews revealed several obstacles for farmers to make this shift. These include – amongst others – requirements set by retailers, lack of cost-effective measures for prevention and non-chemical pest control, and an inappropriate infrastructure for knowledge transfer.



Integrated Pest Management can reduce the environmental impact of pesticides by 12-50%, depending on the crop.

Proposal for a harmonised framework for spatially distributed modelling for pesticide registration in Europe

Bernhard Jene, Paul Sweeney, Erik van den Berg, Michael Klein, Gerco Hoogeweg and Robin Sur

Presenter Bernhard Jene

BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: bernhard.jene@basf.com

Objectives

- Report on the outcomes of a Workshop on Distributed modelling convened by a panel of experts at the IUPAC international conference in Ghent Belgium in May 2019.

Highlights

- The workshop consisted of international experts in GIS and groundwater modelling and was comprised of representatives from academia, regulatory authorities, research institutes, contract organisations and industry
- Topics of the workshop: "Input Data", "Model Requirements" and "Regulatory Aspects".
- The need to provide guidance to Member States and the wider scientific community on how to perform and interpret distributed modelling studies at the European level was recognised.
- Interaction with SETAC EMAG-Pest GW working group.

Recent improvements in the definition and identification of error models for chemical degradation data

Johannes Ranke

Presenter Johannes Ranke

Scientific consultant
Kronacher Str. 12
Grenzach-Wyhlen - Germany
E-mail: johannes.ranke@jrwb.de

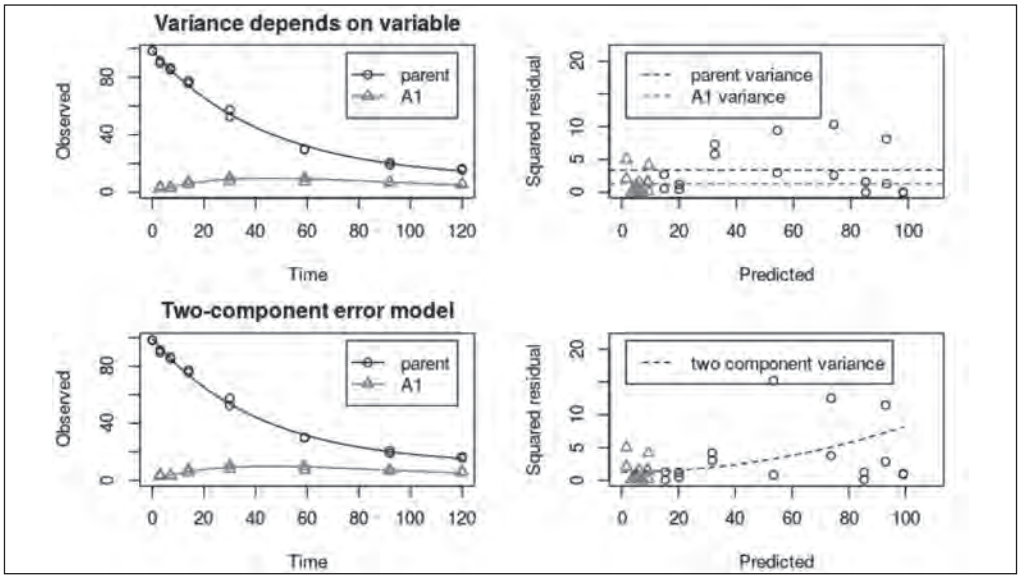
Project support by the German Environment Agency (UBA) is gratefully acknowledged

Objectives

- Derive reliable endpoints from experimental degradation studies.
- Make use of knowledge about error structure from analytical chemistry.
- Make advanced fitting routines available as Open Source software.

Highlights

- An alternative error model with two parameters has been implemented in mkin.
- Several fitting algorithms have been tested.
- In many cases the error structure is adequately represented by the new error model.



Comparison of the error model commonly used in IRLS with the two-component error model.

Effectiveness of Vegetative filter strips for pesticides mitigation: mechanistic analysis with VFSMOD

Rafael Muñoz-Carpena, Garey Fox, Amy M. Ritter, Oscar Perez-Ovilla, Ismael Rodea-Palomares

Presenter Rafael Muñoz-Carpena

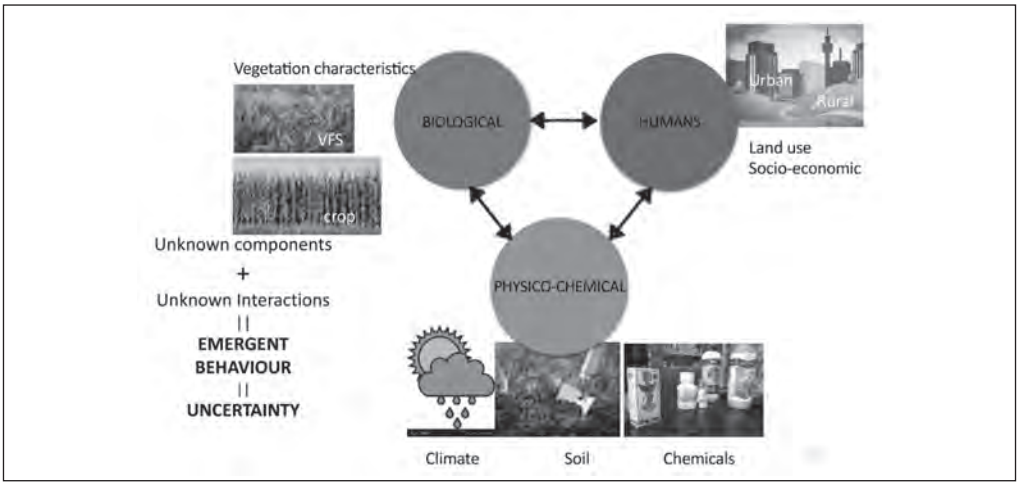
University of Florida, USA
1741 Museum Road, PO Box 110570
Gainesville – USA
E-mail: carpena@ufl.edu

Objectives

- Present an integrated analysis of pesticide mitigation processes with VFSMOD
- Analyze drivers and limitations of vegetation buffers under common field situations

Highlights

- Pesticide mitigation with vegetation buffers is a complex system
- Regulatory transparency requires well tested mechanistic integration tools/models
- Importance factor analysis allows identification of main drivers and limitations of buffer efficiency under realistic field situations.
- VFSMOD tested and refined to answer key questions about realistic buffer efficiency
- New VFSMOD developments address empiricism in pesticide trapping, presence of seasonally shallow groundwater, vegetation degradation, land use and others.



Pesticide mitigation with vegetation buffers: a complex system

Water drainage evaluation in hilly vineyards for groundwater aquifer characterisation and its contamination risk by pesticides

Elisabetta Russo, Marco Marcaccio, Vittorio Marletto, Gabriele Antolini, Fausto Tomei, Marcello De Crema, Emanuela Peroncini, Roberta Zambito Marsala, Camilla Farolfi, Ettore Capri, Nicoleta Alina Suciu

Presenter Elisabetta Russo

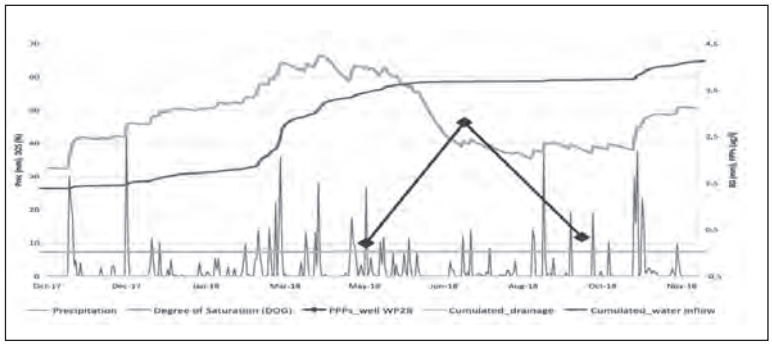
Unità Specialistica Acque APA Ovest
ARPAE Emilia-Romagna
Via XXI Aprile, 48
Piacenza-Italy
E-mail: erusso@arpae.it

Objectives

- Parameterisation of water balance model CRITERIA 3D to simulate water movement in a hilly area case study, within *H2020 WaterProtect Project*
- Description of interaction between wine grape, soil and water
- Characterization of phreatic aquifer model and its interaction with pesticides

Highlights

- The study area covers 7 km^2 in Val Tidone, no hydrologically characterized before
- The quantitative and qualitative characterization of phreatic aquifer was carried out trough monitoring of five representative wells, specifically searched
- The water drainage and possible pollutants leaching to groundwater was assessed by the use of CRITERIA 3D model, land use data, meteorological and climatic conditions and soil/subsoil characteristics, provided by ARPAE Emilia-Romagna
- The simulation results highlight the impact of increasing climatic variability on land use and effects on the groundwater resources



PPPs concentration in groundwater and water movements in surrounding soil of well WP-28

Towards the derivation of realistic mixing factors for drinking water abstraction combining GIS analysis and landscape level modelling

Sebastian Gebler, Tom Schröder, Eric Henry

Presenter Sebastian Gebler

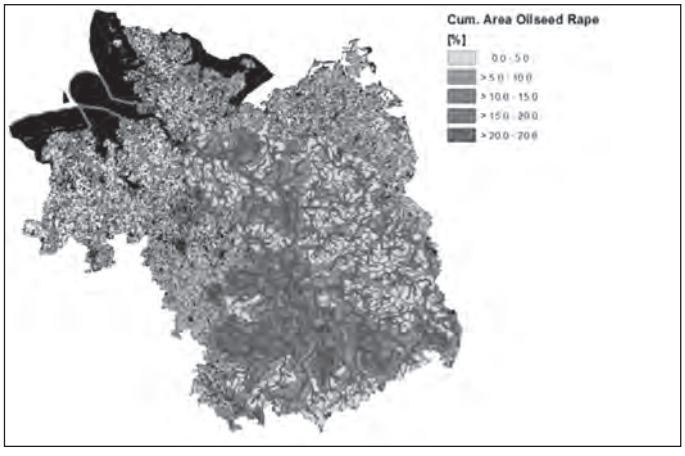
BASF SE , APD/EF
Speyerer Straße 2
67117 Limburgerhof – Germany
E-mail: Sebastian.gebler@basf.com

Objectives

- Explore more realistic scenarios for drinking water abstraction
- Derivation of more realistic mixing factors on landscape level
- Identification of representative vulnerable drinking water catchments in the EU for generic and regulatory use

Highlights

- Analysis of different European catchments with combined approach of GIS analysis and catchment modelling
- GIS was used to examine catchment characteristics (e.g., cropped area, crop type, and soil hydraulic properties) which have a strong impact on runoff generation
- Mixing factor for the most vulnerable catchments was modeled using the Soil and Water Assessment Tool (SWAT) to explore its spatio-temporal controls
- Approach can be used to derive representative vulnerable scenarios regarding the mixing factors on EU level for specific crop and plant protection products



Cumulated crop area for oilseed rape for the Elbe river catchment (German part). Hamburg was selected as catchment outlet/virtual abstraction point

Aquatic risk assessment at landscape scale – conceptual framework and an application example

Louise Wipfler, Hans Baveco, Wim Beltman, Sebastian Multsch, Florian Krebs, Thorsten Schad, Thomas Preuss

Presenter Wim Beltman

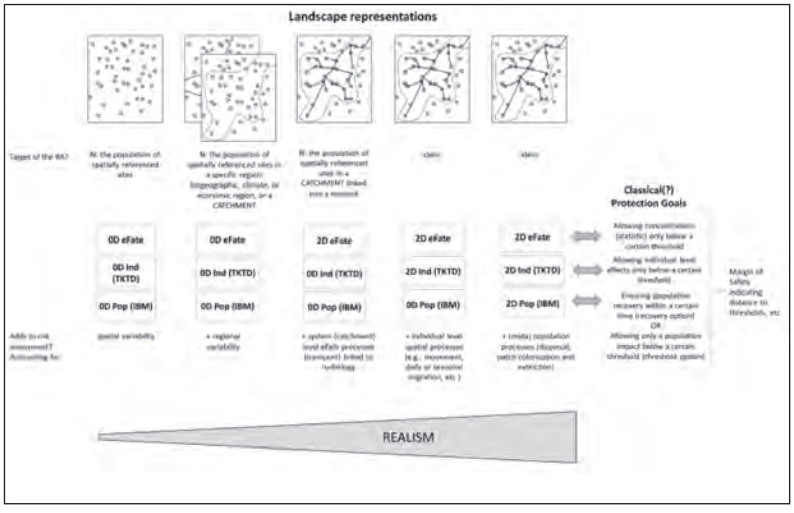
Wageningen Environmental Research
P.O. Box 47
6700 AA, Wageningen, the Netherlands
E-mail: wim.beltman@wur.nl

Objectives

- Need for a proper framework for linking protection goals to landscape scale assessment endpoints, including associated spatial and temporal scales
- Multitude of possible combinations and complexity of different exposure and effect assessment. Modelling approaches must be organized and selection criteria identified
- Identification of relevant environmental parameters, uncertainty propagation and how to present assessment endpoints and the definition of decision making criteria for the risk evaluation

Highlights

- Provide a framework for organizing the challenges given above and develop practical modelling tools for aquatic ERA at landscape scales
- Systematic and comprehensive characterization of possible modelling approaches (see e.g. presentation 223 by Multsch *et al.*)
- Example how landscape scale modelling results can be translated into predicted risk for the survival of aquatic macroinvertebrates (see presentation 230 by Beltman *et al.*)



Running large scale spatially distributed process-based models for groundwater risk assessment: computational demands and practicable infrastructure solutions

Benedict Miles, Sebastian Gebler

Presenter Benedict Miles

BASF SE
Speyerer Strasse 2
Limburgerhof
Germany
E-mail: Benedict.miles@basf.com

Objectives

- Look at strategies that can effectively used to run large spatially distributed simulations in GeoPEARL for different computing infrastructures
- Show that acceptable run times can be achieved with publicly available cloud-based computing

Highlights

- A scalable approach for distributing GeoPEARL simulations on multi-processor systems
- Experiences with running GeoPEARL on a supercomputer and in the cloud

Timing is everything: the relationship between rain patterns and application timing in the context of the FOCUS Surface Water repair action

Lucas Garcia, Jérôme Goulet-Fortin and Sebastian Gebler

Presenter Lucas Garcia

Global Environmental Fate Modelling BASF SE
Speyerer Strasse 2
Limburgerhof, Germany
E-mail: lucas.garcia@basf.com

Objectives

- Investigate the variability of PEC_{sw} with selected application dates of multi-year simulations of runoff scenarios in the context of the FOCUS SW repair action;
- establish if PEC variations can be statistically linked to the rain patterns involved around application time;
- determine if rain input can be used directly to define realistic worst-case application dates and determine vulnerability of an application period for the final $PEC_{sw.}$

Highlights

- Preliminary results of multi-year calculations with focus on runoff are showing that the application date may have a significant impact on PEC_{sw} of some substances;
- high PEC_{sw} variations were found between simulations using application dates a few days apart, particularly in the summer periods due to the associated rain patterns;
- these variations may concern a relatively broad combination of K_{oc} and DT_{50} for mobile compounds;
- potential to statistically define the vulnerability of application periods specific to given FOCUS SW scenarios based on climatic modelling input.

Automatic irrigation concept as implemented in PRZM to align with the FOCUSsw procedure

Stephan Sittig, Mark Cheplick, Stefan Reichenberger, Gerald Reinken

Presenter Stephan Sittig

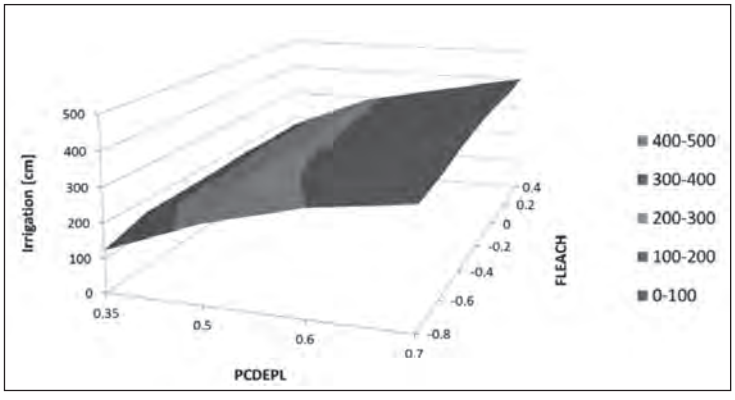
knoell Germany GmbH
Konrad-Zuse-Ring 25
Mannheim – Germany
E-mail: ssittig@knoell.com

Objectives

- Investigate and adapt the existing irrigation routines in FOCUS PRZM
- Replace the existing FOCUSsw practice of adding irrigation to meteorological files with an automatic irrigation procedure
- Irrigation to be calculated by FOCUS PRZM based on soil moisture deficit

Highlights

- The irrigation options in PRZM were replaced with three new ones: sprinkling over/under the canopy, and sprinkler irrigation under canopy with a fixed rate
- Repeated PRZM runs for all irrigated FOCUS scenario/crop combinations were performed with the goal to find settings leading to similar irrigation as before
- Two issues fixed: i) no more inconsistency between water balances of two models (PRZM and ISAREG), ii) irrigation events do not trigger surface runoff anymore
- The new automatic irrigation concept is going to be applied in the context of the new multiyear FOCUSsw exposure assessment



Total applied irrigation volumes over 20 years as calculated by FOCUS PRZM depending on model input parameters PCDEPL and FLEACH (scenario: R1 potatoes).

Evaluation of a methodology for estimating pesticides water contamination in tropical volcanic context

Pauline Campan, David Crevoisier, Anatja Samouelian, Arnaud Boivin, Arnaud Duboisset, Julien Fostier, Marc Voltz

Presenter Pauline Campan

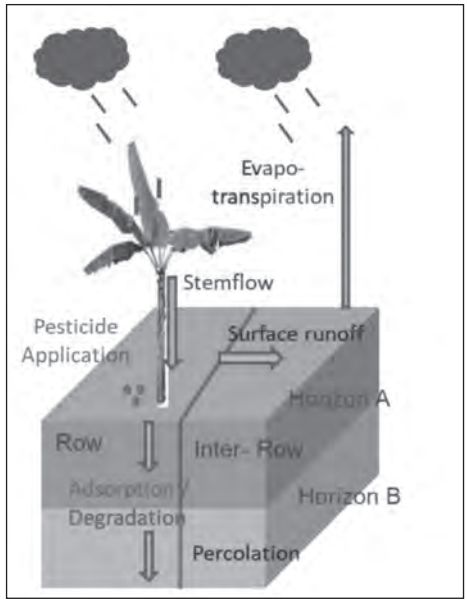
University of Montpellier- INRA-IRD- SupAgro-
UMR LISAH, Bât 24
2 place Pierre Viala
34060 Montpellier, France
E-mail: pauline.campan@inra.fr

Objectives

- Presentation of a new software tool TROPHY for estimating surface and groundwater contamination by pesticides in the tropical volcanic context of French West Indies.
- First evaluation of TROPHY to estimate the contamination of water for local agropedoclimatic scenarios in the French West Indies.

Highlights

- The TROPHY software comprises a set of agropedoclimatic scenarios for banana and sugarcane crops and main volcanic tropical soils and a numerical pesticide transport model adapted for tropical row crops with main rainfall interception processes.
- Comparison of simulated concentrations with TROPHY for a 10-year simulation period with experimental surface runoff and percolation data observed at plot scale in banana fields was made for a range of pesticides.
- Simulated concentrations were mostly protective as compared to field data for most compounds and agropedoclimatic scenarios.
- For some scenarios and compounds simulated concentrations underestimated actual observations which may be related to an insufficient length of simulation period and to the use of standard values of physicochemical properties of compounds (Koc, DT50) instead of specific values for tropical soils



Scheme of the numerical pesticide transport model.

The Greenhouse Emission Model: fate process description developments for soilless cultivation

Maarten C. Braakhekke, E.L. Wipfler, J.J.T.I. Boesten, E.A. van Os, N.C.G. Tan, M. Hoogsteen

Presenter Maarten Braakhekke

Wageningen Environmental Research
P.O. Box 47
6700 AA, Wageningen, the Netherlands
E-mail: maarten.braakhekke@wur.nl

Objectives

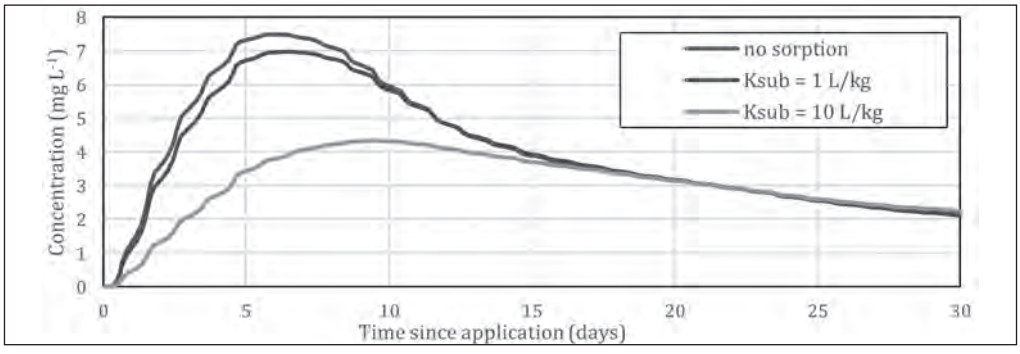
Improvements of fate process descriptions in the Greenhouse Emission Model (GEM) for soilless cultivation resulting in:

- More realistic description of PPP fate in soilless cultivation in Dutch greenhouses
- Better predictions of PPP environmental concentrations in ditches and streams receiving discharge from greenhouses

Highlights

Improved process descriptions related to:

- Sorption of PPP to various materials, including substrate, and pipes and tubes, and plant roots
- PPP flows between various compartments in the greenhouse, including plants, floor, roof, air, and condensation water
- Deposition to the roof, throughs and the substrate during application
- PPP fate and transport for pot plants on tables



Predicted effect of sorption to stone wool substrate on PPP concentration in discharge water.

Pesticide use data for environmental exposure and risk assessment

A. Bolekhan, Krisztian Szegedi, M.A. Thomas

Krisztian Szegedi

BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: Krisztian.szegedi@basf.com

Objectives

- Analyse sequential applications of plant protection products with a focus on general patterns and trends for individual substances based on actual use data
- Investigate differences among crops, countries, and indications
- Examine the impact of observed patterns relative to environmental risk when multiple products containing the same active ingredients are applied in the same year

Highlights

- The analyses revealed that market research data (Agrowin® by AgroBase), on the actual crop protection used, are suitable to address questions relevant for realistic environmental risk assessment of plant protection products
- The applied methodology enables direct comparisons with use details of registered products, which passed regulatory risk assessment and were thus deemed safe
- The number of applications in a sequence is: a) Independent of the crop for herbicides, b) Strongly dependent on crop for insecticides and for fungicides, c) Affecting application rates of individual products (rate reduction)
- Climatic differences, rather than country, appears to be a dominant contributor: For all indications similar distribution for a number of applications can be observed for Germany and Poland but not for the United Kingdom.
- Worst-case number of applications among all registered products is exceeded on a very small percent of treated area for individual actives and is expected to be accompanied by use rate reductions of individual products
- The mean seasonal application rates are in most cases significantly lower than the maximum registered application rates of individual products

National ground water monitoring as higher tier assessment for pesticides and their metabolites

Federico Ferrari, Camilla Zighetti, Tommaso Ferrari, Lucio Botteri, Nicola Ballerini, Riccardo Rossi, Luca Medini, Diego Bruzzone, Silvia Venzano, Eliana Cavallo, Silvia Villa, Nicoleta Suciu

Presenter Camilla Zighetti

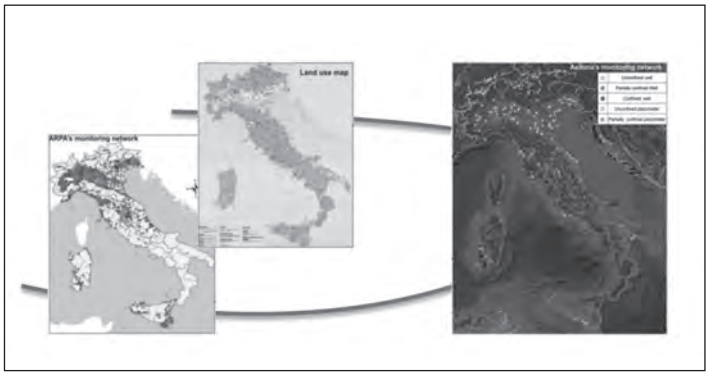
Aeiforia S.r.l.
Strada Faggiola 12/16
29027 Podenzano-Italy
E-mail: info@aeiforia,it

Objectives

To establish a robust methodology at national and EU level for the identification of sites vulnerable to leaching based on the indication of GW FOCUS modeling and to characterize the extent of occurrence of active substance or its metabolites in wells by retrospective monitoring.

Highlights

In the framework of GW risk assessment for pesticides under EU Reg.1107/2009, monitoring studies can be required by the authorities, if FOCUS PECgw simulations flag risk of leaching of the parent substance or metabolites. In recent years more than 20 groundwater monitoring studies are implemented (of 1 to 3 years of duration) taking also into account the recent report produced by the SETAC EMAG-Pest GW group's on the recommendations on study designs and study procedures. Encouraging results obtained until now indicate that population of concentrations exceeding the limit of 0.1 µg/L for a.i. and relevant metabolites, and the threshold of 0.75 µg/L for non-relevant metabolites is near to the 1% of the whole dataset. Values above 10 µg/L have not been observed.



The identified monitoring areas mostly correspond to the sites monitored by the Italian authority for environmental monitoring (ARPA) and to the most intensively cultivated areas.

Rice cultivation and environmental exposure modelling in Asia/China

Jing Ma

Presenter Jing Ma

BASF (China) Company Ltd. ,
25F,Tower A, Gateway Plaze,
No.18 Xiaguangli Dongsanhuanbeilu,
Chaoyang District, 100027 Beijing,
China

Objectives

1. Rice cultivation in Asian countries;
2. Rice environmental exposure modelling in China ERA;
3. Comparison of the Chinese rice model and the US-EPA PFAM model

Highlights

The charactistics of Rice cultivation in different Asian countries are described and the environmental exposure modelling in China and environmental risk assessment (ERA) are presented.
Experiences from the Sino-Dutch Pesticide Environmental Risk Assessment Project and working with Dutch and other Chinese experts to establish the Chinese ERA systems are shared.

The Chinese rice model and the US-EPA PFAM model are described and modelling results are compared.

An easy to use indicator for pesticide risk management and mitigation at farm level

Andrea Di Guardo, Maura Calliera, Ettore Capri, Antonio Finizio

Presenter Andrea Di Guardo

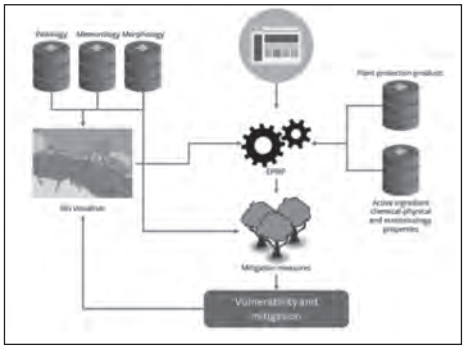
Università di Milano-Bicocca
P.zza della Scienza, 1
Milan - Italy
E-mail: andrea.diguardo@unimib.it

Objectives

- Provide an easy-to-use web tool to farmers for evaluating the impact of pest management strategies at field and farm levels
- Simultaneously it calculates parameters of risk mitigation measures for runoff and drift to reduce the evidenced risks to harmless impacts
- Interaction with the tool has been kept at a minimum level (selection of fields, crops and pesticides), while the database contains all the other data for the analysis

Highlights

- The tool has been developed within the Train-Agro project funded by the EU Rural Development Fund 2014-2020 in Lombardy region (Italy)
- The system automatically provides georeferenced data about pedology, meteorological series, terrain morphology, parcels dimension and position and other data about phisical-chemical properties and ecotoxicological end-points of each active ingredient on the market



Component diagram of the software tool

- The tool evaluates the sustainability of the pest management strategy (using the EPRIP indicator on each selected field) and highl ight parcels where there is an environmental concern; moreover it suggests the right mitigation measure in order to reduce drift or runoff.

PEC calculation for non-professional uses: a new approach

Sonia Ullucci, Luca Menaballi, Cristian Riva, Mara Luini, Giovanna Azimonti

Presenter Sonia Ullucci

ICPS (International Centre for Pesticides and
Health Risk Prevention)
Via G.B Grassi, 74 –
ASST Fatebenefratelli - Sacco - polo universitario.
Milan – Italy
E-mail: ullucci.sonia@asst-fbf-sacco

Objectives

ICPS developed a specific approach for the exposure assessment of pesticide products for non-professional uses, taking into account the different characteristics of this use (treated areas, crop and application types, application rates and timings etc.) established in the new Italian Ministry decree law n. 33 enacted on 22 January 2018.

Highlights

A new calculation approach was developed for PECsoil, PECgw and PECsw/sed calculation, starting from the "standard" environmental risk assessment. Reductions in the application rate and in the target area are foreseen, based on considerations about the garden areas and their composition. Assumptions on the main routes of contamination are made in order to consider the available application equipment and techniques for non-professional uses. A Microsoft Excel tool has been created to help both the applicants and the assessors and to guide them through the risk assessment.

Efficiency of a pilot stormwater pond for reducing pesticide concentrations from surface water

Sylvie Dousset, Anne Caner-Chabran, Béatrice Marin, Alexandra Conreux, David Billet

Presenter Sylvie Dousset

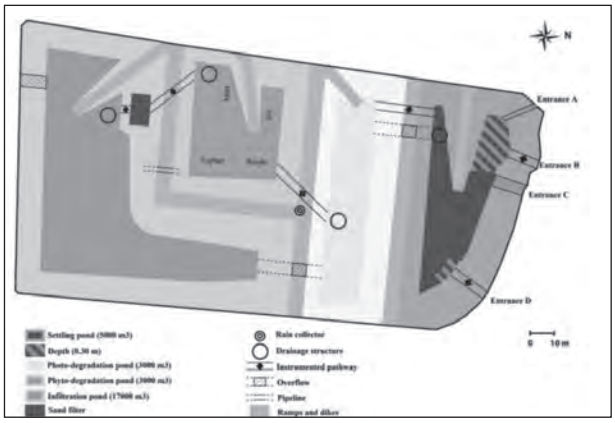
LIEC, UMR 7360 CNRS, Université de Lorraine,
Bd des Aiguillettes, BP 70239,
54506 Vandœuvre-lès-Nancy, France
E-mail: sylvie.dousset@univ-lorraine.fr

Objectives

The aim of this study was (i) to assess the global efficiency of a stormwater pond consisted of four remediation units (figure) for reducing the concentrations of pesticides in surface water and (ii) to evaluate the effectiveness of each unit in order to understand the relative contribution of the processes involved.

Highlights

The decantation unit was the most efficient with 36% reduction in pesticide contents. The phytodegradation unit planted with four plant species (*Typha latifolia, Phragmites australis, Mentha aquatica* and *Iris pseudacorus*) allowed a reduction of 33% of the pesticides amounts. The photodegradation unit showed an efficiency of 17%. In the infiltration unit, the sand filter released pesticides, and therefore showed a negative efficiency of -3%. Finally, the measured effectiveness of the stormwater pond was 83% for the 78 quantified pesticides.



Scheme of the stormwater pond

SESSION III
ENVIRONMENTAL FATE IN AIR, SOIL AND WATER

The understanding of processes controlling the environmental dynamics of pesticides in the environment is essential to investigate and mitigate the risk of environmental contamination. With this regard, the routes and rates of dissipation of active substances and their metabolites as well as the transport/mobilization processes are key factors to determine the actual levels of exposure of pesticides in environmental compartments.
This is made even more complicated by global change challenges, and climate change in particular, because of variable temperature trends, increased drought or flooding amplitude and frequency, depletion of soil carbon content and increase in soil erosion. Therefore, besides the interplay of the complex mechanisms underlying environmental fate, we should also consider the dynamics imposed by climate change.
On these bases, this section focuses on environmental fate of pesticides from laboratory to landscape level, including the assessment of the mechanisms determining the fate as well as the modelling of fate into environment.

Session Chairs
- Luigi Lucini
- Neil Mackay
- Bernard Jene
- Begoña Miras

Behavior of the chiral herbicide imazamox in soils: enantiomer composition differentiates between biodegradation and photodegradation

Ignaz J. Buerge, Roy Kasteel, Thomas Poiger

Presenter Ignaz J. Buerge

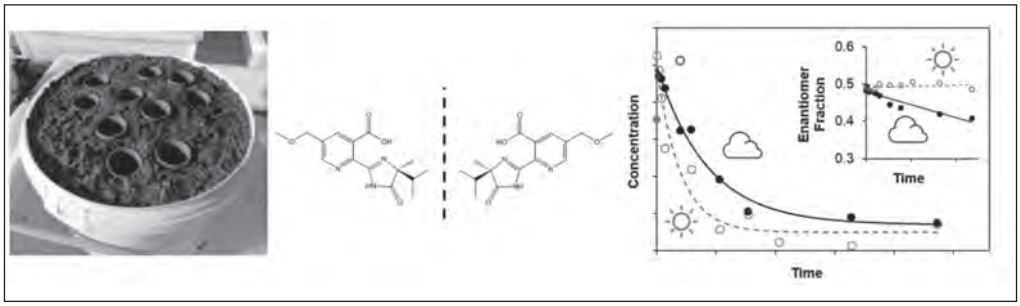
Agroscope
Müller-Thurgaustr. 29
Wädenswil, Switzerland
E-mail: ignaz.buerge@agroscope.admin.ch

Objectives

Biodegradation is an important loss process for the chiral herbicide imazamox in soils. Under certain conditions, however, photodegradation may contribute notably to its overall loss. We conducted a set of soil incubation experiments, using enantioselective LC-MS/MS analysis as a probe to distinguish biodegradation and photodegradation.

Highlights

In the dark, imazamox was degraded enantioselectively, whereas at sunlight, degrada-tion was non-enantioselective and 2× faster, suggesting that biodegradation and photo-degradation were the predominant processes, respectively. A sand cover did not pre-vent photodegradation. On the contrary, degradation was 10× faster and non-enantio-selective. Computer simulations indicated that imazamox was transported to the sand layer by capillary flow due to evaporation at the surface, where it was photodegraded. Irrigation postponed, but not completely prevented photodegradation. For mobile substances, upward transport in soils thus needs to be considered.



Small-scale mesocosm incubation experiments showed enantioselective biodegradation in the dark and non-enantioselective photodegradation at sunlight

Volatilization and deposition behavior of non-formulated Prosulfocarb – lab scale investigations

Dennis Steven Wallace, Gunnar Fent, Roland Kubiak

Presenter Dr. Gunnar Fent

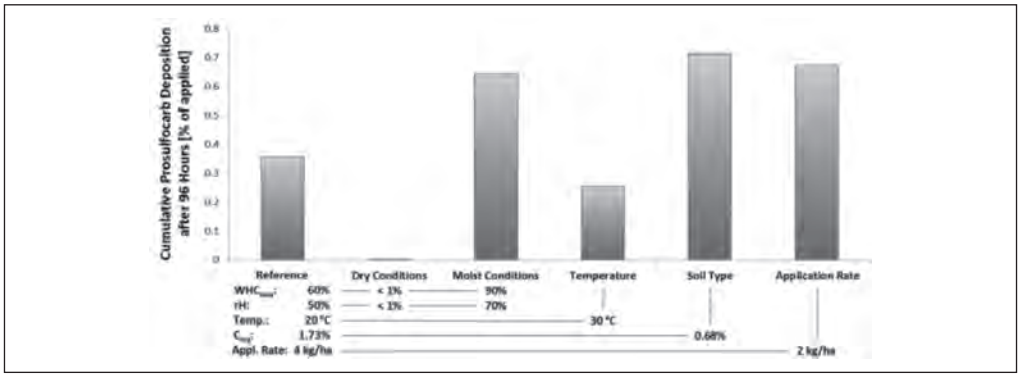
RLP AgroScience GmbH
Institute for Agroecology
Breitenweg 71
67435 Neustadt an der Weinstraße
Germany
E-mail: gunnar.fent@agroscience.rlp.de

Objectives

- Importance of aqueous deposition by volatilized Prosulfocarb
- Assessment and evaluation of influencing factors: air humidity in combination with soil moisture, temperature, soil organic carbon and application rate
- Relationship between air concentration and aqueous deposition amount

Highlights

- 96h tests in lab system, consisting of volatilization chamber with applied soil petri dish linked to deposition chamber containing water filled petri dish
- Moist conditions lead to increased deposition (×1.8), under dry soil and air conditions Prosulfocarb deposition remained below LOQ (0.05 µg/L)
- Higher temperature (Δ 10K) forced fast drying of soil resulting in lower deposition
- Lower Corg content (Δ 1.05%) increased volatilization and subsequent deposition
- Non- linear relationship between treatment rate and volatilization
- Deposition amounts are reflected by air concentrations (factor volatilization ~ ×34)



Set up of the outdoor contain Graph: Means (n=2) of cumulative Prosulfocarb deposition after 96 hours (4×24h samples) in % of the applied amount and under varying parameters er study in the roofed vegetation hall, devices for percolate sampling.

Slow release of the herbicide terbuthylazine from biochar-based formulations

Beatriz Gámiz, Esperanza Durán, Pilar Velarde, Kurt Spokas, Lucía Cox

Presenter Beatriz Gámiz

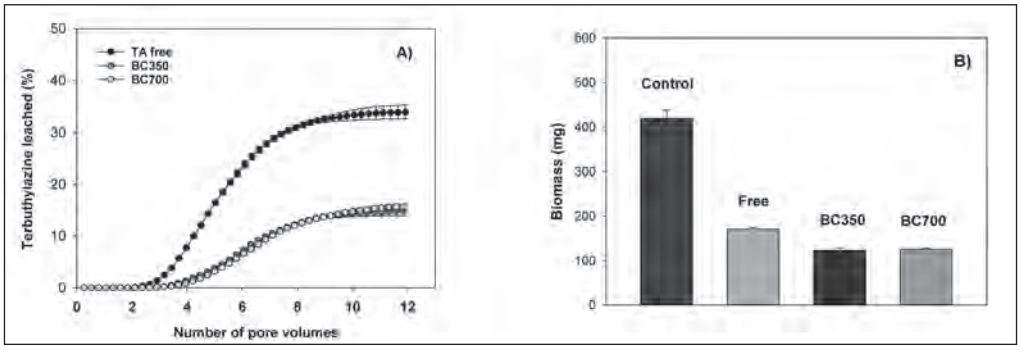
Instituto de Recursos Naturales y
Agrobiología de Sevilla (IRNAS, CSIC)
Avda. Reina Mercedes, 10
Sevilla – Spain
E-mail: bgamiz@irnase.csic.es

Objectives

- Preparation of two complexes of terbuthylazine (TA) based on biochar (BC) obtained from olive oil mill waste at two different pyrolysis temperatures (350 and 700ºC);
- Assessment of persistence, leaching and bioefficacy of TA applied to soil as BC-TA complexes.

Highlights

- TA slowly releases from BC-TA formulations when applied to soil;
- TA degrades equally in all treatments;
- Leaching of TA is reduced and retarded when the herbicide is applied as BC-TA formulations as compared with the application of the herbicide in a readily available form;
- Bioassays demonstrated similar phytotoxicity of the prepared formulations in controlling the growth of *Lepidum sativum* respect to the free-TA.



A) Amount of TA leached applied to soil columns as free or as BC-based formulations; B) Effect of TA on the growth of Lepidum sativum after the application of the herbicide as free or as BC-formulation

Development of protocols for the measurement of the emission of pesticides into the air during and after application in agriculture

Carole Bedos, J.P Douzals, F. van den Berg

Presenter Carole Bedos

INRA-AgroParisTech
UMR 1402 ECOSYS
78850 Thiverval-Grignon
France
E-mail: carole.bedos@inra.fr

Objectives

- provide harmonized protocols to measure emission of pesticides into the air by airborne drift and volatilization
- gather international expertise and give advice on methods to be used

Highlights

- An international workshop has been organized in Montpellier (France) in June 2018 to elaborate guidance
- Regarding airborne drift, a protocol has been defined based on the ISO22866 (figure)
- Regarding volatilization, a protocol has been defined depending on the purpose of the experiment, the configuration of the sprayed area, available equipment and expertise of the team carrying out the experiment
- Need to test these protocols and explore further development for other cropping systems (e.g. volatilization measurements in vineyard and orchards)

Standard protocol for measurement of pesticide emission to the air

New FOCUS surface water scenarios. Do the new procedures for multiple applications and application windows produce meaningful results

Michael Klein

Presenter Michael Klein

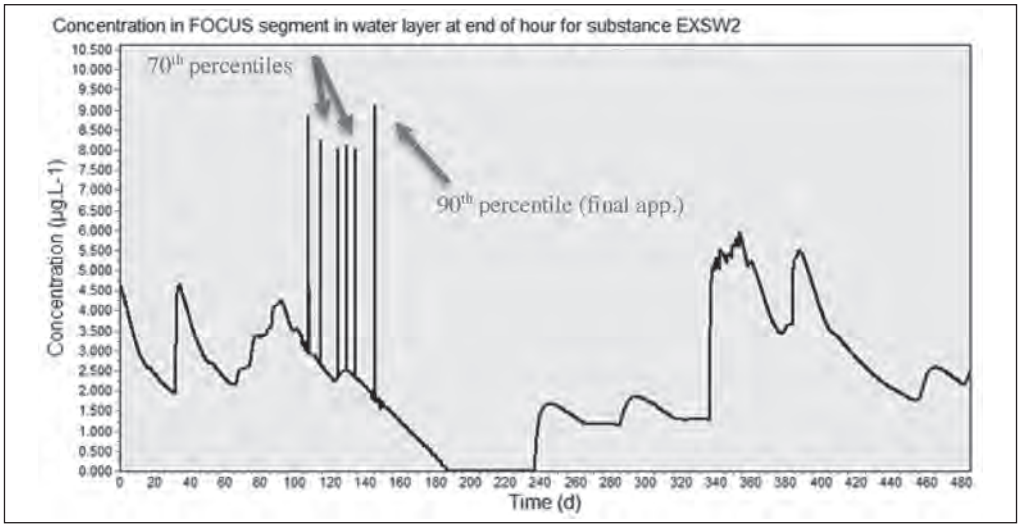
Fraunhofer IME
Auf dem Aberg 1
Schmallenberg - Germany
E-mail: Michael.Klein@ime.fraunhofer.de

Objectives

- Results of the FOCUS SW Repair Action (EFSA working group)
- Now application timing based on the BBCH code window
- Now final application in the sequence always 90th drift percentile
- No double number of simulations for single and multiple applications

Highlights

- Reduction of CPU time for multiple applications by a factor of 2
- Simpler approach for the application timing (reduction of user subjectivity)
- More confidence in the simulation results



Time dependent concentrations in surface water (D2 stream) new application scheme

Update on finalisation of the Aged-sorption Guidance Document and extension to the evaluation of field data

Sabine Beulke, Wendy van Beinum, Ian Hardy, Andy Massey and Michelle Morris

Presenter Ian Hardy

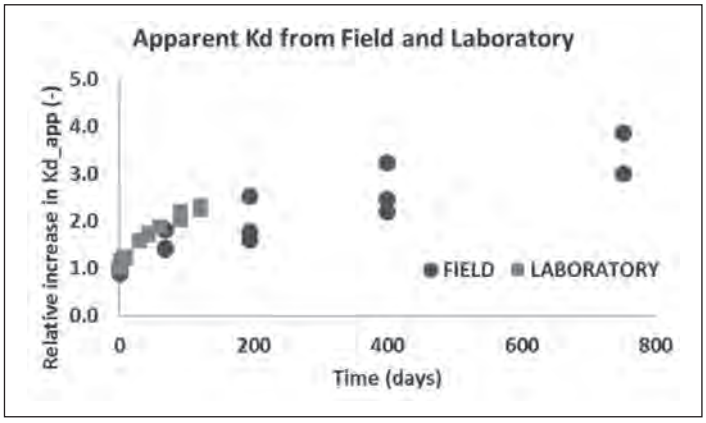
Battelle UK Ltd.
29, Springfield Lyons Approach
Chelmsford – UK
E-mail: i.hardy@battelleuk.com

Objectives

- Development of a Guidance Document for the evaluation of aged-sorption studies
- Update of the Guidance Document based on EFSA review and Opinion (2018)
- Further research for the extension to the evaluation of aged sorption and field data

Highlights

- The Guidance Document has been finalised based on comments in the EFSA Opinion
- Approaches to estimate $DegT_{50EQ}$ values from lower-tier aerobic soil study data have been provided
- Detailed procedures are described for combining aged-sorption and lower tier data for PECgw evaluations
- Use of field $DegT_{50}$ data in combination with aged-sorption in PECgw evaluations has some restrictions and further research and guidance development is ongoing
- Evidence of aged-sorption under field conditions has been evaluated with $CaCl_2$ extraction followed by Apparent Kd calculation and comparison to laboratory data



Set up of the outdoor container study in the roofed vegetation hall, devices for percolate sampling.

A standardised approach to address pH-dependent sorption and degradation in groundwater risk assessment

Wolfram König, Thomas Gräff, Gabriele Holdt, Wolfgang Janzen, Stephan Marahrens, Anne Osterwald, Mark Rauch, Janina Wöltjen

Presenter Wolfram König

Federal Environment Agency
Wörlitzer Platz 1
Dessau-Roßlau – Germany
E-mail: wolfram.koenig@uba.de

Objectives

Several active substances and metabolites of plant protection products (PPPs) exhibit pH dependent degradation and/or sorption in soil, which needs to be considered for groundwater risk assessment. Some experience on addressing this issue was already gained during EU approval processes and some national approaches on how to address pH-dependency are available on Member State level. In order to develop standardized approaches for EU approval and zonal registration processes, we re-evaluated known compounds showing pH dependent behavior taken into account the suggestions made in national guidance documents and recommendations by EFSA.

Highlights

Standardized approaches have been developed on (i) how to evaluate pH-dependent behaviour and (ii) how to consider it in groundwater modelling.

The evaluation of pH-dependent behaviour considers the chemical structure and other substance properties, propose additional statistical analysis for decision-making and take into account expected and observed trends of pH-dependent behaviour. Additionally, a parameter to account for surface acidity of soil particles was tested. For choosing appropriate endpoints, the pH range of topsoils in the EU and the three registration zones was taken into account and different options for choosing appropriate endpoints are suggested depending on the quality of the available data.

The developed approaches come together with an easy to use evaluation tool suitable both for deciding on pH-dependent behaviour and for choosing appropriate endpoints for groundwater modelling

Freezing and thawing of soil increase the leaching of pesticides

Roger Holten, Frederik Bøe, Marit Almvik, Sheela Katuwal, Marianne Stenrød, Mats Larsbo, Nicholas Jarvis, Ole Martin Eklo

Presenter Roger Holten

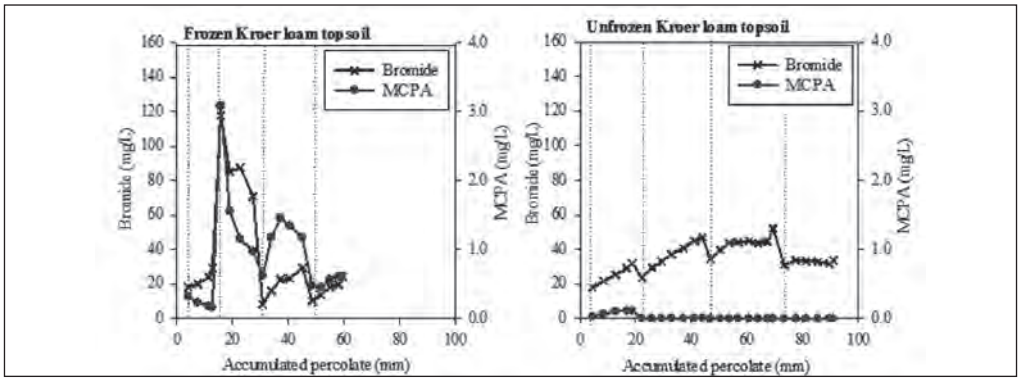
Researcher, PhD
NIBIO
Høgskoleveien 7
Ås – Norway
E-mail: Roger.holten@nibio.no

Objectives

- Generate new knowledge and better understanding of freezing-thawing effects on transport processes in soil.
- Investigate the effect of freezing and thawing of soil on transport of pesticides with a range of soil sorption properties.
- Develop and test a dual-permeability approach for modelling water flow and heat transport in macroporous soils undergoing freezing and thawing.

Highlights

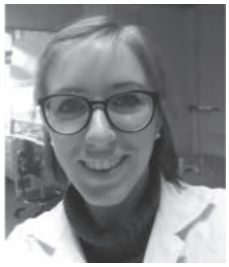
- Preferential flow through macropores can transport high concentrations of pesticides through partially frozen soil.
- Sorption plays a role in determining leaching losses even in frozen soil.
- The model provides results according to already published data and according to our expectations.



Bromide and MCPA (mg L-1) concentrations plotted as a function of accumulated amount of percolate (mm) for a representative soil column from frozen and unfrozen topsoil of a loam soil.

Effects of decyl glucoside surfactant Triton CG-110 on the environmental fate of glyphosate in soil

Laura Carretta, Alessandra Cardinali, Roberta Masin, Giuseppe Zanin, Harald Cederlund



Presenter Laura Carretta

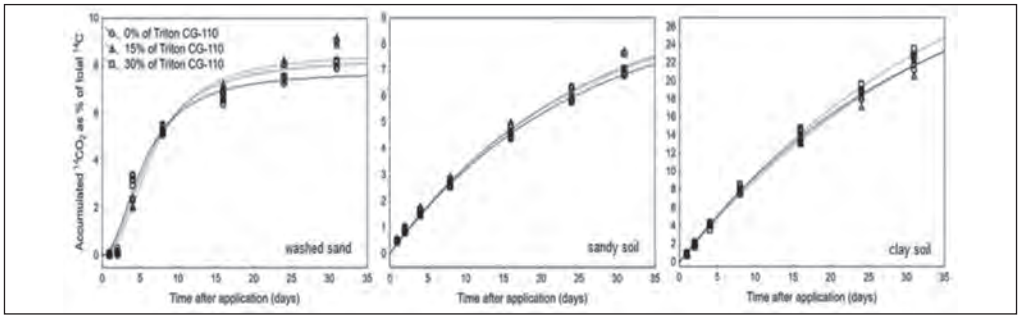
Department of Agronomy, Food, Natural resources,
Animals and Environment (DAFNAE)
University of Padova
Viale dell'Università 16
Legnaro - Italy
E-mail: laura.carretta.2@phd.unipd.it

Objectives

- Investigate the possible effects of the decyl glucoside surfactant Triton CG-110, contained in some glyphosate-based formulations, on the environmental fate of glyphosate in the soil.

Highlights

- Adsorption, leaching, and mineralization behaviour of glyphosate was studied in two soils with different textures (sandy and clay soil) and in washed sand, with and without the addition of Triton CG-110.
- Triton CG-110 decreased the adsorption of glyphosate in washed sand and in sandy soil.
- The adsorption in clay soil was not affected by Triton CG-110 concentration.
- Leaching of glyphosate in washed sand was unaffected by the surfactant concentration.
- Triton CG-110 did not significantly affect glyphosate mineralization in any of the tested soils.



Cumulative mineralization of glyphosate in the soils with different Triton CG-110 concentrations, expressed as accumulated $^{14}CO_2$ as the percentage of total ^{14}C applied.

Effects of pesticide incorporation due to tillage on pesticide transport through heavy clay soils

Bibiana Betancur-Corredor, Colin Brown, Mark Greener

Presenter Bibiana Betancur-Corredor

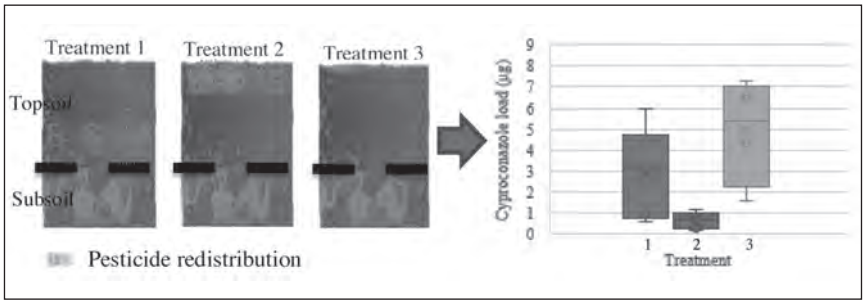
Department of Environment and Geography, University of York
290 Wentworth Way, YO10 5NG
York - United Kingdom
E-mail: bibiana.betancurcorredor@york.ac.uk

Objectives

Tillage operations redistribute any solutes that are present in the soil surface prior to tillage. In structured soils, macroporous flow of solutes can be affected as the solute is removed from the surface layers. A lysimeter experiment was undertaken to investigate the effects of pesticide incorporation after inversion ploughing and harrowing on pesticide transport through structured soils. Timing of pesticide spraying and tillage operations were manipulated to create three treatments: (1) sprayed on the surface then incorporated with inversion ploughing and harrowing (2) sprayed on the surface then incorporated with harrowing and (3) sprayed on the surface after inversion ploughing and harrowing.

Highlights

Cumulative mass of cyproconazole leached from the lysimeters was significantly lower ($p < 0.01$) for pesticide incorporated by harrowing (0.70±0.39 µg) compared with pesticide incorporated by inversion ploughing and harrowing (2.83±2.1 µg), or sprayed on the surface after tillage was complete (4.9±2.5 µg). This demonstrates that redistribution of any pesticide residues during tillage influences subsequent leaching behaviour. The finding is being investigated with modelling, but is thought to arise because pesticide incorporated into the upper soil layers may protect part of the residue from preferential flow when compared to pesticide present at the soil surface.



Graph 1. Expected pattern of pesticide residues within the soil profile for each treatment (left). Cumulative cyproconazole loads in leachate collected between 21/11/2018 – 31/03/2019 for each treatment (right).

Influence of 26-year FOCUS SW simulations on calculations times and hardware requirements

Denis Weber, Michael Brauer, Beate Erzgräber, David Patterson, Gregor Spickermann, Dieter Schäfer, Tim Jarvis

Presenter Denis Weber

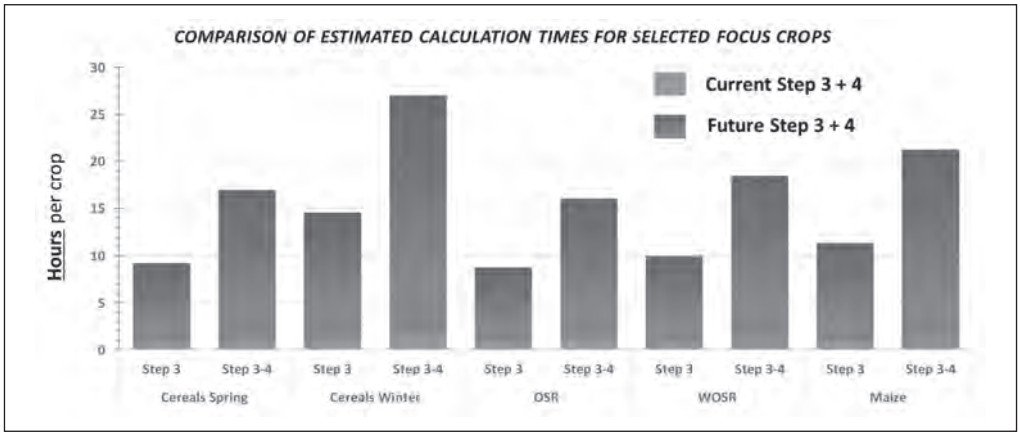
Exponent International Ltd.
Nauenstrasse 67
4052 Basel – Switzerland
E-mail: dweber@exponent.com

Objectives

- Compare computation times of standard FOCUS and 26-year FOCUS simulations, i.e. 6 warm-up years and 20 simulations years
- Assess duration of FOCUS MACRO and TOXSWA simulations at Step 3-4 for 26-year simulations
- Compare hardware requirements (storage of modelling data) for 26-year FOCUS simulations

Highlights

- Calculation times increase significantly for FOCUS MACRO
- Calculation times increase significantly for FOCUS TOXSWA at Step 3-4
- Significantly higher storage capacity needed to save 1-row-per-hour out-files for 26 year simulations



Comparison of estimated calculation times for selected FOCUS crops

Assessment of environmental fate of novel clay-based herbicide formulations

Monica Granetto, L. Re, S. Fogliatto, F. Vidotto, T. Tosco

Presenter Monica Granetto

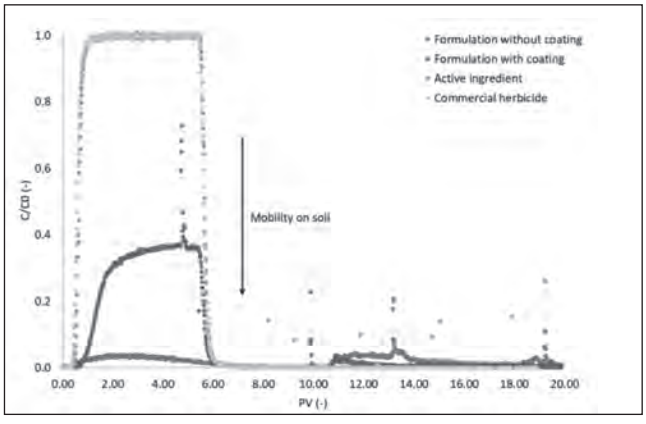
Politecnico di Torino - DIATI
C.sa Duca degli Abruzzi, 24
Torino
E-mail: monica.granetto@polito.it

Objectives

- Developping a novel environmental-friendly herbicide formulation using clay and biopolymers as a particle coating
- Reducing herbicide spreading on subsoil, surface water and groundwater
- Reducing herbicide spreading in air
- Testing efficacy in greenhouse test

Highlights

- Mobility on soil was investigated through unsaturated column transport tests.
- Mobility in groundwater was investigated through saturated column transport tests.
- The novel clay formulation showed reduced mobility both on soil and in groundwater compared to the free compound and a commercial formulation. At least 50% of the clay formulation was retained in the first cms of the columns.



Breakthrough curves for unsaturated column transport tests.

- Volatility was studied through both batch open vessel tests (with and without soil). Formulation with coating showed negligible volatilization compared to active ingredient alone.
- Greenhouse tests showed comparable efficacy to the commercial herbicide

MEDWATERICE project: Towards a sustainable water use in Mediterranean rice-based agro-ecosystems. The Italian case study

Alice Tediosi, Federico Ferrari, Marco Trevisan, Marco Romani, Arianna Facchi

Presenter Federico Ferrari

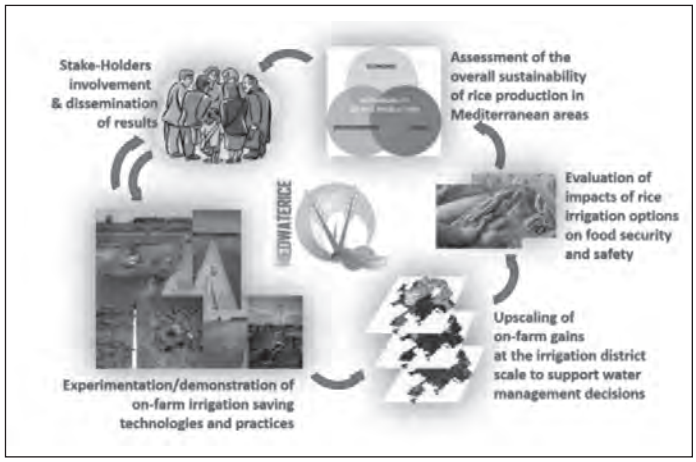
Aeiforia srl
Loc. Faggiola 16
Gariga di Podenzano - Italy
E-mail: federico.ferrari@aeiforia.it

Objectives

- exploring rice irrigation options alternative to continuous flooding in the main Italian rice basin (Lombardy-Piedmont)
- assessing their water consumption, crop yield, nutrient balance, and potential pesticide water pollution through field experimentation
- assessing their overall sustainability (economic, environmental, and social)

Highlights

- rice is strategic for food security in some countries, and human consumption in the whole Mediterranean is steadily increasing
- irrigation solutions to be experimented are tailored to local conditions
- for each solution, innovative technologies and the most appropriate agronomic practices are adopted



The MEDWATERICE project approach

- data collected at the farm level will be extrapolated to the irrigation district level to support water management decisions and policies

Excluding soil surface processes in field soil degradation studies – comparison of sand cover versus substance incorporation

Herbert Bayer, Jan Hassink, Bernhard Jene, Thomas Richter, Marius Roos-Majewsky

Presenter Jan Hassink

BASF SE
Agricultural Solutions
Limburgerhof, Germany
E-mail: jan.hassink@basf.com

Objectives

OECD and EFSA guidance on the design of field degradation studies to derive DegT-50_{matrix} values is available. Techniques such as soil incorporation or sand cover are proposed to exclude dissipation of the test substance, however, use of sand cover for potentially volatile substances is not recommended. The contrary is to be proven.

Highlights

- Degradation of pendimethalin (Vp $3.3x10^{-3}$ Pa, 25°C) investigated at 4 EU field sites.
- Two different designs were realized at each site in parallel after spray application:
  - Even application of a 3 mm layer of commercial fine sand to the soil surface.
  - Incorporation of pendimethalin in the soil over a depth of 7 cm.
- No statistically significant differences in the degradation of pendimethalin were observed during the relevant first time period after application.
- Covering the soil surface with a layer of fine sand is sufficient to eliminate the influence of soil surface processes, i.e. photolysis and volatilization.

Sand coverage (left) and soil incorporation (right).

Aqueous deposition of volatilised Lindane. A comprehensive data review of its use as internal standard in wind tunnel studies

Christian Staffa, Gunnar Fent, Roland Kubiak

Presenter Christian Staffa

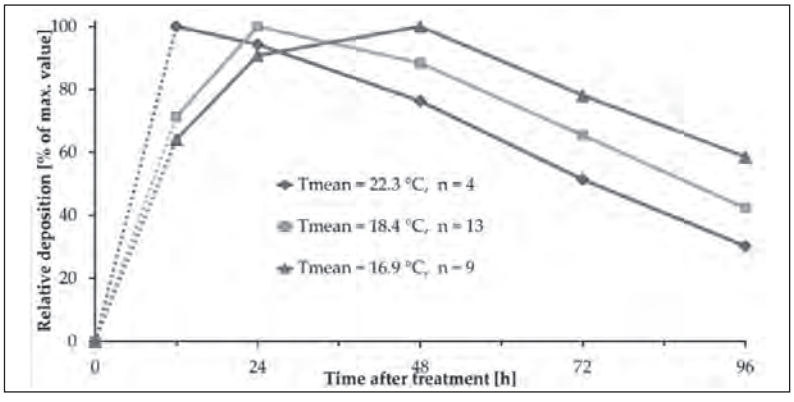
RLP AgroScience GmbH
Institute for AgroEcology
Breitenweg 71
Neustadt an der Weinstraße - Germany
E-mail: christian.staffa@agroscience.rlp.de

Objectives

- Lindane is used as tracer in wind tunnel studies conducted by RLP AgroScience.
- Its deposition is independent from investigated plant protection product.
- Large dataset of Lindane deposition dependent from time after application and distance from treated area is available together with climatic conditions during the experiments.

Highlights

- Decrease of Lindane deposition over distance was independent from absolute deposition level.
- Kinetics of deposition over time was linked to mean temperature during experimental period:
- For higher temperatures, highest deposition was measured earlier, whereas the deposition maximum occurred later for lower temperatures.



Relative Lindane deposition at 1 m distance as function of time after treatment, grouped by sampling interval with maximum deposition.

Calculation of average DFOP input parameters for PEC modelling from mixed kinetics datasets

Simon Ford, Johannes Witt, David Patterson, Sabine Beulke, Dieter Schaefer, James Hingston, Russell Jones, Ian Hardy, Mark Thomas, Beate Erzgräber

Presenter Simon Ford

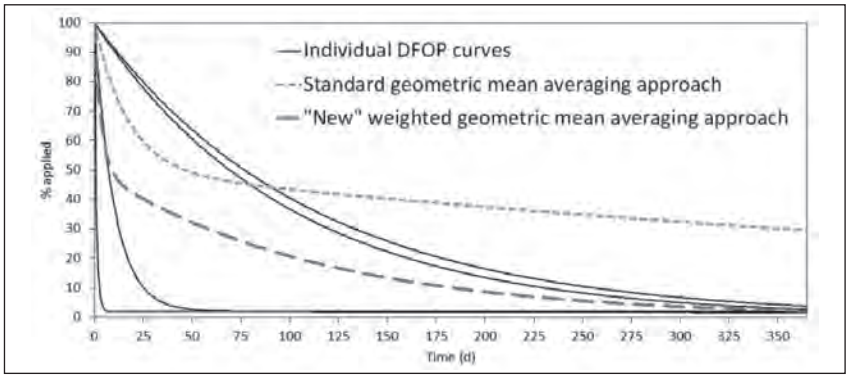
Battelle UK Ltd.
29 Springfield Lyons Approach
Chelmsford – UK
E-mail: s.ford@battelleuk.com

Objectives

- Develop guidance for averaging kinetic parameters within update to FOCUS kinetics
- Assess suitability of existing approaches to averaging of DFOP parameters
- Develop methods for combining parameters from SFO and DFOP kinetics

Highlights

- Issue identified with existing averaging approach for DFOP parameters
- Caused by not accounting for influence of DFOP g parameter when averaging rates
- New method developed with weighting of individual rate parameters to address issue
- DFOP k_{fast} weighted in geometric mean calculation by respective g, k_{slow} by $1 - g$
- Weighting considers proportion of overall degradation represented by each rate kx
- SFO rate constants included in averaging with both k_{fast} and k_{slow}
- Tests show new method provides "reasonable" average curve for mixed SFO/DFOP
- Test also proposed to identify when average can be represented with pseudo SFO



Comparison of new weighted geometric mean DFOP parameter averaging method with undesirable result from a standard geometric mean approach

GEORGE – A NEW, SPATIALLY-DISTRIBUTED PESTICIDE LEACHING MODEL

Tim Häring, Bernhard Jene, Oliver Schmitz, Marcel van der Perk, Derek Karssenberg

Presenter Tim Häring

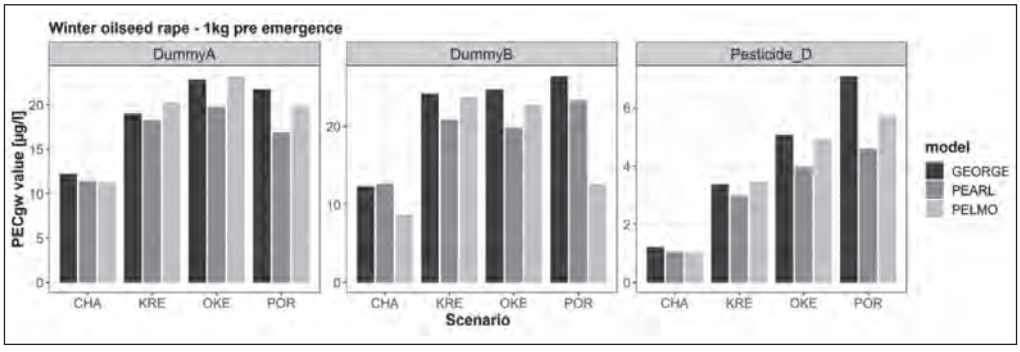
BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: tim.haering@basf.com

Objectives

- Introducing a new pesticide groundwater leaching model, developed explicitly for spatially-distributed modelling in regulatory context in the EU.
- Validating the GEORGE model against FOCUS scenarios and GW models.
- Application of GEORGE for GW vulnerability mapping and in-context setting of monitoring sites.

Highlights

- Flexible and new modelling framework: water and solute transport processes implemented directly into GIS environment (PCRaster Python).
- A capacity approach was used to model soil water balance. Convective-dispersive solute transport using nonlinear Freundlich-type sorption, depth, temperature and moisture dependent degradation and metabolite transformation are implemented.
- Good agreement between the established FOCUS models and GEORGE



Predicted environmental concentration in groundwater for FOCUS Dummy-A and -B (1kg pre-emerg. to winter oilseed rape) calculated with FOCUS PEARL, FOCUS-PELMO as well as GEORGE.

Estimating residue travel times and well catchments to assess hydraulic connectivity of edge-of-field groundwater monitoring wells

Nils Kehrein, Wenkui He, Florian Hegler, Robin Sur

Presenter Wenkui He

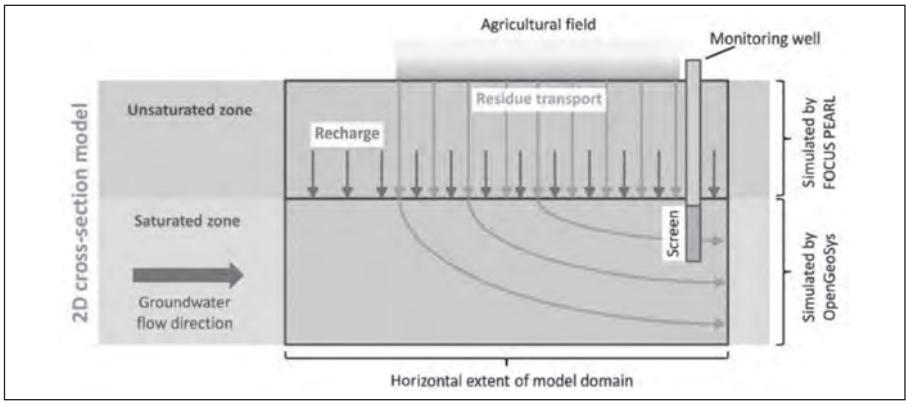
knoell Germany GmbH
Konrad-Zuse-Ring 25
68163 Mannheim – Germany
E-mail: whe@knoell.com

Objectives

Assessment of the hydraulic and temporal connectivity of a well with neighbouring agricultural fields. Two approaches were compared to assess hydraulic connectivity: a piston-flow model (PFM) and a 2D cross-section model (2DM) coupling PEARL and OpenGeoSys. Travel times of residues from surface to groundwater were estimated using a simple model of substance transport in the vadose zone.

Highlights

- The described methods can be used to assess new wells or to evaluate existing monitoring wells; these can be used either in a tiered or combined approach
- PFM and 2DM generally agree on depths where highest concentrations are likely to occur; PFM requires few parameters which may be available as part of a monitoring study; 2DM can account for time-dependent dynamics and accommodate various levels of data availability and model complexity



Schematic illustration of the 2DM, coupling of PEARL with OpenGeoSys to represent processes in unsaturated and saturated zone

Lysimeter study on the leaching of cyantraniliprole, paclobutrazol and metribuzin in silt loam soil

Victoria N. Kolupaeva, Ann A. Kokoreva, Alexandra A. Belik, Angelika A. Astaikina, Mikhail V. Kolupaev

Presenter Victoria N. Kolupaeva

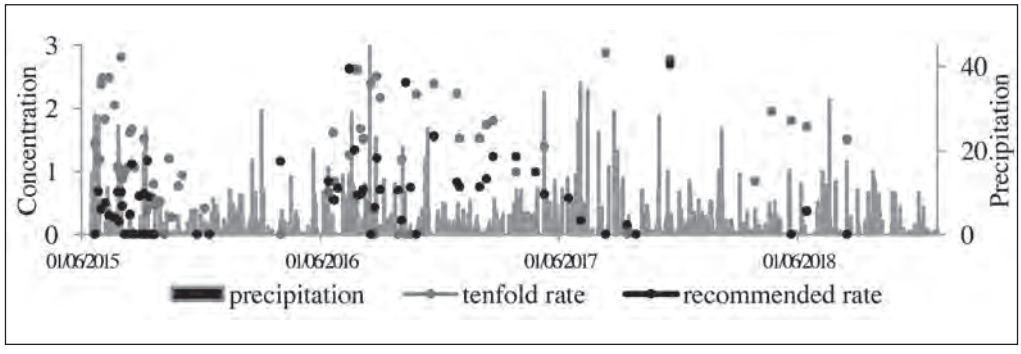
Russian Scientific-Research Institute of Phytopathology
Bolshye Vyazemy
Moscow region Russia
E-mail: ogiyvita@rambler.ru

Objectives

- To study migration cyantraniprole, paclobutrazol and metribuzin
- To assess risk of these pesticides for groundwater;
- To compare experimental and predicited environmental impact

Highlights

- Pesticides were applied in the recommended and increased rates
- Pesticides in leachate were analyzed with HPLC and GLC methods
- Pesticides were detected in water in both variants with recommended and increased doses. The maximum detected concentrations in the leachate (recommended rate) were higher than EU threshold concentration of 0.1 μg L^{-1}
- Predicted with model PEARL concentration were close to experimental ones
- The danger of migration by GUS and K_{oc} were high for all pesticides studied



Precipitation (mm) and cyantraniliprole concentration (μg L-1) in leachate

Modelling the effect of the landscape and agricultural practices on atmospheric dispersion and deposition of pesticides used in agriculture

Meriem Djouhri, Benjamin Loubet, Pierre Benoit, Laure Mamy, Carole Bedos

Presenter Meriem Djouhri

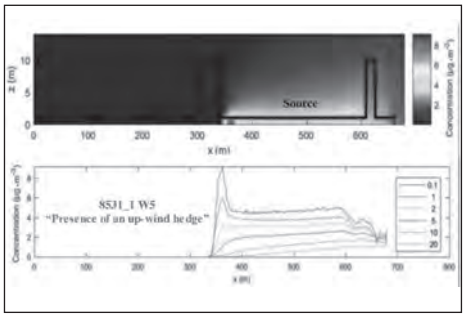
University of Montpellier-INRA-IRD-SupAgro
UMR LISAH
2 place Pierre Viala - Montpellier (34060) – France
E-mail: meriem.djouhri@inra.fr

Objectives

- Evaluation of the effect of the landscape configuration on pesticide atmospheric dispersion.
- Identification of the main influencing elements of the landscape.
- Evaluation of the effect of agricultural practices on pesticide volatilization and dry deposition.
- Assessment of the contribution of pesticide dry deposition on the contamination of non-targeted area.

Highlights

- Identification of the effect of hedges on pesticide atmospheric dispersion.
- Hedges thickness and their relative position from the source have an important impact on pesticide atmospheric dispersion.
- Application period and pesticide physico-chemical characteristics strongly affect the contamination of the non-targeted areas.



Effect of hedges on pesticide concentration (Hedges LAI=7, windspeed=5.5m/s)

EFAM: AUTOMATED MODELING SOFTWARE FOR ENVIRONMENTAL RISK ASSESSMENT

Frank Voß, Ronnie Juraske, Patrick P. Lenhardt, Wolfgang Reiher

Presenter Frank Voß

knoell Germany GmbH
Konrad-Zuse-Ring 25
Mannheim – Germany
E-mail: fvoss@knoell.com

Objectives

Knoell developed the software package efam (environmental fate automated modeling) to facilitate automated modeling and reporting. The aim was to create a software application that can drive regulatory necessary computer models and evaluate the results from one single platform in an automated manner

Highlights

The software is developed in a modular structure allowing for integration of individual modeling tools. This enables flexible adaptation e.g. when new models are released, or new model versions need to be applied. Model calculations do no longer need to be carried out on desktop computers, but can be performed on a more powerful and remote server located in a secured data center. efam is developed to automate model parameterization and model simulations, extract the results and transfer outputs to formatted tables suitable for dossier/report incorporation. efam can optimize the organization of data, reduce the occurrence of manual input errors and reduce the effort required for quality control.

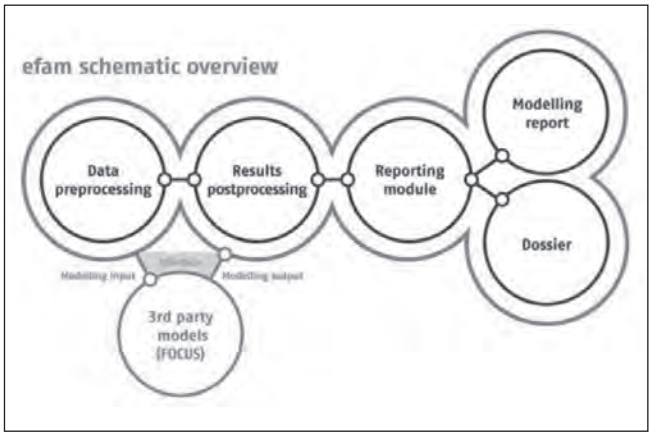


Figure 1: efam schematic overview

Pesticide transfer in the vadose zone: impact of geological materials and pesticide properties

Nicole Baran, Pauline Sidoli, Patrick Ollivier

Presenter Nicole Baran

BRGM (French Geological Survey)
3, avenue C. Guillemin
BP 36009
45060 Orléans cedex 2 - France
E-mail: n.baran@brgm.fr

Objectives

- Improve our knowledge of pesticide transfer in geological materials undelaying soil
- Estimate the time lag between pesticide application and potential detection in groundwater

Highlights

- Active substances and their metabolites have contrasted behavior.
- For a given molecule, the observed time lag compared to non-reactive tracer is material-dependent.
- Interactions between molecules and matrix is higher for an altered amphibolite compared to calcareous materials.

Towards a more realistic soil exposure assessment for pesticides in the EU regulatory context

Laima Abromaityte, Michele Ghidotti, Gabriella Fait, Laura Padovani, Christopher Lythgo

Presenter Laima Abromaityte

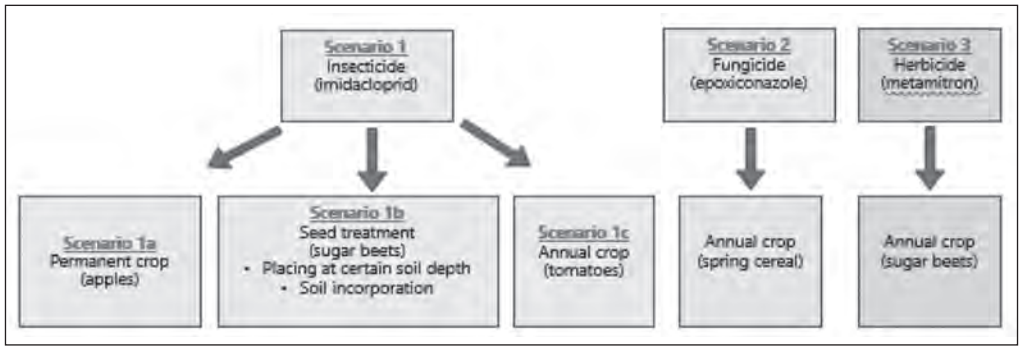
European Food Safety Authority (EFSA)
Via Carlo Magno 1A
43126, Parma, PR, Italy
E-mail: laima.abromaityte@ext.efsa.europa.eu

Objectives

- Compare two different exposure-assessment calculation regulatory approaches (an old one (from FOCUS, 1997) and a new one (from EFSA Guidance, 2017)): the Estimation of Soil Concentration After PEsticide applications (ESCAPE) and the Persistence in Soil Analytical Model (PERSAM) for Predicted Environmental Concentrations (PECs) in soil.

Highlights

- Three substances (imidacloprid, metamitron, and epoxiconazole) representative of different pesticide classes (insecticides, herbicides and fungicides) were selected for PECs modelling in soils cultivated with different crops.
- The PERSAM model was used for Tier 1 and Tier 2 calculations. The (Pesticide Emission At Regional and Local Scales) PEARL tool was chosen for higher tier (Tier 3A) calculations for epoxiconazole which was the most persistent fungicide among all pesticides in this study.



Scheme of the scenarios modelled with PERSAM.

DegKinManager. Evaluation of water sediment studies including volatilisation

Judith Klein, Michael Klein, Prasit Shrestha

Presenter Judith Klein

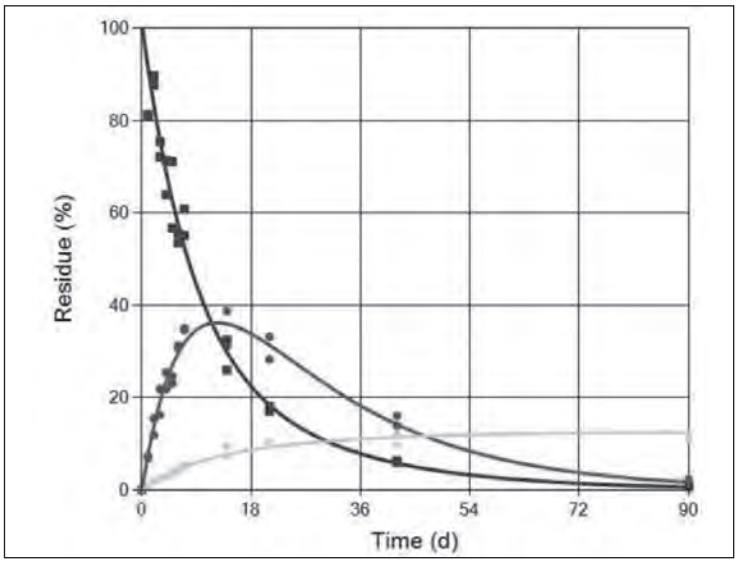
Fraunhofer IME
Auf dem Aberg 1
Schmallenberg - Germany
E-mail: Judith.Klein@ime.fraunhofer.de

Objectives

- Evaluation of biodegradation water sediment test (level II)
- Calculation of individual degradation rates and DegT50 values for water and sediment
- Estimation of explicit volatilisation rates

Highlights

- New test design for volatilizing substances and user-friendly software tool for the evaluation of biodegradation water sediment test (level II)



DegKinManager 2.1: Fitting result (parent without metabolites including volatilization): Dots: experimental data, lines: model prediction; aqua blue: water, brown: sediment, light blue: volatile

Comparison of the nicosulfuron herbicide degradation in soils under conventional and conservation agriculture

Sixtine Cueff, Lionel Alletto, Déborah Mouquet, Valérie Dumeny, Yolaine Delaunay, Pierre Benoit, Valérie Pot

Presenter Sixtine Cueff

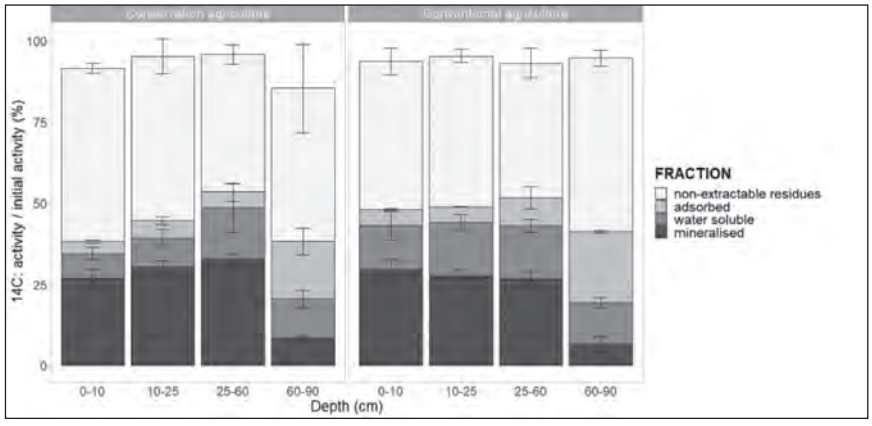
INRA UMR AGIR
24 Chemin de Borde Rouge
Castanet Tolosan - France
E-mail: sixtine.cueff@inra.fr

Objectives

- Compare the degradation of nicosulfuron in soils samples collected in conventional and conservation agriculture fields of 2 sites located in South West of France

Highlights

- Microbial activity and biomass were the highest in the surface horizon of both conservation agriculture plots
- Most of the differences regarding the degradation of nicosulfuron between agricultural systems were not significant
- The degradation of nicosulfuron was lower in the deepest horizon of each site
- The distribution of nicosulfuron in the different measured fractions evolved during the experiment: more mineralisation, less water soluble fraction and more bound residues were found with time.



^{14}C mass balance after 91 days of incubation for conservation plot (left) and conventional plot (right) of one site of study

Comparison of water and pesticides transfers in undisturbed soil columns sampled in conservation and conventional agriculture

Sixtine Cueff, Lionel Alletto, Léonore Flipo, Marjolaine Deschamps, Valentin Serre, Nathalie Bernet, Christophe Labat, Ghislaine Delarue, Valérie Pot

Presenter Cueff Sixtine

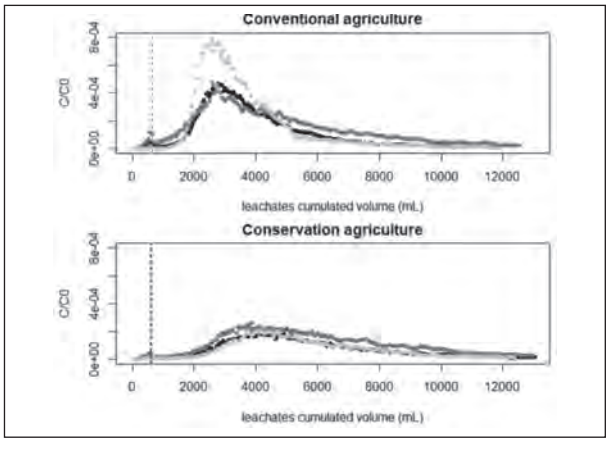
INRA UMR AGIR
24 Chemin de Borde Rouge
Castanet Tolosan - France
E-mail: sixtine.cueff@inra.fr

Objectives

- Assess the effects of soil management, conventional vs. conservation agriculture on the leaching of three pesticides: metaldehyde (molluscicide), nicosulfuron, mesotrione (herbicides) on 2 sites located in South West of France

Highlights

- Metaldehyde arrived at the same time as bromide. Other pesticides were delayed
- Mesotrione was the only pesticide that showed a clear difference between practices
- Concentrations of the three pesticides in soil layers were always the highest in the surface layer and decreased with depth
- All three pesticides arriving at the same time as bromide on the second site suggested strong preferential flow



Triplicate breakthrough curves of mesotrione on 1st site plots. Leachates concentrations are corrected by initial applied concentration. Dotted lines correspond to the beginning of the second rain

Behavior of glyphosate in wastewater treatment plants

Thomas Poiger, Martina Keller, Sebastian Huntscha, Ignaz J. Buerge

Presenter Thomas Poiger

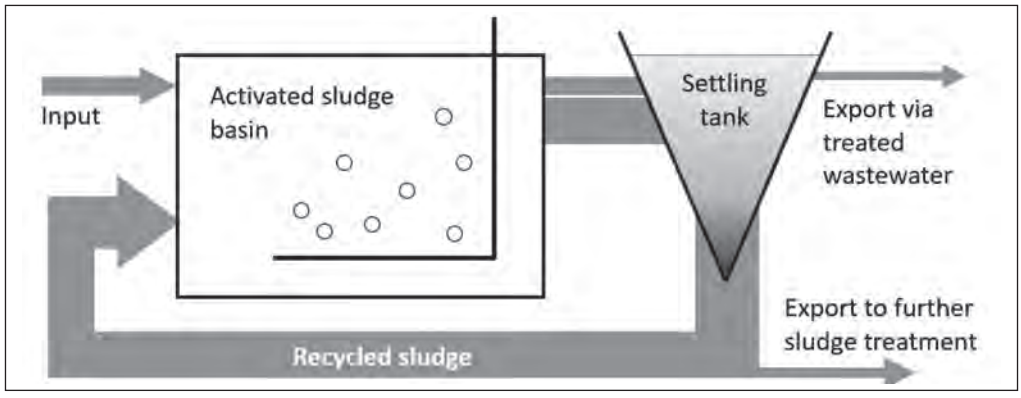
Agroscope
Müller-Thurgau-Strasse 28
Wädenswil, Switzerland
E-mail: thomas.poiger@agroscope.admin.ch

Objectives

- Characterize the seasonal occurrence of glyphosate in municipal wastewater
- Determine the removal efficiency in different wastewater treatment plants
- Study adsorption and degradation in activated sludge treatment

Highlights

- Glyphosate concentrations in raw municipal wastewater from < LOQ to 8.5 µg/L
- Clear seasonal trend with maximum in summer
- Fairly strong day-to-day fluctuations in raw wastewater, linked to rain events
- Much less fluctuation in treated wastewater, removal efficiency 40-90%
- No degradation was observed in (aerobic) activated sludge treatment
- Strong adsorption to activated sludge
- Computer simulations show that removal can be described by adsorption only



Simulation of glyphosate behavior in activated sludge treatment. Note that, due to strong sorption, the glyphosate mass flow with recycled sludge is usually greater than that in untreated wastewater.

Assessment of a potential of selected microbial cultures to degrade residues of "modern" pesticides

Frantisek Kratky, Jana Hajslova, Petra Lovecka, Blanka Vrchotova, Vaclav Kadlec, Tomas Kourimsky, Adriana Novotna, Vojtech Hrbek

Presenter Frantisek Kratky

University of Chemistry and Technology
Technicka 5
Prague – Czech Republic
E-mail: kratkyf@vscht.cz

Objectives

- investigate a potential of bacterial species to degrade residues of commonly used pesticides;
- simulation of degradation processes in a liquid medium spiked with respective pesticides.

Highlights

- UHPLC-MS/MS method was validated for 6 picked pesticides residues in a liquid medium (spiked levels 0,02 and 0,002 mg/L);
- bacteria isolated from soil were cultivated in a medium spiked with respective pesticide (spiked levels 10 and 100 mg/L) up to 25 days;
- species proved to possess a degradation potential will be used for future bioremediation experiments under real-life conditions at contaminated localities.

Dedications

- This work was supported by METROFOOD-CZ research infrastructure project (MEYS Grant No: LM2018100) including access to its facilities.
- Financial support from specific university research (MSMT No 21-SVV/2019).
- This project was funded by project TAČR (TN010000048/06).

Post-registration monitoring of pesticides in groundwater in Italy

Silvia Ghisoni, Lucio Botteri, Federico Ferrari, Yolanda Picó, Marco Trevisan, Luigi Lucini

Presenter Silvia Ghisoni

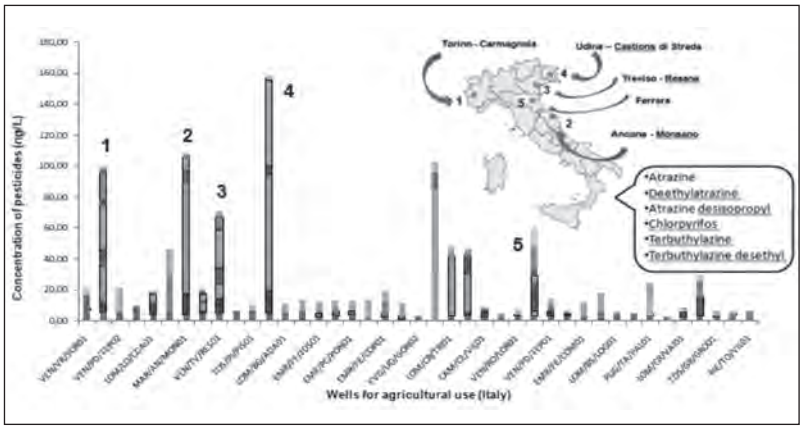
Università Cattolica del Sacro Cuore
Via Emilia Parmense, 84
Piacenza – Italy
E-mail: silvia.ghisoni@unicatt.it

Objectives

- To monitor the occurrence of 61 pesticides in 41 groundwater wells from Italy.
- To optimize the extraction process by comparing Solid Phase Extraction and lyophilization.
- To develop a liquid chromatography tandem mass spectrometry (LC-MS/MS) method for the target determination of pesticides.

Highlights

- The atrazine metabolite deethylatrazine, showed the highest concentrations (75.6 and 72 ng L^{-1}) in two wells, whereas the parent atrazine and its Desisopropyl metabolite were frequently detected even thought at lower concentrations.
- Similarly, Terbuthylazine and Terbuthylazine-desethyl were found in groundwater samples, ranging from 0.96 to 17.24 ng L^{-1}, and up to 55.3 ng L^{-1}, respectively.



Occurrence of pesticides in groundwater samples collected from Italian wells for agricultural use.

- Chlorpyrifos was found in over 97% of the samples analyzed, although at low concentrations (0.72-5.58 ng L^{-1}).

Hidden effects of herbicides on metabolism and fruits quality in tomato

Begoña Miras-Moreno, Paola Ganugi, Valeria Terzi, Luigi Lucini, Marco Trevisan

Presenter Begoña Miras-Moreno

Università Cattolica del Sacro Cuore/ CREA-GB
Via Emilia Parmense 84, 29122
Piacenza-Italy
E-mail: mariabegona.mirasmoreno@unicatt.it

Objectives

- To investigate the impact of selective (metribuzin and rimsulfuron) and non-selective herbicides (glyphosate and pelargonic acid) on tomato plants.
- Untargeted screening of metabolites by using a UHPLC/Q-TOF following herbicides application.
- Effect of treatments on fruits quality.

Highlights

- Both primary and secondary metabolism were distinctively shaped by the treatments.
- Amino acids and other nitrogen-containing metabolites showed marked changes after the treatment.
- Significant impact on berries since weight, antioxidant activity, total polyphenol content and percentage of carbon were affected

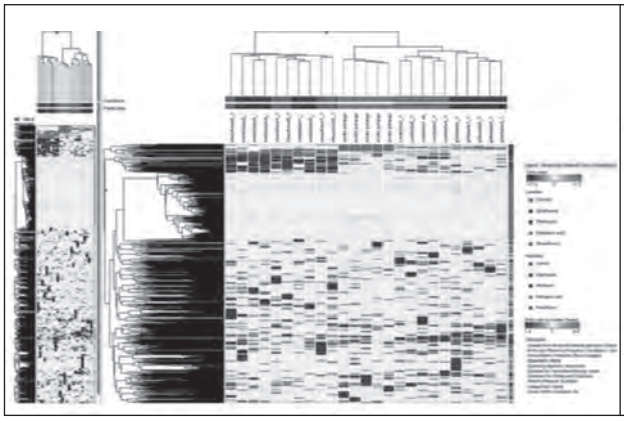


Figure 1. Unsupervised hierarchical cluster analysis of metabolomic profile in tomato leaves

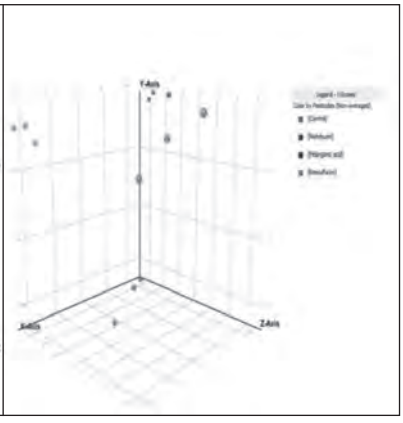


Figure 2. PLS-DA score plot of metabolomic profile in tomato fruits

Vigneto: A GIS-based model to evaluate environmental impact of pesticide use in vineyards

Daniele D'Ammaro, Lucrezia Lamastra

Presenter Daniele D'Ammaro

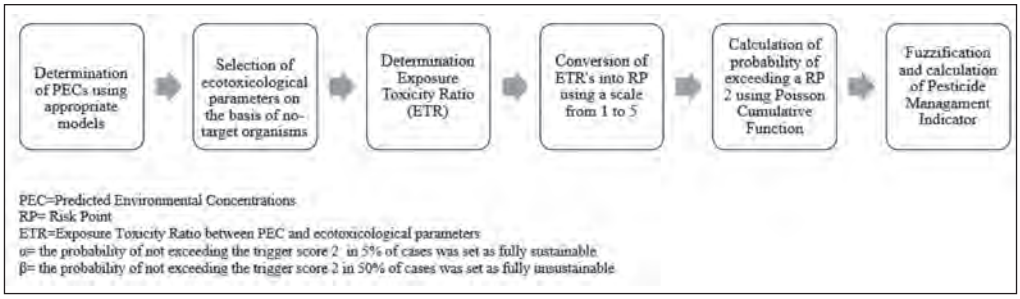
DiSTAS Department for Sustainable food process
Catholic University of the Sacred Heart
Via Emilia Parmense 84, 29100
Piacenza, Italy
E-mail: daniele.dammaro@unicatt.it

Objectives

- "Vigneto" is a multidimensional indicator to evaluate the sustainability of management options adopted at field scale based on six sub-indicators. The application of the Pesticide Management Indicator (PMI) allows obtaining a judgment of the environmental impact of pesticides use in vineyards

Highlights

- A new multidimensional indicator has been developed to evaluate the sustainability of management options adopted at vineyard scale.
- The indicator considers the main agronomic aspects, including the pest management, related by a hierarchical fuzzy logic and implemented in web GIS software.
- The developed model plays a critical role in human decision-making processes for pest management strategies to foster a sustainable interaction of agriculture with the environment.



Flow diagram: procedure to calculate Pesticide management indicator

Determination of the Experimental Leaching Index (ELI) of five herbicides in amended and unamended soils

Gabriel Pérez-Lucas, María P. Navarro, Nuria Vela, Ginés Navarro, José Fenoll, Simón Navarro

Presenter Simón Navarro

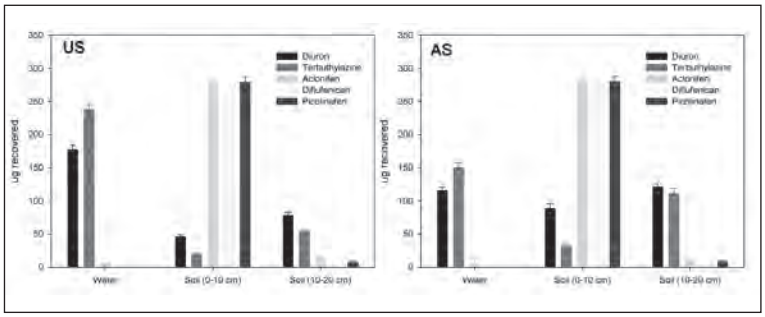
University of Murcia
Campus Universitario de Espinardo
Murcia-Spain
E-mail: snavarro@um.es

Objectives

- Appraisal the potential of five pesticides (Aclonifen, Diflufenican, Diuron, Picolinafen y Terbuthylazine) for movement (leaching) into deeper soil layers and eventually into groundwater.
- Determination of the Experimental Leaching Index (ELI) of the herbicides through disturbed soil columns packed with unamended and amended soil with exogenous organic matter.

Highlights

- Leaching experiments were performed in polyvinyl chloride (PVC) columns of 40 cm (length) × 4 cm (i.d.) packed with 300 g of soil each of them being separated into fractions of 150 g
- Humic acid extract from American leonardite was used as organic amendment.
- The columns were washed by adding 600 mL of 0.01 M CaCl2 during 8 days with a peristaltic pump.
- Terbuthylazine and diuron showed high potential leaching, mainly in unamended soil, while aclonifen, diflufenican and picolinafen behave as non-leacher compounds.



Distribution of pesticides from soil and water in amended (AS) and unamended soil (US).

Effect of compost addition on the adsorption of several herbicides on the soil

Manuel Gambín, Gabriel Pérez-Lucas, Ginés Navarro, Nuria Vela, José Fenoll, Simón Navarro

Presenter Nuria Vela

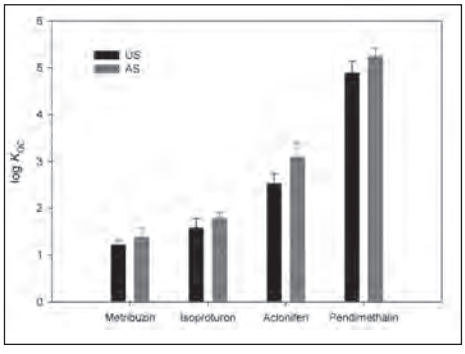
Catholic University of Murcia
Campus de los Jerónimos s/n, 30107
Murcia-Spain
E-mail: nvela@ucam.edu

Objectives

- Adsorption is the result of the electrical attraction between pesticide molecules (sorbate) and soil particles (adsorbent).
- We examined the effect of an organic amendment on the sorption of four herbicides (metribuzin, isoproturon, aclonifen and pendimethalin) on the soil.

Highlights

- An ecological compost (EC) of sheep manure (pH 7.7, EC 13.0 dS m^{-1}, OC 166 g kg^{-1}, C/N 10.1) was used as organic amendment.
- The sorption of herbicides in unamended and amended soils was determined using a batch equilibrium method.
- The organic carbon-normalized adsorption coefficient (K_{OC}) was calculated as (K_d x 100)/% OC
- The addition of EC noticeably increases the sorption of the studied herbicides, especially for aclonifen.



Values of log KOC obtained for pesticides applied to unamended (US) and amended soil (AS).

Quantifying water budget components in clay till settings and relating these to pesticide leaching

Sachin Karan, Nora Badawi, Preben Olsen, Anne Louise Gimsing, Annette E. Rosenbom

Presenter Sachin Karan

Geological Survey of Denmark and Greenland (GEUS)
Øster Voldgade 10, 1350 K
Copenhagen – Denmark
E-mail: saka@geus.dk

Estimation of groundwater recharge at agricultural fields in clay till settings poses great challenges due to the unknown distribution between groundwater recharge and drain runoff. Consequently, potential pesticide leaching distribution to groundwater and drain runoff is difficult to estimate. Based on nearly 20 years of monitoring in the Danish Pesticide Leaching Assessment Programme (PLAP), at agricultural fields, we are aiming to: (i) quantify different water budget components at the agricultural field scale and (ii) relate pesticide leaching concentrations to groundwater as well as drain runoff, also at the agricultural field scale.

The water balance distribution in clay till fields is especially challenging since flow is governed by the presence and density of macropores (biopores and fractures). Though drains are known to capture a large proportion of the flow from macropores, the quantification of drain flow relative to the groundwater recharge is not known. Here, PLAP monitoring of crop rotation, climate variables, soil saturation, hydraulic heads and drain flow at the agricultural field scale is used to calculate water budget components. In conjunction to quantification of water budget components, pesticide leaching concentrations in drain flow and groundwater samples are analyzed to gain knowledge of how these concentrations are distributed. Additional PLAP monitoring of pesticide concentrations (from application doses together with soil water-, groundwater- and drain flow samples) are used in the analyses. Finally, the long time series of hydrological variables and pesticide concentrations yield knowledge of how concentrations in groundwater and drain flow are affected by dynamic events related to rainfall intensity. This study provides novel insights to water budget distributions, pesticide leaching concentrations related to both water budget components and temporal effects.

Speciation of non-extractable residues of pesticide in soil: is it possible?

Michael Xiao Huang, Andrew Eatherall, Laura Laughlin, Pat Havens, Mingming Ma, Shiran Qiu, Ash Sharma, Chengwei Fang

Presenter Michael Xiao Huang

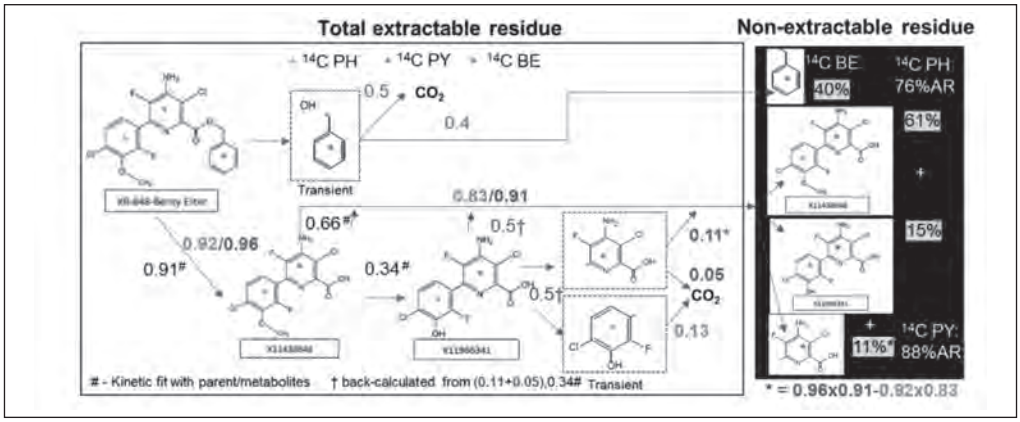
Corteva Agriscience
9330 Zionsville Rd.
Indianapolis, IN, U.S.A.
E-mail: xiao.huang@corteva.com

Objectives

Determine the major molecular entities contributing to non-extractable residues (NER) of pesticide in soil.

Highlights

In this study, we explore a step-wise approach to determine the major contributors of molecular entities of pesticide to NER, by analyzing laboratory degradation studies with multiple ^{14}C labels using a four-pool (parent compound, combined metabolites, CO2, and NER) kinetics pathway model. DFOP (the double-first-order-in-parallel model) is used as a model for the combined metabolite pool in which a major metabolite contributes to NER and a terminal metabolite degrades to CO_2. This four-pool kinetic analysis is then sequentially applied to degradation studies dosed with 14C-labeled metabolites, to determine or verify major contributors to NER.



The contribution of molecular entities to non-extractable residues (NER) of pesticide in soil, as predicted by the four-pool (parent, combined metabolites, CO2, and NER) kinetic pathway model

Industry position on the EFSA opinion on aged sorption

Bernhard Jene, Klaus Hammel, Paul Sweeney, Chengwei Fang, Prasesh Sharma, Michael-Xiao Huang

Presenter Bernhard Jene

BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: bernhard.jene@basf.com

After a first draft of the aged sorption guidance in 2010, an updated version was sent to EFSA in 2012. EFSA evaluated the draft and published a critical statement in 2015 where it was recommended not to use aged sorption in the regulatory context. This led to a second guidance update in 2016 where the issues raised by EFSA were addressed and which finally resulted in the EFSA scientific opinion from 2018.
Industry agrees with EFSA that aged sorption can be used to refine the leaching assessment at higher tier. The worked examples in the EFSA opinion using data made available by ECPA companies clearly show how the guidance could be applied. Industry also agrees with EFSA on how to derive aged sorption parameters for metabolites and how to combine first tier degradation and sorption parameters with aged sorption parameters for the assessment.
However, industry is critical of the fact that EFSA is reluctant to accept the use of aged sorption in combination with field degradation studies. A number of scientific papers show that aged sorption effects could be observed in field degradation, field leaching studies or in undisturbed outdoor lysimeters. From industry perspective, the most recent version of the guidance (2016) describes a scientifically reasonable way of combining aged sorption with field degradation studies. Especially the method of determining aged sorption parameters from well controlled laboratory studies using the soils from the field degradation studies and rescaling the DegT50 values from the corresponding fields to DegT50eq values with the obtained parameters describes a sensible and pragmatic way that should be followed.
Finally, industry is of the opinion that there is no scientific reason to reject the use of aged sorption as a higher tier for surface water exposure assessment.

SESSION IV
SUSTAINABLE USE, IPM AND STAKEHOLDER'S RESPONSE

The Directive 2009/128/EC introduced the need for a sustainable use of pesticides in the EU, through the mitigation of risks and the reduction of impacts of pesticide use. In this concept, both on human and environment health are included. The directive referred to the promotion of Integrated Pest Management (IPM) and the adoption of alternative approaches (including non-chemical alternatives to pesticides) as key drivers for sustainable use. Other critical aspects have been related to the training of users and distributors of pesticides, the inspection of application equipment, the limitation of use in sensitive areas, as well as to the raising in information and awareness about pesticide risks. Following 2009/128/EC, EU countries have developed National Action Plans to implement the range of actions provided by the Directive.
In this framework, the active involvement of stakeholders is also crucial, in order to achieve an effective involvement of the whole chain of actors involved in the adoption of sustainable uses of pesticides, thus including manufacturers, sellers, farmers, organizations and consortia. Only through this coordinated involvement, sustainable practices can be effectively implemented.

Session Chairs
- James Garratt
- Maura Calliera

Stimulating implementation of best management practices to reduce pesticide loads to surface water in a small agricultural catchment

Ellen Pauwelyn, Els Belmans, Ingeborg Joris, Elien Dupon, Eva Kerselaers, Lieve Borremans, Saskia Lammens, Ingrid Keupers, Piet Seuntjens

Presenter Ingeborg Joris

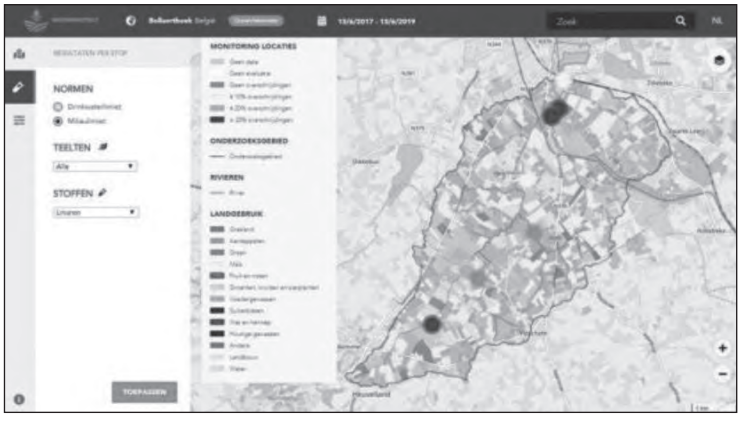
VITO
Environmental Modeling Unit
Boeretang 200
Mol - Belgium
E-mail: ingeborg.joris@vito.be

Objectives

- Stimulate implementation of best managements practices to reduce PPP load in an agricultural catchment in a multi-actor approach

Highlights

- Pilot area is agricultural catchment with drinking water production
- Water quality under pressure from PPP residues in surface water
- Monitoring shows main pathways are point sources and runoff and erosion
- Risk analysis to focus on critical source areas and farmyards
- Suitable measures have been selected in consultation with actors and bottlenecks for implementation identified
- Methods for increasing involvement of targeted farmers and alternative governance systems are proposed



Water quality results and land-use for the Bollaertbeek catchment in the Water-Protect tool

Development of regulatory modelling: achievements of the EU modelling Workshops

Bernhard Gottesbüren, Sabine Beulke and Jos Boesten

Presenter Bernhard Gottesbüren

BASF SE,
Speyerer Straße 2,
67117 Limburgerhof, Germany
E-mail: bernhard.gottesbueren@basf.com

Objectives

- Achievements of European Modelling Workshops (EMW) to provide a forum for discussion on regulatory modelling in Europe are described.

Highlights

- The European Modelling Workshops (EMW) provide a forum to discuss urgent regulatory modelling topics at the European level (30-50% of time reserved for debate). Presentations and resolutions are made available at the PF-Models website (e.g. http://www.pfmodels.org/emw9.html).
  The EMWs have become focal points for exchange and inspirations and their resolutions are well accepted references, being starting points leading to changes on regulatory framework recommendations e.g.
  - consideration of aged sorption (UK CRD Guidance),
  - multiyear -runs for PECsurface water calculations (EFSA FOCUSsw repair)
  - design and evaluation of groundwater monitoring studies (SETAC EMAG groundwater).
- Some resolutions of the last EMW9 in Copenhagen (2018) are:
- Definition of specific groundwater protection goals at EU
- Dialog on spatial modelling framework needed
- Establish a workgroup and roadmaps towards landscape risk assessment
- Consider latest development in drift exposure assessments •

"Policies and stakeholder's role in groundwater protection in areas with intensive agriculture"

Alexandru Marchis, Maura Calliera, Nicoleta Suciu, Ettore Capri

Presenter Alexandru Marchis

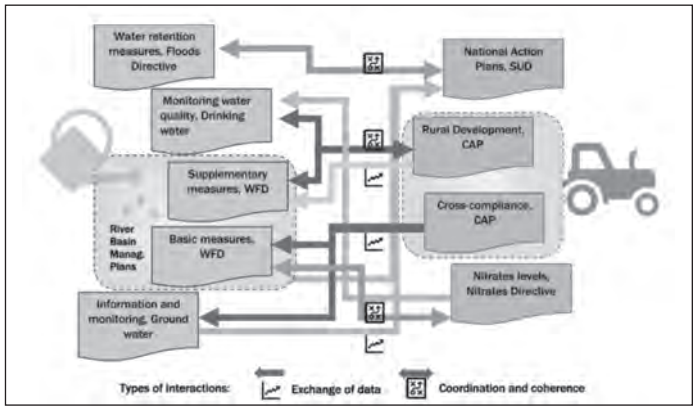
Università Cattolica del Sacro Cuore
E. Parmense, 84
Piacenza, Italy
E-mail: alexandruvasile.marchis@unicatt.it

Objectives

- define the level of engagement of stakeholder groups in groundwater protection
- debate on the role and impact of EU and national policies in water management
- define elements for the long-term strategy for water management with support of agriculture

Highlights

- EU policies are evolving to consider these new realities of the interactions between water and agriculture
- implementation in Member States should further enhance policy synergies in the areas of water management and agriculture
- stakeholders are all keen and ready to engage in developing and deploying solutions for better water management



Opportunities for interactions and exchange of information between various EU water and agriculture related policy instruments

- best management practices exist, but more training to farmers is needed;
- Progress made needs to be communicated to incentivize farmers to continue

Ditch maintenance as a lever to limit water contamination by pesticides

Cécile Dagès, Jean-Stéphane Bailly, Jeanne Dollinger, Marc Voltz

Presenter Cécile Dagès

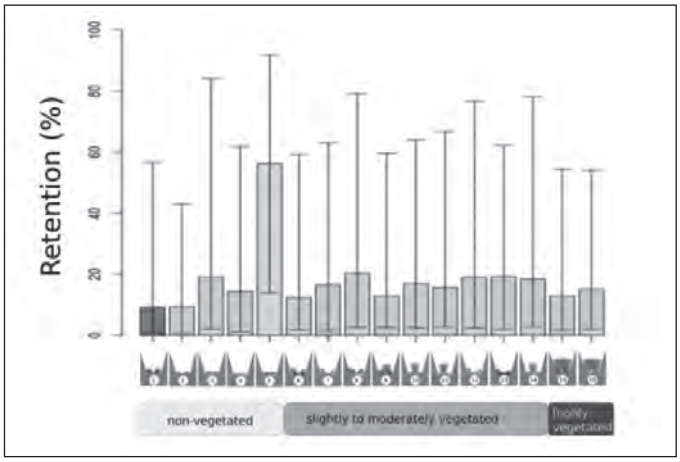
University of Montpellier-INRA-IRD-SupAgro
UMR LISAH
2 place Pierre Viala
Montpellier - France
E-mail: cecile.dages@inra.fr

Objectives

- This study aimed to i) assess the control that ditches exert over water contamination ii) identify the most effective management method (among dredging, mowing, chemical weeding, burning) to maximize the buffer effect iii) evaluate the effect of the spatial distribution of maintenance along the network on the buffer effect.

Highlights

- We analyzed the sensitivity of ditch pesticide retention to ditch properties derived from field observations, with a new reactive ditch transfer model.
- Simulated pesticide retention in a flooded ditch varied from 0.5 to 99%, and ditch properties were a key factor explaining this variability.



Functional types of ditches with contrasting physical and retention properties have been identified, as shown by the small figures on the x-axis, here for the retention of diuron in case of contaminating floods

- A wide ditch, burned or mowed, showed to have a better overall retention capacity.
- Ditches networks with high retention capacity reaches in their downstream part have a greater efficiency than when their high retention capacity is located upstream

Chasing the dream of zonal and interzonal harmonization

Krisztian Szegedi

Presenter Krisztian Szegedi

BASF SE
Speyerer Str. 2
67117 Limbugerhof – Germany
E-mail: Krisztian.szegedi@basf.com

Objectives

- The aim of the presentation is to highlight increased complexity and unnecessary complications introduced by the lack of harmonization in the evaluation of in the evaluation of environmental fate and behavior of active ingredients and their metabolites.
- Practical and regulatory consequences of the lack of harmonization will be discussed.

Highlights

- The aim of the regulatory framework defined by 1107/2009 and related regulations is to ensure evaluation within agreed timeframes following harmonized scientific criteria and harmonized procedures by all member states.
- However, the different interpretation of submission requirements and guidelines by different evaluating authorities has lead to a lack of harmonization at operational level.
- Anonymized examples from recent evaluations will be presented. Good and bad practice will be highlighted.
- Immediate consequence of lack of harmonization is increased workload for applicants and evaluators
- Long-term consequences are reduced predictability of the evaluation process and substantial workload for mutual recognitions
- Most hurdles for a fully functioning harmonization could be resolved within the current regulatory framework

Integrated modelling of pesticide fate in landscapes for designing sustainable agricultural management strategies

Bedos C., Voltz M, Crevoisier, D., Dagès C., Fabre J.C., Lafolie F., Loubet B., Personne E., Casellas E., Chabrier P., Chataigner M., Chambon C., Nouguier C., Bankwal P., Barriuso E., Benoit P., Brunet Y., Douzals J.P., Drouet J.L., Mamy L., Moitrier N., Pot V., Raynal H., Ruelle B., Samouelian A., Saudreau M.

Presenter Carole Bedos

INRA-AgroParisTech
UMR 1402 ECOSYS
78850 Thiverval-Grignon
France
E-mail: carole.bedos@inra.fr

Objectives

- This paper presents the state of development and first simulation test of a new integrative pesticide fate model MIPP at the landscape scale that couples the fate of pesticides in soils, waters and air as influenced by the spatial and temporal organization of farming practices and landscape properties.

Highlights

- The use of pesticides in agriculture leads to the contamination of most ecosystem compartments in many countries. There is therefore a general need to design sustainable agricultural management strategies combining agronomical and landscape levers to limit the use and dispersion of pesticides. Integrated landscape models can help to that aim.
- A version of the MIPP model has been completed. It couples pesticide fate and transport in the atmosphere, in the hydrological networks and in the soil. Main simulated processes are sedimentary drift, soil and plant volatilization, atmospheric dispersion, diffuse and concentrated overland flow, coupled air, water and energy transfer in soil, root uptake, degradation and sorption.
- Test of the model confirms its numerical stability and consistency of simulation results.
- A first intended application of the model consists in the identification of the main source (airborne drift versus volatilization) of exposition of bystanders and non target ecosystems in Mediterranean vineyard landscapes.

Micro-dams on potato and maize fields: consideration in environmental risk assessment as part of the MAgPIE toolbox

Stephan Sittig, Robin Sur, Dirk Baets

Presenter Stephan Sittig

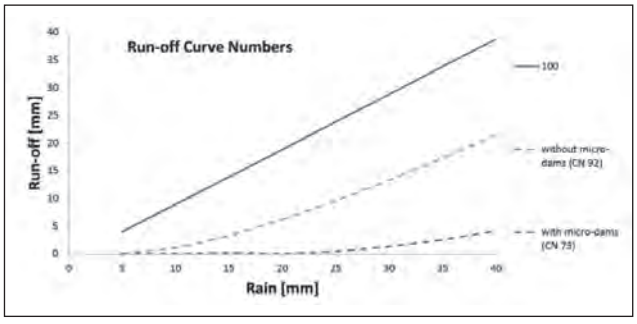
knoell Germany GmbH
Konrad-Zuse-Ring 25
Mannheim – Germany
E-mail: ssittig@knoell.com

Objectives

- Inclusion of in-crop micro-dams as runoff mitigation practices into risk assessment
- Quantify micro-dam mitigation effects based on field trials
- Application: Adapting runoff curve numbers in FOCUS PRZM when calculating regulatory surface water exposure (as proposed by the SETAC MAgPIE workshop)

Highlights

- Literature research and evaluation of own field trials: 7 trials to determine the effect of micro-dams on runoff
- Reductions of runoff volumes, erosion masses and plant protection product loads derived quantitatively
- Adapted runoff curve numbers (CN) calculated based on the measured relations between precipitation and runoff:
  Potato trials: 90% runoff reduction → 24% CN reduction (20 pts.)
  Maize trials: 50% runoff reduction → 5% CN reduction (4 pts.)



Relationship between rain and run-off as expressed by the curve number

PERFECT LIFE PROJECT: Pesticide Reduction using Friendly and Environmentally Controlled Technologies

Héctor Calvete-Sogo, Patricia Chueca, Emilio Gil, Clara Coscollà, Paolo Balsari, Egon Cervera, Daoíz Zamora, Sébastien Codis, Cruz Garcerá, Antonio López, José Castro, Irene Carnicero, Xavier Delpuech, Paolo Marucco, Montse Gallart, Amalia Muñoz

Presenter Héctor Calvete-Sogo

CEAM Foundation (Centro de Estudios Ambientales del Mediterráneo)
C/ Charles R. Darwin, 14 4698
Paterna - Valencia – Spain
E-mail: hectorcalvete@ceam.es

Objectives

To demonstrate the reduction of pesticides in the atmosphere using Optimal Volume Rate Adjustment (OVRA) tools and Spray Drift Reducing Techniques and Tools (SDRTs). Developing a new ultra-fast technology for the analysis and improving the knowledge of stakeholders to achieve environmentally sustainable productions.

Highlights

- Nowadays, general crop production in the EU without pesticides is not realistic.
- Only a portion of the sprayed volume is deposited on the target crops. The rest is lost in the environment affecting biodiversity and people.
- The use of the tools, technologies and knowledge of the project will save costs and time, and will decrease the pesticide exposure risk for fauna, flora and humans.
- As a result, the project has specific aims leading to less: pesticide consumption, diesel consumption, atmospheric pollution, water footprint, non-target crop deposition, etc.
- Goal: reduce 20% of product released to the environment in the experimental areas.

General objective of the PERFECT LIFE project

Exposure to pesticide: a comparison among risk perception and expert risk evaluation for residents and bystanders

Maura Calliera, Gloria Luzzani, Ettore Capri

Presenter Gloria Luzzani

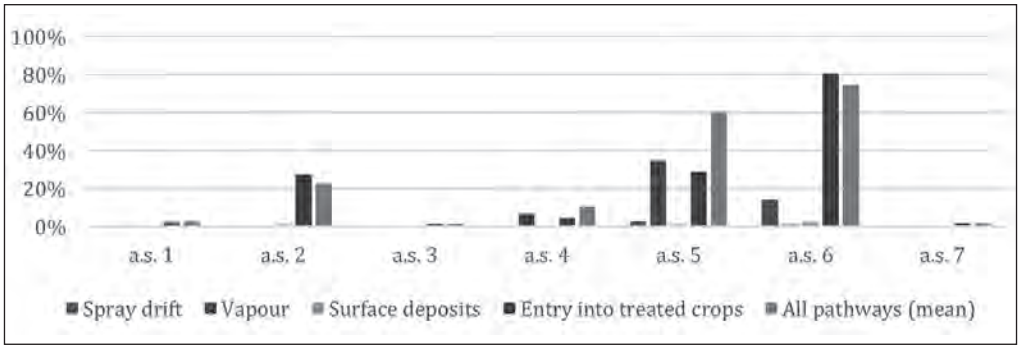
DISTAS Università Cattolica Sacro Cuore Piacenza
Via Emilia Parmense
Piacenza – Italy
E-mail: gloria.luzzani@unicatt.it

Objectives

- to assess citizens' risk perception of non-dietary exposure to pesticides, through a household survey, conducted in the rural area of Piacenza, in Northern Italy
- to compare the survey results with exposure data assessed through EFSA model in a realistic condition and scenario and assist policy-makers in developing targeted and context specific awareness-raising materials

Highlights

- Data calculated with EFSA model on exposure for adults show that in no case the exposure is higher than the RNVAS threshold.
- Pesticide use in the test area can be considered safe if performed in compliance with the regulations in force and as described in the product label.
- Residents exposure evaluation is subjected to a high degree of uncertainties due to lack of data. Contrasts and complaints should be managed with a risk communication campaign, also based on the understanding of citizen exposure risk perception.



Graph Residents Exposure (adults) to active substances in worst-case scenario (% RNVAS), CROP: Tomato

The multi actor approach enabling engagement of actors in sustainable use of chemicals in agriculture

Ingeborg Joris, Els Belmans, Paul Campling, Piet Seuntjens, Eva Kerselaers, Ellen Pauwelyn, Elien Dupon, Erwin Wauters, Miren López de Alda, Anna Kuczyńska, Anker L. Højberg, Nicoleta Suciu, Per-Erik Mellander, Alexandru Marchis, Tom Vereijken, Alexandra Puscas

Presenter Ingeborg Joris

VITO
Environmental Modeling Unit
Boeretang 200
Mol - Belgium
E-mail: ingeborg.joris@vito.be

Objectives

- Engage actors to take mitigation measures to improve water quality in a multi-actor approach

Highlights

- Drinking water quality is under pressure in intensive agricultural regions
- A lot of knowledge on mitigation measures to prevent PPPs from entering water bodies is present but implementation on the terrain is lagging behind
- We present a multi-actor approach to engage actors at the scale of a surface water catchment or a groundwater body in a so-called action lab
- Innovative governance strategies are set up including alternative financing regimes, participatory monitoring approaches, best management practices and collaborative software applications

The seven action labs in WaterProtect.

OpenTEA, the e-learning platform for a sustainable use of pesticides

Gabriele Sacchettini, Maura Calliera, Federico Ferrari, Ettore Capri

Presenter Gabriele Sacchettini

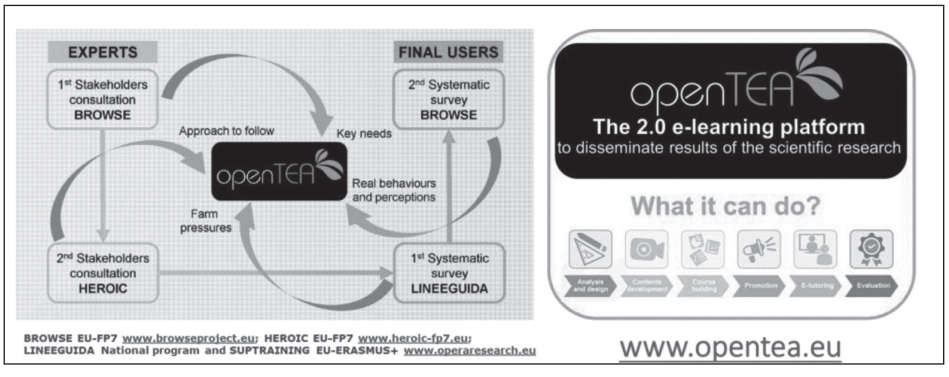
OpenTEA srl
Via Gramsci 22, 43036 Fidenza (PR) – Italy
AEIFORIA srl
Loc. Faggiola 16, 29027 Gariga di Podenzano (PC) - Italy
E-mail: gabriele.sacchettini@opentea.eu

Objectives

- To contribute to SUD (2009/128/EC) implementation building an e-learning platform for training for a sustainable use of pesticides.
- To deliver practice-oriented research to end-users as required by the EU framework programme H2020 for research and innovation.

Highlights

- OpenTEA was built based on former academic scientific research experiences on training, taking into account existing experiences, involving stakeholders in the decision-making process and considering final users' real behaviours and perceptions.
- OpenTEA is moderated and interactive, including multi-format materials, self-assessment approaches and the possibility to build tailored e-learning courses combining materials already available as well as including own contents.
- OpenTEA has been used in a growing number of projects on SUD including an EU training initiative (BTSF) for risk assessors following a "train the trainers" principle



Mitigation Measures and Best Management Practice for vineyards and assessment of the potential for the uptake of new ideas

Maura Calliera, Ruggero Colla, Miriam Bisagni, Silvia Ferrari, Alessandro Braghieri, Elisabetta Russo, Nicoleta Alina Suciu, Ettore Capri

Presenter Calliera Maura

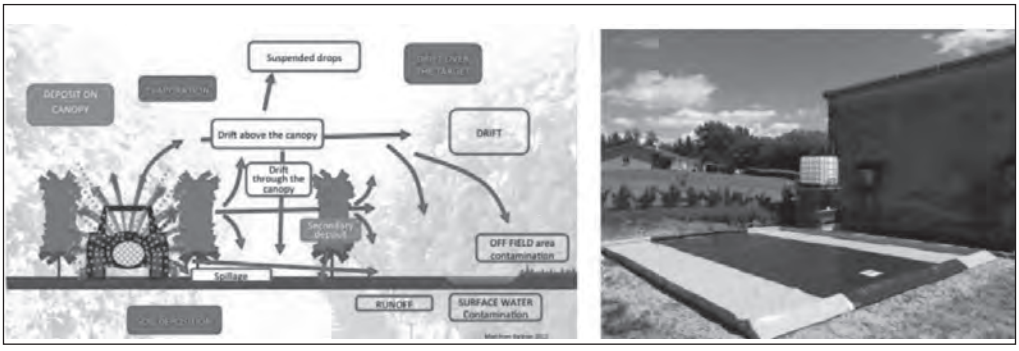
DiSTAS
Università Cattolica del Sacro Cuore
Via E Parmense 84
Piacenza – Italy
E-mail: maura.calliera@unicatt.it

Objectives

- To bring pesticide Mitigation Measures (MM) and Best Management Practices (BMPS), closer to the territory and to the specific critical issues to be solved, taking into account the combined agronomic and environmental aspects and assess the willingness of farmers to implement additional measures, depending on costs and benefits.

Highlights

- Stakeholders consultations and questionnaires, with the support of the local technical assistance systems, were planned in Val Tidone Catchment, north-west of Italy. Distribution of vineyards, hydrology, existence on the territory of MMs and BMPs already implemented were investigated.
- Several BMPs are recognized effective in the reduction of water pollution, but some of them are not considered applicable without significant financial investments. Management of PPPs in farms was identified as the critical issue regarding groundwater contamination. Actions, supporting farmers knowledge upgrade and for the improvement of management of contaminated water are of great interest



Example of material used to inform farmers on pesticide's fate during a treatment and mobile platform

Elementary teachers' knowledge on endocrine disruptor pesticides and their in-service learning motivation

Fu-Chi Chuang, Yu-Liang Chang, Wen-Der Wang

Presenter Fu-Chi Chuang

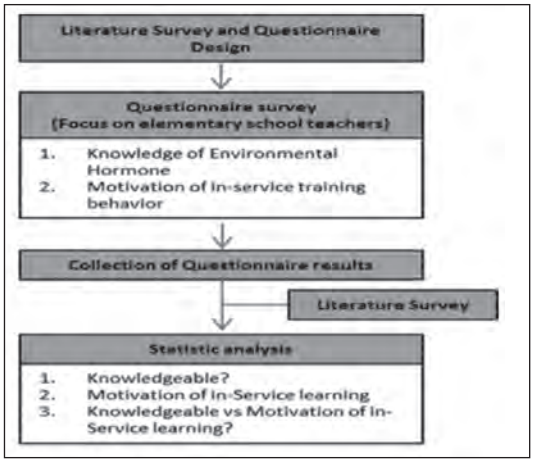
Graduate Institute of Educational Administration and Policy, National Chiayi University
No.85, Wunlong Village, Minsyong Township
Chiayi County, Taiwan
E-mail: vvan@mail.ncyu.edu.tw

Objectives

- Environmental protection is the most important issue for all the global citizens.
- Education is the main way to educate citizens to know how to protect our environment.
- questionnaire survey indicates the environmental knowledge of the elementary teachers and the relationship to their active motivation of in-service learning.

Highlights

- Pesticides have been utilized to protect crops since 2000 BC. And many of them have been identified as endocrine disruptor chemicals which severely impairs our ecosystem and health.



Research strategy to the association of environmental knowledge and active learning motivation of elementary school teachers.

- We collected 207 questionnaires and indicate around 34% elementary school teachers are not knowledgeable about endocrine disruptor pesticides and it potential risk for health and also indicate the less understanding of endocrine disruptor pesticides will strengthen their learning motivation.

SESSION V
ECOTOXICOLOGY INTO FATE IN REAL WORLD

The correct definition of the risk(s) to non-target organisms has to be provided before a pesticide is approved. This assessment is essential, with a long-term perspective, to ensure (i) the absence of negative effects towards non-target organisms and (ii) that there are no adverse changes to the population or the function of the ecosystem. This concept includes the active substance and its relevant metabolites, refers to both vertebrate and non-vertebrate organisms and is typically carried out using model species. Beneficial organisms must receive particular attention in this framework. Furthermore, a correct definition of ecotox outcomes needs a following comparison to actual pesticide concentrations in environmental compartments to discriminate between acceptable and unacceptable impacts from pesticide use.
This session reports the most recent advances in ecotoxicology concerning birds and mammals, tiered risk assessment for aquatic and terrestrial organisms, as well as assessment on relevant metabolites.

Session Chairs
- Gabriella Fait
- Matteo Ottini

Modelling effects of pesticides for regulatory risk assessment: TKTD models and beyond

Andreas Focks, Maria Arena, Theo C.M. Brock, Nina Cedergreen, Sandrine Charles, Sabine Duquesne, Alessio Ippolito, Michael Klein, Melissa Reed, Ivana Teodorovic

Presenter Andreas Focks

Wageningen Environmental Research
Droevendaalssteg 3a
6700 AA Wageningen, The Netherlands
E-mail: andreas.focks@wur.nl

Objectives

The Panel on Plant Protection Products and their Residues (PPR) of the European Food Safety Authority (EFSA) published a scientific opinion (SO) on the state of the art of Toxicokinetic/ Toxicodynamic (TKTD) models in regulatory risk assessment of pesticides for aquatic organisms (EFSA PPR, 2018. EFSA Journal 2018;16(8):5377). This SO gives an overview and evaluates the state of science of existing TKTD models for lethal and sublethal effects on animals and primary producers.

Highlights

- GUTS models (General Unified Threshold models of Survival), which account for lethal effects on animals, are well established and can be used in the risk assessment scheme to assess the risk of time-variable exposure.
- DEBtox models (Dynamic Energy Budget toxicity models) account for sublethal effects of pesticides on growth and reproduction and are considered to be in an advanced state but not yet ready to be used for regulatory risk assessment;
- Models accounting for the effects of pesticides on primary producers have been also evaluated for *Lemna* sp., *Myriophyllum* sp, and two algae species.
- The presentation will give an overview about the principles of these different TKTD models and summarise the conclusions presented in the SO.
- An outlook will shed some light on lessons learnt from TKTD modelling for the possible application of population-and community models for regulatory risk assessment.

Aquatic risk assessment at catchment scale – case study on insecticide exposure concentrations and effects on macroinvertebrates

Wim Beltman, Hans Baveco, Louise Wipfler, Maarten Braakhekke, Zaman Ziabakhshganji, Sebastian Multsch, Florian Krebs, Stefan Reichenberger, Philipp Kraft, Lutz Breuer, Sascha Bub, Thorsten Schad

Presenter Wim Beltman

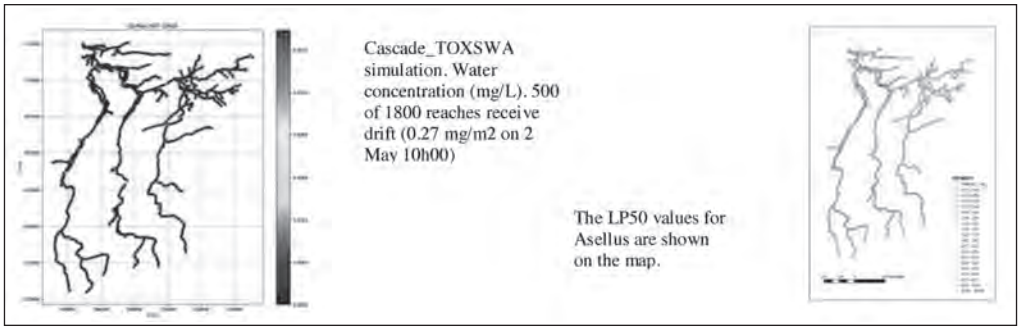
Wageningen Environmental Research
P.O. Box 47
6700 AA, Wageningen, the Netherlands
E-mail: wim.beltman@wur.nl

Objectives

- Calculation of exposure and effects of plant protection products (PPP) in surface water at the catchment scale
- Include more realism by assessing risk at landscape level
- Allow for consistent risk characterization across temporal and spatial scales (see poster 200 Wipfler et al.)

Highlights

- Modular catchment-scale modelling framework is being developed
- Hydrology module based on hydrological programming library 'Catchment Modelling Framework (CMF) (see presentation XX by Multsch et al.)
- Simulated water fluxes are used to model the fate of the PPP in the river network, using the e-fate module Cascade_TOXSWA
- Case Rumen catchment (B); entry only by spray drift of insecticide with high K_{oc}
- Predicted exposure levels used to predict survival probabilities of Asellus aquaticus and distances from a certain effect level (margin of safety), using the GUTS model



Investigating chemical mixtures toxicity in bees: data collection, modelling, mechanistic basis and implications for risk assessment

Edoardo Carnesecchi, Claus Svendsen, Simone Tosi, Agnes Rortais, Nadia Quignot, Andrey Toropov, Ettore Capri, Nynke I. Kramer, Emilio Benfenati, Jean Lou Dorne

Presenter Edoardo Carnesecchi

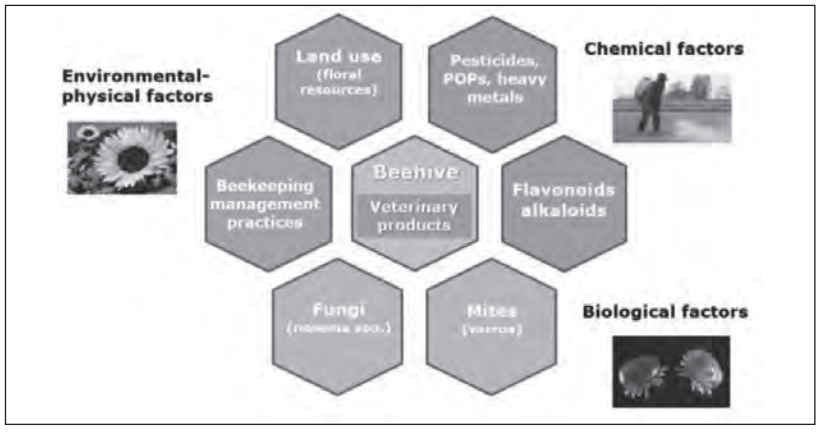
[1] Utrecht University, Institute for Risk Assessment Sciences
Utrecht – The Netherlands
[2] Institute for Pharmacological Research Mario Negri IRCCS
Via G. la Masa - Milano – Italy
E-mail: Edoardo.Carnesecchi@marionegri.it

Objectives

- Quantifying the magnitude of the interaction of pesticides binary mixtures in bees.
- Developing new tools for analysing large binary mixture toxicity data in pollinators.
- Identifying data gaps and implications for risk assessment of multiple stressors.

Highlights

- From dose response analysis, 72% and 17% of binary mixtures demonstrated synergisms and dose addition respectively.
- Synergies were mostly observed for fungicides and insecticides/acaricides (55%) via metabolic inhibition of cytochrome P450s.
- Model Deviation Ratio (MDR) and Estimated Mean Ratio (EMR) are valuable tools for predicting chemical mixture toxicity effects



Conceptual scheme illustrating potential multiple stressors affecting honeybee health.

Tackling some of the research gaps identified in the EFSA Scientific Opinion on the risk assessment of in-soil organisms

Tiago Natal-da-Luz, Letícia Scopel Camargo Carniel, Osmar Klauberg Filho, Camila Campello, Pedro Campos, Sónia Chelinho, José Paulo Sousa

Presenter Tiago Natal-da-Luz

Centre for Functional Ecology - CFE
University of Coimbra
Coimbra – Portugal
E-mail: tiagonluz@iav.uc. pt

Objectives

- Improve testing and exposure scenarios in lower tier;
- Use SSDs as intermediate tier to calibrate assessment factors;
- Evaluate the influence of different application scenarios (single application vs multiple applications) in higher tier Terrestrial Model Ecosystem studies.

Highlights

- In tests with the predatory mite *Hypoaspis aculeifer* exposure via food significantly increased toxicity to PPPs (e.g. Fig 1);
- SSDs are a feasible tool for in-soil ERA, and the standard species are not always representative of the sensitivity of other species from the same group;
- TME experiment indicates that the effects found are dependent not only on the traits and ecological groups of species analyzed but also on the application scenarios adopted.

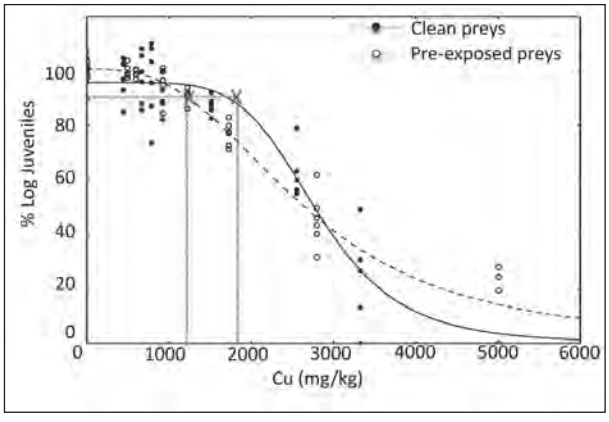


Fig 1 - Number of juveniles of the predatory mite Hypoaspis aculeifer as a function of copper doses in reproduction tests using clean preys or preys pre-exposed to copper

Towards a coupled exposure and effect model for earthworms

Christoph Oberdörster, G. Ernst, A. Gergs, S. Oberdörster, K. J. Rakel, V. Roeben, P Neumann, T. G. Preuß, D. Schäfer

Presenter Christoph Oberdörster

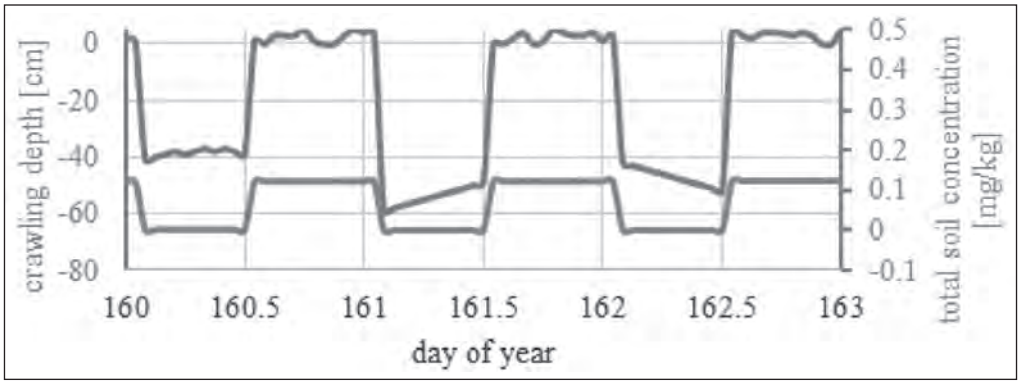
Bayer AG
Alfred-Nobel-Straße 50
40789 Monheim – Germany
E-mail: christoph.oberdoerster@bayer.com

Objectives

- In the current regulatory framework toxicity endpoints and predicted realistic worst case environmental concentrations are compared for the characterization of risks; this does not consider any spatio-temporal dynamics of exposure and earthworm behaviour
- In order to address this shortcoming, a modelling framework is currently developed which relies on a modular approach linking exposure and effects

Highlights

- The spatio-temporal exposure patterns are simulated by a numerical model
- A movement module directly translates the environmental exposure pattern into a time-series of exposure that each earthworm experiences
- This individual exposure pattern will serve as input for a toxicokinetic-toxicodynamic module which predicts the toxic effect on each individual



Simulated crawling depth for one earthworm (L. terrestris) and related simulated soil concentration that is experienced by this individual.

DNA-damaging potential of the pesticides penoxsulam and imazalil on gill and sperm cells of *Procambarus clarkii* - an *ex vivo* approach disclosing cell specific vulnerabilities

Raquel Marçal, P. Oskoei, M. Pacheco, S. Guilherme

Presenter Raquel Marçal

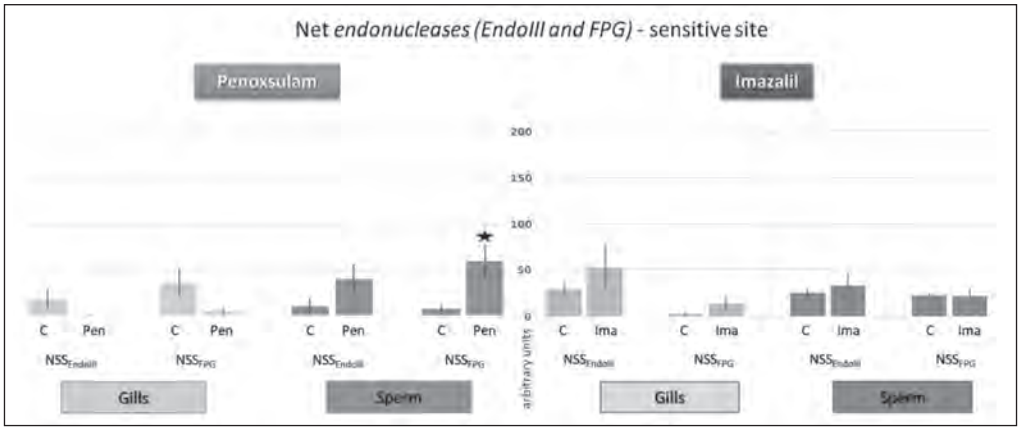
CESAM and DBio, UA
Campus Universitário de Santiago
Aveiro – Portugal
E-mail: armarcal@ua.pt

Objectives

- Genotoxic assessment on gills and spermatozoa cells exposed to environmentally relevant concentrations of the pesticides penoxsulam (23 $\mu g.L^{-1}$) and imazalil (160 $\mu g.L^{-1}$), in an ex vivo approach

Highlights

- *Procambarus clarkii* gills and spermatozoa cells are sensitive to penoxsulam and imazalil genotoxic effects (non-specific DNA damage)
- Sperm cells are more vulnerable than gills cells to penoxsulam oxidative DNA damage effects



Net endonucleases-sensitive site. Values resulted from the comet assay with an extra step of digestion with endonucleases, EndoIII and FPG, to detect oxidized pyrimidine and purine bases, respectively. Only penoxsulam induce oxidative DNA damage on sperm cells of Procambarus clarkii.

Experimental investigation of the efficiency of agroforestry alley cropping systems in the reduction of excess pesticides from soil

George Pavlidis, Helen Karasali, Vassilios A. Tsihrintzis

Presenter George Pavlidis

Centre for the Assessment of Natural Hazards and Proactive Planning & Laboratory of Reclamation Works and Water Resources Management, School of Rural and Surveying Engineering, National Technical University of Athens, Zografou, 15780, Athens, Greece
E-mail: g.pavlidis@bpi.gr

The rising trend of agricultural pollution from agrochemicals during the last decades has raised the need for mitigation measures in order to protect the environment and the health of living organisms. Measures may include both regulation and field applications. Field applications include, among others, vegetated filter strips (VFS), drift buffers, drift reduction nozzles and others.
Agroforestry (AFS), which is the common cultivation of crops and trees, is proposed as one such mitigation technique. The mode-of-action hypothesis is that trees, with their deeper and wider roots, create a protective net underneath crops, thus minimizing the pollutant amounts that would elsewhere remain in soil or reach groundwater and surface water.

Objectives

- Evaluation of poplar trees in the reduction of pesticides mitigation
- Evaluation of olive trees in the reduction of pesticides mitigation
- Different tree-crop combinations testing
- Examination of the environmental fate and behavior of pollutants in AFS

Highlights

- Totally 6 different active substances and a metabolite were examined
- Pendimethalin herbicide was common in all systems
- Sampling was performed in various soil layers and varying distances from the tree rows to examine the tree-root effect for pollution mitigation•
- Pesticides reductions were 61.5% and reached 100%
- Pesticides residues in the sampling points next to the tree row were near or below the LOQ at the end of cultivation period
- From the srudy findings it can be foreseen that poplar and olive tree roots in AFS have positive effect in the reduction of excess pesticides that would else leach to GW

Degradation of alloxydim herbicide in chlorinated water. QSAR and ecotoxicity study of the main by-product

Juan José Villaverde, Beatriz Sevilla-Morán, Javier Pro-González, Álvaro Cervantes-Díaz, José Luis Alonso-Prados, Pilar Sandín-España

Presenter Juan José Villaverde

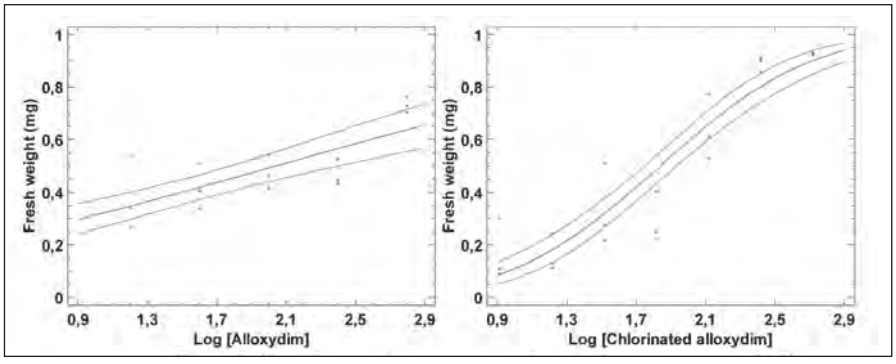
Unit of Plant Protection Product, INIA
Ctra. La Coruña Km.7.5
Madrid – Spain
E-mail: juanjose.villaverde@inia.es

Objectives

- To study the degradation of alloxydim herbicide in chlorinated water
- To identify the by-products formed during the chlorination process.
- To study the environmental impact of the main by-product formed by means of QSAR analysis and *Lemna minor* ecotoxicity assay.

Highlights

- Chlorine, a common disinfectant in drinking water treatment, is able to react not only with pathogenic microorganisms but also with pesticide residues present in waters.
- Alloxydim herbicide was fastly degraded by chlorine, disappearing completely in less than 20 minutes.
- Chlorinated-alloxydim was identified as the main by-product during the degradation.
- QSAR analysis pointed out that environmental and ecotoxicological effects of chlorinated-alloxydim differ from its parent herbicide.
- Chlorinated-alloxydim showed a deleterious effect on the aquatic plant *L. minor*.



Comparative effect of alloxydim herbicide and its by-product chlorinated alloxydim on Lemna minor growth at 7 days after treatment.

Explore the biological toxicity of a triazole pesticide, Paclobutrazol, in Zebrafish

Wen-Der Wang

Presenter Wen-Der Wang

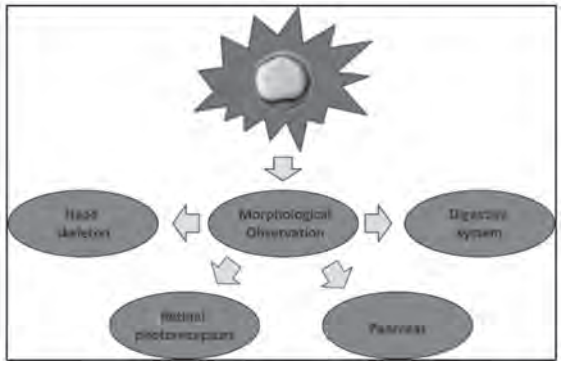
Department of Bio-Agricultural Sciences, National Chiayi University
No.300 Syuefu Road
Chiayi City, Taiwan
E-mail: wangw4@mail.ncyu.edu.tw

Objectives

- Paclobutrazol (PBZ), a trazole-containing fungicide and plant growth retardant, the one of the most heavily used pesticides in the world.
- We focus on the biological toxic effects of PBZ and the molecular mechanism of its toxic actions.

Highlights

- PBZ harms zebrafish embryo survival and hatching rates, and causes developmental failure of the neural crest cells, head skeleton, the digestive system, and eyes.
- AhR2, a transcription factor regulating xenobiotic-metabolizing enzymes, mediates the effects of PBZ on the digestive system.
- PBZ exposure disrupts endogenous retinoic acid biosynthesis, which results in the development defects in retinal photoreceptor cells.
- pancreatic beta-cells were impaired by PBZ exposure.



Explore the biological toxic effects of Paclobutrazol in zebrafish model

Effect of synthetic and natural pesticides on the soil microbial biomass and on earthworm *Eisenia foetida*

Arianna De Bernardi, Enrica Marini, Sonia Silvestri, Cristiano Casucci, Francesca Comitini, Luca Tiano, Maurizio Ciani, Costantino Vischetti

Presenter Arianna De Bernardi

D3A- Università Politecnica delle Marche
Via Brecce Bianche 10
Ancona - Italy
E-mail: a.debernardi@pm.univpm.it

Objectives

- Evaluating the effect of sub-lethal doses of natural (Spinosad) and synthetic (Chlorpyriphos) pesticides on DNA of *E.foetida* and on microbial biodiversity.
- Measuring pesticide residues at each sampling time to understand their kinetics and interaction in the studied mesocosm.

Highlights

- The effect of pesticides on soil microbial diversity is still under evaluation.
- The high organic matter content of the studied soil allowed a faster degradation of the two pesticides.
- Earthworms DNA damage and signs of suffering were evidenced in the chloprpyrifos test and not in the spinosad test.

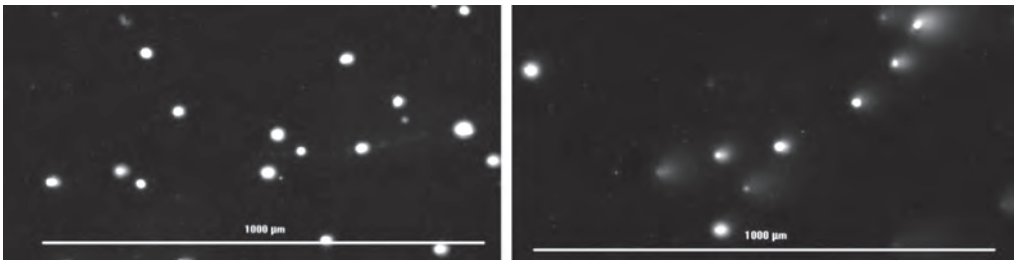


Image of earthworm celomocites at 14 days: on the left a negative control and on the right a treatment with chlorphyrifos where the DNA damage is clearly visible from the comets.

Subacute-oral toxicity of Thiamethoxam (ACTARA®) insecticide in albino mice: biochemical, oxidative damage and histopathological evaluations

Gamal Elsayed Abouelghar, Rania I. Yassien, Zeinab A. El-Bermawy, Yassamin A. Shalaby

Presenter Gamal Elsayed Abouelghar

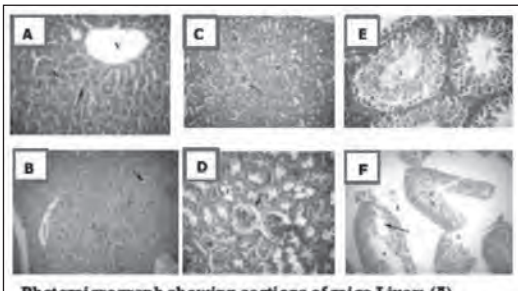
Professor of Pesticide Toxicology, Dept. of Pesticides,
Faculty of Agriculture, Menoufia University
Moustafa Kamel Street
Shebin El-Kom, MNF – Egypt
E-mail: gamal.abouelghar@agr.menofia.edu,eg

Objectives

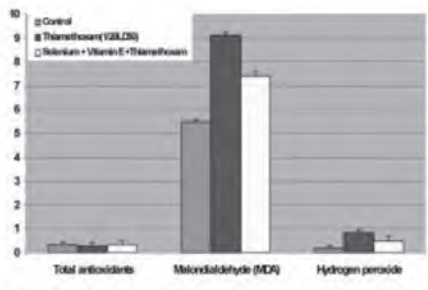
The objective of this study was to investigate the potential adverse effects of formulation of thiamethoxam (TMX), (ACTARA®), on some biochemical and oxidative stress parameters in the albino mice via oral sub-acute toxicity.

Highlights

Male albino mice received three sublethal doses of TMX (1/100, 1/50 and 1/20 of LD_{50}) given via oral gavage for 28 days. Animals in another group were administered with selenium (Se) plus α-tocopherol (vitamin E) prior to exposure to the higher dose of THM. Liver and kidney damage was determined by measuring specific serum biomarkers. The oxidative stress markers were also determined. It was obvious that TMX increased the liver enzyme activities as well as cholesterol level. Interestingly, Se plus vit E showed ameliorative effect by recovering the levels of liver enzyme activities, cholesterol, total antioxidants and lipid peroxidation. In conclusion, it is our thought that the dose < 6.0 mg/kg b.w. of TMX may be considered as no-observed-adverse-effect-level (NOAEL).



Photomicrograph showing sections of mice Liver: (A)-control, (B)-TMX; Kidney: (C)-control, (D)-TMX; Testis: (E)-control, (F)-TMX



Total antioxidants and oxidative stress markers in blood serum of male albino mice administrated TMX either alone, or in association with selenium + vitamin E.

Removal of aqueous residues of plant protection compounds by photo-catalysis using coating processes

Laura Scrano, G. Bianco, S. De Franchi, L. Foti, S.A. Bufo

Presenter Laura Scrano

University of Basilicata
Via dell'ateneo lucano 10
Potenza, Italy
E-mail: laura.scrano@unibas.it

Objectives

The aim is an innovative and cost-efficient solutions to purify contaminated water and recycle by using heterogeneous photo-catalysis and titanium dioxide (TiO_2) supported on borosilicate tubes.

Highlights

- Heterogeneous photocatalysis with TiO_2 coated on borosilicate tubes accelerate the degradation rate with complete decomposition of all contaminants tested (MCPA-herbicide, mepanipyrim-fungicide and deltamethrin-insecticide).
- The degradation rates of pollutants by the sol-gel-coated tubes were much faster than the degradation by the nanoparticle/PECVD-coated tubes.
- TiO_2 supported on borosilicate tubes appears to be a promising alternative to conventional TiO_2 suspension avoiding post-separation stages (no significant deactivation or loss of the catalyst immobilized on the borosilicate tubes during experiments).

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Notes