<u>Conference Report</u>

European Symposium on atmospheric transport of synthetic pesticides

What are the implications of monitoring results for regulatory measures?

31st May and 1st June 2023

<u>Organiser</u>
Brandenburg Academy
"Schloss Criewen"

<u>In cooperation with</u>
Bündnis für eine
enkeltaugliche
Landwirtschaft e.V

The event is funded by the state of Brandenburg

Contents

Conclusion and summary from the initiators’ perspective

Anna Becker
Bündnis für eine enkeltaugliche Landwirtschaft e.V.

Conclusion and summary from the initiators' perspective

The European Symposium on Atmospheric Transport of Pesticides was initiated by Bündnis für eine enkeltaugliche Landwirtschaft (BEL) and brought together representatives from eight European countries from the fields of science, politics, administration, environmental organisations, as well as conventional and organic industries.

First, eight monitoring studies from across Europe were presented, which provided a consistent picture of pesticide contamination in the air. Regardless of the methodology used or the country analysed: Cocktails of different pesticide active substances in the air can be detected everywhere. The event also highlighted the legal framework regarding long-range transport, its impacts on biodiversity as well as the perspectives of water suppliers and the umbrella organisation for organic farming IFOAM.

The scientists agreed that the presented results must lead to timely consequences to mitigate the impacts on the environment, people, and the economy. Therefore, following the presentations, workshops were held with all participants to discuss necessary regulatory and political measures. Three main points were established:

- Independent Monitoring: Further development and standardisation of monitoring programs are needed to improve the comparability of results between European countries.
- Air Quality Standards: The introduction of a technical threshold for air, comparable to the one for groundwater, which, if regularly exceeded, must lead to a ban of the respective active substance.
- Need for Research: More research on the impacts of atmospheric transport of pesticides on health and environment is needed. The effects of the continuous intake of pesticide active substances - especially pesticide cocktails - through our lungs, are largely unexplored. Since these are complex and time-consuming studies, the precautionary principle must be applied and substances that spread most frequently and widely through the air should be restricted.

For farmers, long-range transport already has negative impacts when active substances that are not approved for their crops are detected on their fields. This affects both conventional and organic farmers and threatens the coexistence between organic and conventional agriculture, which is desired politically and socially. Thus, political measures are necessary to minimise economic damage and enable a sustainable transformation of our food systems, as stated in the EU Green Deal and demanded on a national (German) level by the „Commission on the Future of Agriculture".

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The interdisciplinary exchange on atmospheric transport of pesticides was the first of its kind in Europe and was highly appreciated by all participants. At the same time, scientists expressed frustration over the lack of action from politicians and authorities, despite the alarming results. Increased public communication was therefore deemed necessary by the scientific community to bring the issues of long-range transport into the societal debate and establish transparency in this regard.

The Bündnis für eine enkeltaugliche Landwirtschaft (BEL) would like to thank all speakers and participants for their presentations and constructive discussions. The event was an important milestone in our work on long-range transport and we are aiming to continue the interdisciplinary exchange.

Bündnis für eine enkeltaugliche Landwirtschaft

Legal framework: Approval criteria and assessment of pesticides with regards to atmospheric transport

Achim Willand
(GGSC)
(Gaßner, Groth, Siederer & Coll.)

Symposium at 31st May – 1st June in Criewen - lectures by jurist LL.D. Achim Willand – abstract

Lecture 1:
Legislative framework: Requirements for the approval and risk assessment of pesticides with regard to airborne transport

The legal framework for the authorization and use of pesticides is largely shaped by Union law ("harmonization"). The central **licensing requirement** is the **avoidance of harmful or unacceptable effects**. (Art. 4 para. 3 Regulation 1107/2009).

Plant protection products dispersed via the atmosphere (with the active substances contained) can cause risks for human health and/or for the environment - depending on toxicity, concentration and exposure conditions. They are legally **"residues"** in the sense of plant protection law.

Therefore, **the fate and behavior** of **substances in the environment** must be **determined and evaluated** as part of the **risk assessment** in the approval process. This explicitly includes **volatilization** via the air and **long-distance transport** (cf. in particular Annex II No. 3.7 of Regulation 1107/2009 and N. 2.5.1 of Regulation 546/2011 as well as Regulation 283/2013 and Regulation 284/2013).

The assessment has to be carried out on the basis of the **latest state of science and technology**, considering the **precautionary principle** (no "freezing" of knowledge or criteria on established guidelines).

The scientific discussion reveals **uncertainties** regarding **possible risks** due to the **ubiquitous distribution** of numerous (persistent) active substances (and metabolites) in the air we breathe, besides possible **interactions** of the individual substances.

Against this background, the presentation critically addresses the argument that the risks from atmospheric dispersion are already covered by the assessment of effects on users and neighbors.

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Partnerschaft von Rechtsanwälten mbB

Europäisches Fachsymposium zum atmosphärischen Transport von Pestiziden in Criewen am 31. Mai und 01. Juni 2023

Rechtlicher Rahmen:
Risikoprüfung, Zulassung von Pestiziden und Einfluss des Monitorings

Rechtsanwalt Dr. Achim Willand

[GGSC]
[Gallner, Groth, Siederer & Coll.]
Partnerschaft von Rechtsanwälten mbB

Vorträge

- **1. Teil am 31.05.2023:**

  „Rechtlicher Rahmen: Anforderungen an die Zulassung und Risikoprüfung für Pestizide hinsichtlich der Verfrachtung über die Luft“

- **2. Teil am 01.06.2023:**

  „Rechtlicher Einblick: Welche Auswirkungen können Monitoring-Ergebnisse für die Zulassung haben?“

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Übersicht

[GGSC]
[Gaßner, Groth, Siederer & Coll.]
Partnerschaft von Rechtsanwälten mbB

I. Pestizide in der Luft – was ist das rechtlich? >> VO (EU) 1107/2009

„Wirkstoffe" und **„Pflanzenschutzmittel" (PSM), „Auswirkungen";**
Ziele Art. 4 Abs. 2/3, Art. 29:
keine **schädlichen** Auswirkungen auf die Gesundheit von **Mensch/Tier**; keine **unannehmbaren** Auswirkungen auf die **Umwelt**

↓

„Rückstände", Art. 3 Nr. 1 VO 1107/2009: „…Stoffe, die in oder auf …Erzeugnissen, im Trinkwasser oder anderweitig **in der Umwelt** vorhanden sind und deren Vorhandensein von der **Verwendung** von **Pflanzenschutzmitteln** herrührt…"

↓

Risikoprüfung und Zulassungsverfahren für Wirkstoffe und PSM

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II. Handlungsebenen und EU - "Harmonisierung"

Unionsrecht: VO (EG) 1107 / 2009
RL 2009 / 128:

Genehmigung Wirkstoffe: EU
(Art. 4 ff.)

Zulassung PSM: MS
(Art. 29 ff.)

Verwendung PSM (Grundregeln): EU
Art. 55, RL 128/2009: gute Pflanzenschutzpraxis, NAP, IPM, Gewässerschutz, Schutzgebiete…(Art. 55)

„Harmonisierter" Bereich

Mitgliedstaatliche (Rest-) Kompetenz:

./.

Art. 36 Abs. 3: spezifische Verwendungsbedingungen/ Abweichen von der zonalen Zulassung bei **unannehmbaren Umweltauswirkungen**

Ergänzende Verwendungsregeln
§ 14 PflSchG + PflSchAnwV

Umweltrecht: NatSchR, WasserR, BodSchR

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III. Rechtlicher Rahmen: Zulassung und Verwendung von PSM

1. Grundanforderungen /Instrumente

- **Vermeidung <u>schädlicher/unannehmbarer Auswirkungen</u>** (Gesundheit, biologische Vielfalt, Gewässer…), Art. 4 Abs.2/3
- **spezifische naturschutzrechtliche bzw.** wasserrechtliche Anforderungen, z.B. Artenschutz/Gebietsschutz, Trinkwasserschutz
- Hohes Schutzniveau
- Anwendung Vorsorgeprinzip
- **Minimierung Exposition/Risiken** (PSM; unter „Funktionsvorbehalt")
- **Regeln für Verwendung: „Minimierungspflicht"** in Natura 2000-Gebieten (Art. 12 RL 128/2009), Anwendungsverbote (§ 4 PflSchAnwV)
- **integrierter Pflanzenschutz**: Vorrang nichtchemischer Mittel, Begrenzung auf das erforderliche Maß (Art. 55, RL 128/2009)

➢ **…unabhängig von (konkreten) Risiken!**

III. Rechtlicher Rahmen: Zulassung und Verwendung von PSM

2. Risikoprüfung – methodische Anforderungen (Art. 29 Abs. 1 i.V. Art. 4) >> Auswirkungen von Rückständen als Folge der Verwendung….

…entspr. **guter Pflanzenschutzpraxis**

…unter **realistischen Verwendungsbedingungen** (

…berücksichtigen: **Kumulations-/Synergieeffekte**, soweit **anerkannte wissenschaftliche Methoden verfügbar; EuGH C-616/17**: sämtliche Bestandteile eines PSM zu prüfen

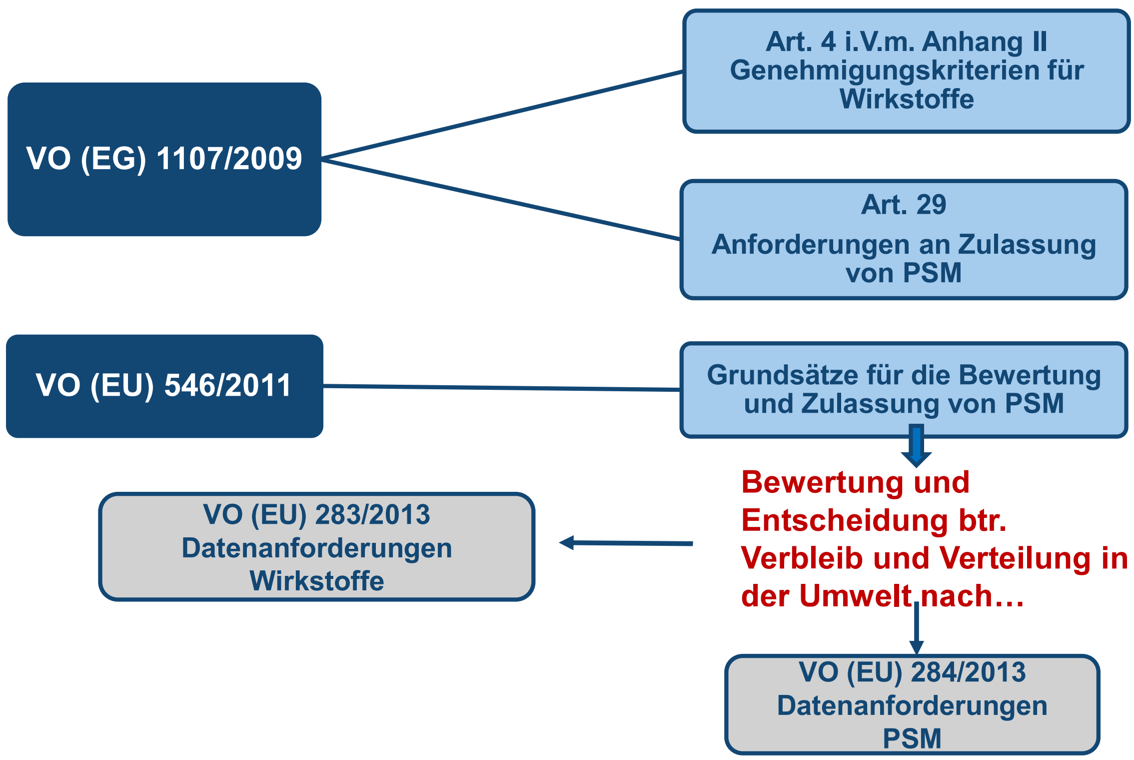
…nach dem **neuesten Stand** von **Wissenschaft und Technik**

…**Exposition** der Verwender und andere **Risiken** sind **minimiert** (soweit keine Funktionsbeeinträchtigung des Produkts)

.. entsprechend den **einheitlichen Grundsätzen** (vgl. VO 546/2011)

>> „Beweislast"– Antragsteller (Hersteller) muss nachweisen: beantragte PSM-Verwendung erfüllt alle Anforderungen (Art. 29 Abs. 2)

III. Rechtlicher Rahmen: Zulassung und Verwendung von PSM



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IV. Vorgaben bezüglich atmosphärischer Verbreitung VO 1107/2009 – Grundanforderungen

Art. 4 Abs. 3 e): PSM „dürfen **keine unannehmbaren Auswirkungen auf die Umwelt** haben, und zwar unter besonderer Berücksichtigung folgender Aspekte (...):

*i) Verbleib und Ausbreitung in der Umwelt, insbesondere Kontamination von (...), Grundwasser, **Luft** und Boden, unter Berücksichtigung von **Orten in großer Entfernung** vom Ort der Verwendung **nach einem Ferntransport** in der Umwelt"*

>> keine entsprechende Vorgabe btr. Schutz der Gesundheit von Mensch und Tier bei PSM-Ferntransport

>> „abgedeckt" durch Prüfung schädlicher Auswirkungen bei direkter Exposition über die Luft (Art. 4 Abs. 3 b)? (z.B. Anwender, Nichtzielarten)

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IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport) Wirkstoffe: Anhang II der VO 1107/2009 – Ausgeschlossene Stoffe

Kriterien für die Genehmigung eines Wirkstoffs (Nr. 3) →

menschl. Gesundheit - Ausschluss: mutagene, kanzerogene, reproduktions-/ endokrinschädliche Stoffe - es sei denn: Exposition vernachlässigbar, Nr. 3.6.3 – 3.6.5

↓

Verbleib/Verhalten Umwelt – Ausschluss: (sehr) persistente/bioakkumulierbare, ggf. ökotoxische Stoffe
PBT/vPvB, Nr. 3.7.2/3.7.3
POP: persistente organische Stoffe, wenn Potential Ferntransport Kriterium: DT50 >2d (Nr. 3.7.1)

→

Sonstige Stoffe: Prüfung Verbleib/Verhalten i.d. Umwelt - Öktoxikologie: Risiken müssen unter realistischen Verwendungsbedingungen annehmbar sein (Nr. 3.8)

> spez. Vorgaben Ferntransport (-)

IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport) Anhang II der VO 1107/2009 - POP

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POP
(Ziffer 3.7.1.)

Potenzial zum Ferntransport der Chemikalie in der Umwelt

„Ein Wirkstoff, Safener oder Synergist erfüllt dieses Kriterium, wenn…“

..gemessene Konzentrationen an weitab von den Quellen ihrer Freisetzung liegenden Orten potenziell Besorgnis erregen; oder..

…aus Monitoringdaten hervorgeht, dass … weiträumiger Transport …über die Luft… in ein aufnehmendes Kompartiment stattgefunden habe könnte; oder…

…Eigenschaften … und/oder Modell-Ergebnisse belegen…Potenzial zum weiträumigen Transport …über die Luft … in ein aufnehmendes Kompartiment an weitab von …Freisetzung liegenden Orten

IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport)

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VO 546/2011 Grundsätze Bewertung/Zulassung PSM >> Stufe: Bewertung:

Nr. 1.4 Gesundheit Mensch/Tier,

1.4.1: Bewertung Exposition **Anwender** (Kriterium: AOEL) und **Nebenstehende** etc; btr. Wirkstoff und sonstige toxikologisch relevante Verbindungen im PSM

Nr. 1.5.1 Verbleib und Verteilung in der Umwelt

1.5.1.4: „Die Mitgliedstaaten **bewerten**, ob sich das **Pflanzenschutzmittel unter den vorgeschlagenen Verwendungsbedingungen in die Luft verflüchtigen** kann; …. mit Hilfe …geeigneten validierten **Berechnungsmodells**… bestmögliche Schätzung der zu **erwartenden Konzentration des Wirkstoffs** und der Metaboliten … in der Luft…“

Bei der **Bewertung** zu berücksichtigen

i) **Wirkstoff/PSM**: Informationen/Bewertung btr. Verbleib/Verhalten, Abbau i.d. Luft (VO 283/2013 und 284/2013)

ii) Dampfdruck, Löslichkeit, photochemischer Abbau…

IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport)

PSM - Datenanforderungen nach VO 284/2013 – Anhang Teil A

Verbleib und Verhalten in der Umwelt
(Ziffer 9.)

in der Luft
(Ziffer 9.3.)

Abbauweg und Abbaugeschwindigkeit sowie Transport durch die Luft
(Ziffer 9.3.1.)

IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport)

Prüfung PSM - VO (EU) 284/2013 – Datenanforderungen Anhang Teil A – 9.3.1. Abbauweg und Abbaugeschwindigkeit sowie Transport durch die Luft

....können Daten aus Experimenten unter geschlossenen Bedingungen vorgelegt werden…erforderlichenfalls…Experimente zur Bestimmung der Deposition nach Verflüchtigung….“

„Wenn der **Auslösewert** für die Verflüchtigung … **überschritten** wird und Maßnahmen zur Minderung …erforderlich sind, um die Exposition von Nichtziel-Organismen zu begrenzen, **sind Modellberechnungen** für die infolge der Verflüchtigung entstehende **Deposition (PEC) vorzulegen**. ….

Risikobewertungsverfahren für die PEC-Werte … können anhand von …Experimenten unter geschlossenen Bedingungen verfeinert werden. Erforderlichenfalls … Labor-, Windkanal oder Freilandexperimente zur Bestimmung von PEC-Werten …Deposition nach Verflüchtigung sowie … **Minderungsmaßnahmen** vorzulegen.“

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IV. Vorgaben btr. atmosphärische Verbreitung (Ferntransport)

VO 546/2011 Grundsätze Bewertung/Zulassung PSM – Stufe: Zulassungsentsch.:

2.4 Gesundheit Mensch/Tier,

2.4.1: keine Zulassung, wenn durch PSM-Verwendung…

…Anwender-Exposition >AOEL

…Überschreitung anderer **Grenzwerte** (RL 28/24 und 20047§/9

2.4.2.1 **Rückstände – Zulassungs-/Verwendungsbedingungen**: Basis sind die erforderlichen PSM-Mindestmengen, Rückstände **„so gering wie möglich"**

2.5 Verbleib und Verteilung i.d. Umwelt: „Die Zulassung wird nicht erteilt, wenn

2.5.1.4: „….Konzentration des Wirkstoffs in der Luft unter Berücksichtigung der **vorgeschlagenen Verwendungsbedingungen** die **AOEL**-Werte oder die **Grenzwerte** für **Anwender**, Arbeitskräfte und **Umstehende** gemäß Ziffer 2.4.1 …überschreitet."

2.5.2: bei unannehmbaren Auswirkungen auf Nichtzielarten (Vögel, Wasserorganismen, Honigbienen usw.)

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V. Zwischenfazit Zulassungsverfahren

- Unionsgesetzgeber: will **Verbreitung** von **PSM** (**über die** Luft und andere **Umweltmedien eindämmen – unabh. von konkreten Risiken** (These)
- **„Gefahrstoffe"** sind **von vornherein ausgeschlossen** (auch wegen ihrer Verflüchtigung, vgl. POP) >> persistente „Altstoffe" u.a. in der Atmosphäre?
- **„Verflüchtigung"**: regelmäßig **Gegenstand der Risikoprüfung** aber:
  - ➢ **Zulassungsbeschränkung nur bei schädl./unannehmb. Auswirkungen**:
- **Gesundheit Mensch/Tier: keine Zulassung** bei **Konzentration > AOEL** etc.
  - ➢ **Kumulations/Synergieeffekte der in einem PSM enthaltenen Stoffe zu prüfen**
- **Umwelt: Prüfung Auswirkungen** auf **Vögel, Wasserorganismen, Bienen etc.: (un)annehmbar? (>> „Gefahrenschwelle")**
  - ➢ **keine zusätzlichen Grenzen btr. Verflüchtigung/Ferntransport**

➢ **Risiken btr. Verflüchtigung: „abgedeckt" durch Prüfung** der **Exposition** der **Anwender, Nichtzielarten** usw. **-** so die **Annahme** des Gesetzgebers!?

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V. Zwischenfazit Zulassungsverfahren

Offene Fragen btr. Risiken und Vorsorge:

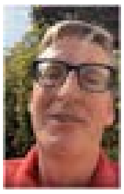
- **Kumulations-/Synergieeffekte verschiedener (Wirk-)Stoffe?**
  - **BfR:** Risikobewertung von **Mehrfachrückständen** aus unterschiedlichen PSM in der **Luft derzeit nur bei Tankmischung (je nach Zulassungs-Antrag);** Diskussion in EU/Forschungsprojekte
- **ubiquitäre Verbreitung persistenter Chemikalien (permanente Exposition,** Aufnahme durch Inhalation)

- Wie wird das **Minimierungsziel** btr. Expositionen (Art. 29 Abs. 1 d) **wirksam umgesetzt**?
- „**Rückholbarkeit**" und Regulierung/Nachsteuern bei neuen **Erkenntnissen** über Risiken? (Reaktionsfähigkeit)

How can monitoring results on atmospheric transport of pesticides be incorporated into the approval process?

Chris Lythgo
EFSA

Key Facts from preliminary discussion with Chris Lythgo (EFSA)



" Thank you for your scientific work and published peer-reviewed studies
→ important basis for knowledge about atmospheric transport

Entry into the renewal process

- Applicant and rapporteur member state are responsible for ensuring all published relevant information is added to the dossier
- The public consultation is a second opportunity to ensure any missing information is added to the dossier —> Any individuals as well as member state competent authorities and EFSA can comment which results in relevant studies being added to the dossier

→ To keep updated about pesticide substances: Subscribe to notification alerts on EFSA website: https://europa.us10.list-manage.com/subscribe?u=e6bc309c39d67dee1eb0bf114&id=7ea646dd1d

Usability of monitoring results

- EU guidance indicates that medium range atmospheric transport due to aerosol formation happens during the periods of spraying, so it is not surprising to find low amounts even in non-agricultural areas.
- However, EFSA cannot complete a risk characterisation using monitoring regarding atmospheric transport and deposition without concentrations
- Concentration amounts from e.g. active samplers are needed to advise decision makers whether there is a risk "

Chris Lythgo - Team Leader-Chemistry and Environmental Exposure Pesticides

Monitoring results from Germany
Detecting atmospheric pesticides using passive air samplers (PAS)

Maren Kruse-Plaß
TIEM Integrierte Umweltüberwachung

Detecting atmospheric pesticides using passive air samplers (PAS)

The study on airborne pesticides carried out in 2019 for the “Bündnis für enkeltaugliche Landwirtschaft” (BEL) was the most comprehensive study of its kind in the Federal Republic of Germany. It was the aim to record the pollution of approved currently used pesticides (CUPs) in the air. The analysis spectrum of over 500 substances also included banned substances such as persistent organic pollutants (POPs). Data collected with passive air samplers (PAS) and the analysis of filter mats from ventilation systems, identified 138 agricultural pesticides in the ambient air over Germany. Up to 33 pesticides in PAS and 36 pesticides in filter mats were detected per site. Glyphosate was identified at all locations (Kruse-Plaß et al. 2021).

The analysis of the 2019 results of the PAS and the filter mats showed that a combined analysis for over 500 pesticides is necessary for improved detection of the airborne pesticides of a site, as both methods detect different substances. In a study in 2020, we were able to analyse the PEF (polyester filters) of the TIEM technic PAS for 6 sites for more than 500 pesticides in addition to the PUF (polyurethane foam) according to the method used for the filter mats in 2019 (Zaller et al. 2021). Previously, the PEF had been analysed only for Glyphosate and AMPA. These results were compared with the measurement data provided by the Swedish University of Upsalla in Hallahus (S), which detected pesticides with an active collector on a weekly basis. It showed that the PAS can detect a similarly high spectrum of substances as the active sampler when PUF and PEF are both used for analysis of the complete pesticide spectrum (SLU:http://www.slu.se/en/departments/soil-environment/environment/data-host/pesticides_air_precipitation/).

Active collectors collect data in much shorter periods of time than PAS. However, further TIEM studies were able to show that substances that are present in comparatively high air concentrations register well over shorter exposure times (4 weeks). The collection of substances with low air concentrations can be additionally recorded by the installation of a second collector with a longer exposure time. Whether this period can be shortened further, especially for the PEF, will have to be clarified in further studies.

The specification of an air concentration (ng/m³) is often required for administrative purposes. Herkert et al. 2018 developed a model that allows to estimate an air concentration using the octanol-air partition coefficient (Koa's). Unfortunately, the Koa is only available for few CUPs. Further work here would be helpful.

For the results of the PEF, such a model needs to be developed.

Overcoming these obstacles may well show the TIEM technic PAS to be an easily usable, low cost alternative to active sampling of airborne pesticides.

Dr. Maren Kruse-Plaß, TIEM Intergrierte Umweltüberwachung

Detecting atmospheric pesticides using passive air samplers (PAS)

Maren Kruse-Plaß

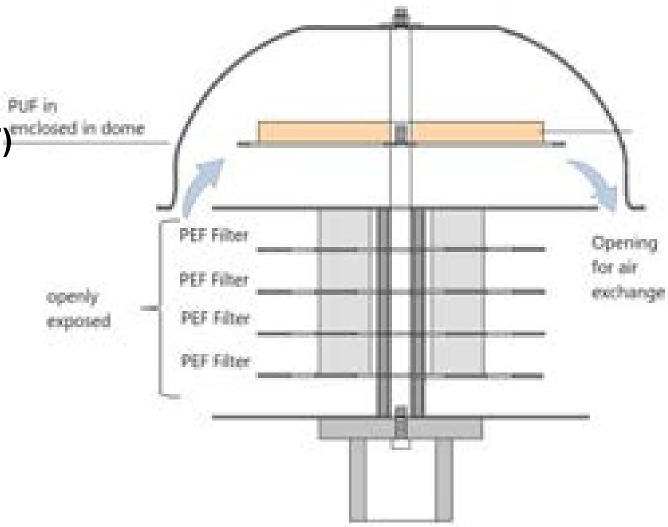
The TIEM Passive Air Sampler (PAS)

DEVELOPED FOR BEL STUDY 2019

It uses a **polyurethane foam (PUF)** disk in an enclosed dome.

Glyphosate is not collected in the PUF. (Morshed et al. 2011; Hofmann et al. 2018)

Therefore openly exposed **polyester filters (PEF)** were added to the PAS to collect **glyphosate.**

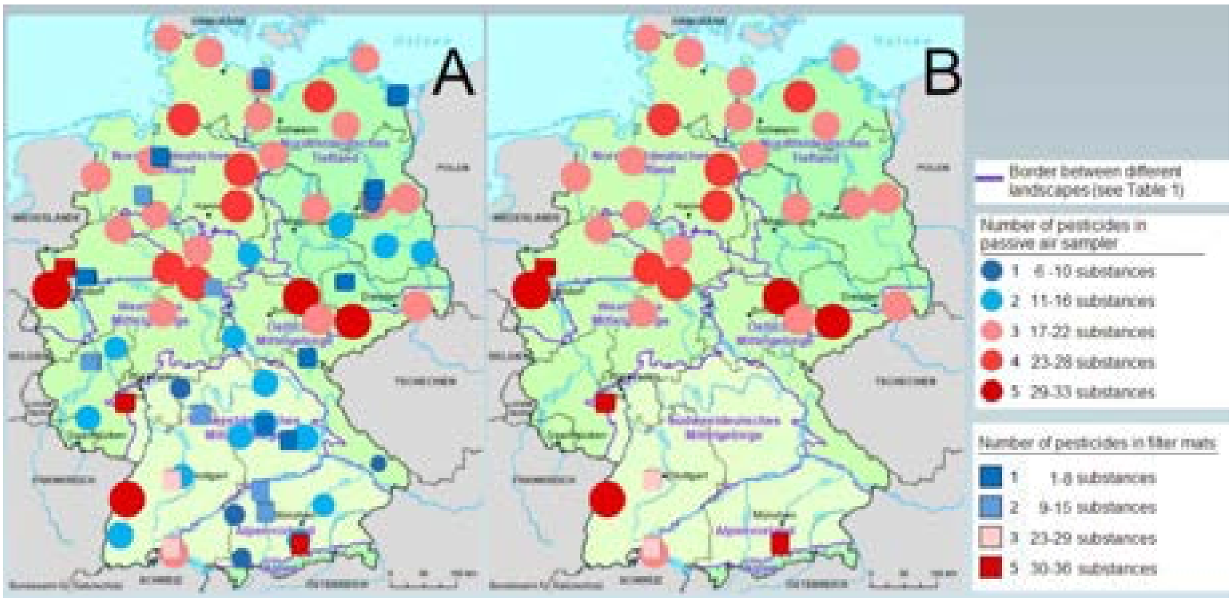


BEL study in Germany 2019

- All over Germany **a wide range of sites** were analysed for airborne pesticides, many in conservation areas.
- **49 passive air samplers**,
  20 sites with filter mats from air ventilation systems, additionally samples of bee bread and tree bark were analysed.
- Focus was on **currently used pesticides** including **glyphosate.**
- Analysis for **over 500 pesticides** of the **PUF in the PAS**
  and
  filter mats of the air ventilation systems **.**
- **PEF** was analysed for **glyphosate**.

* The term pesticides here is refers to a pesticide active substance.

Results of the 2019 study



Number of pesticides detected at sampling sites
(A) All sampling sites. (B) Sampling sites where more than 16 pesticides were detected in passive air samplers and more than 22 pesticides were detected in filter mats.

Summary of the 2019 results

- To our knowledge the BEL study 2019 was the first study that addressed the occurrence of both **currently used and persistent pesticides** in the air in Germany to such an extent (Kruse-Plaß et al. 2021).
- The TIEM technic passive sampler was able to register
  - the **number of airborne pesticides** at a site
  - as well as the **pesticide burden in (ng pesticide/PUF).**
- **138 pesticides** were detected in the study
- Up to **33 pesticides per site in PAS** and
  36 pesticides per site in filter mats were found.
- **Glyphosate** was detected **on all sites** were PAS or filter mat data was available.
- Areas of higher pesticide occurrence and load were associated with the low land in Germany, where higher agricultural activity is possible.

But…

the BEL study 2019 underestimated the total number of detected pesticides at a site.
There was no combined measurement of PUF and filter mat.

RESULTS OF THE AUSTRIAN STUDY 2020 (Zaller et al. 2022)

Number of pesticides detected in PAS PUF and PEF

Results for 6 sites

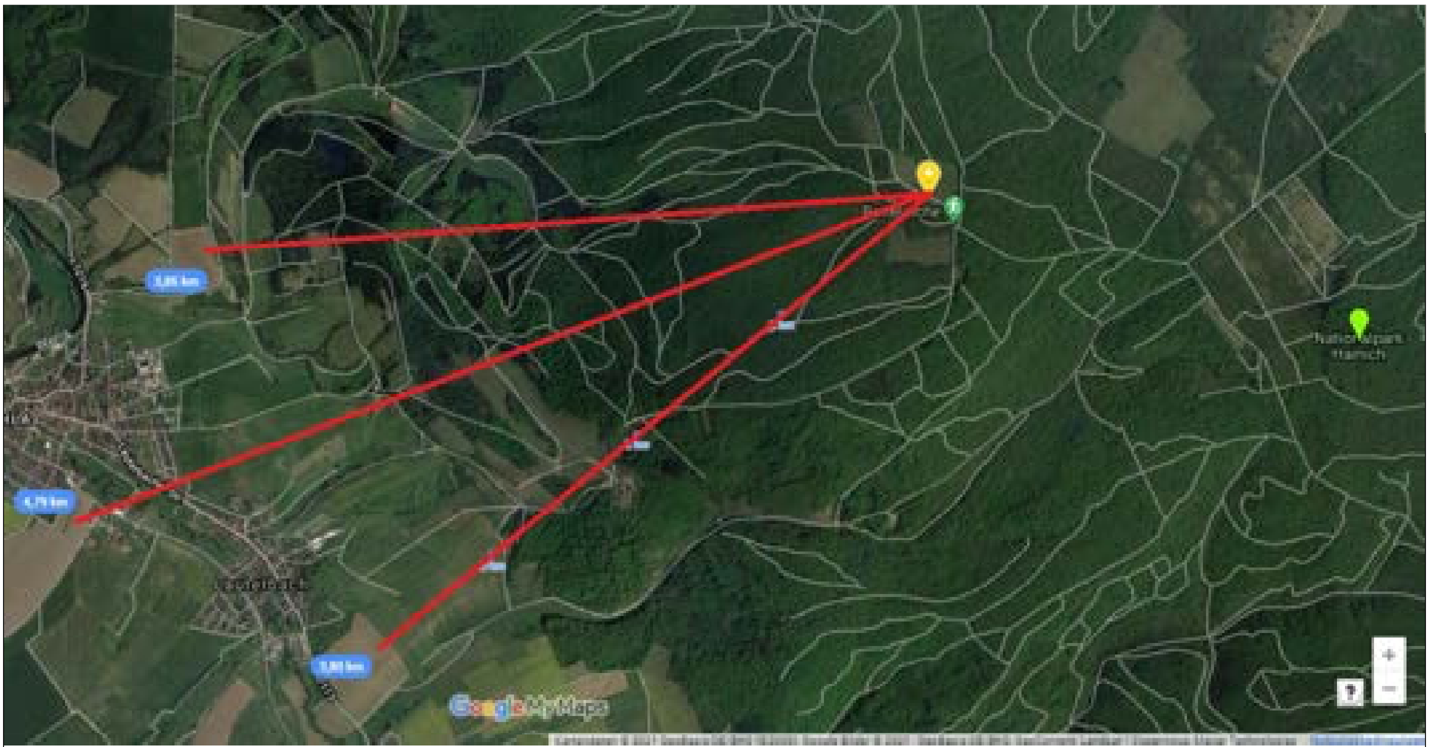
Parameter	PUF	PEF
Collection of	Gaseous substances	Dust
Extraction of sample	Dichloromethane	Acetonitrile/water mixture

The number of detected pesticides per site is comparable to result with AAS in Sweden.

PERIOD OF PAS EXPOSURE

The GAPS program focuses on POPs that are found in low concentrations in the environment.
Therefore, here an exposure time of the PUF of 2 to 3 months is recommended in order to be able to collect enough material for analysis.

For a project in 2021, we set up PAS **for 4 weeks** for the first time.
Exposure was from mid-August until mid-September



SITE NATIONAL PARK HAINICH

THÜRINGEN

Auftrag/Untersuchungsparameter: Pestizide in Luft LC (Spektrum > 500 Parameter)
Prüfverfahren: LC-MS/MS nach Desorption_

Analysenbefund — **Prüfbericht 21-D063-0006**

Probenbezeichnung: Jenke 02 Hainich Nationalpark 1 PUF

Parameter	CAS-Nr.	Gehalt	Einheit	BG
andere analysierten Parameter		**n.d.**	ng/Probe	5
Dimethenamid	87674-68-8	**17**	ng/Probe	5
Metazachlor	67129-08-2	**11**	ng/Probe	5

BG: Berichtsgrenze der Methode
Die in [ ] angegebenen Messwerte sind halbquantitative Abschätzungen von Konzentrationen unterhalb der Berichtsgrenze.

The passive sampler can be used in monthly intervals if CUP occur in large quantities in the environment.

In order to detect substances with low air concentration at the same site, it is an option to install a second sampler at the same site with longer exposure time.

Summary

1. The results of the study 2019 had shown that the PUF of the passive sampler can represent the contamination of a site with airborne pesticide. The data reflects

   - the number of detected pesticides per site
   - and the detected amount of these substances.

2. The spectrum of detected pesticides can be significantly expanded by an additional analysis of the PEF.

3. For the detection of CUP's, a monthly exposure period is conceivable, possibly it can be even shorter.

Thank you for your attention.

TIEM
www.tieminfo.de

Integrierte Umweltüberwachung

SITE LAKE CONSTANCE

Integrierte Umweltüberwachung

Auftrag/Untersuchungsparameter: Pestizide in Luft GC (Spektrum > 200 Parameter)
Prüfverfahren: GC-MS/MS nach Desorption_

Analysenbefund

Prüfbericht 21-D063-0004

Probenbezeichnung: Jenke 03 Bodensee 1 PUF

Parameter	CAS-Nr.	Gehalt	Einheit	BG
andere analysierten Parameter		**n.d.**	ng/Probe	5
1,2,3,6-Tetrahydrophthalimide (cis)	1469-48-3	**489**	ng/Probe	5
Captan (Summe inkl. THPI berechnet als Captan)		**972**	ng/Probe	5
Folpet	133-07-3	**1160**	ng/Probe	5
Folpet (Summe von Folpet und Phtalimid, ausgedrückt als Folpet) (R)		**1160**	ng/Probe	5

BG: Berichtsgrenze der Methode
Die in [ ] angegebenen Messwerte sind halbquantitative Abschätzungen von Konzentrationen unterhalb der Berichtsgrenze.

The passive sampler can be used in monthly intervals if CUP occur in large quantities in the environment.

In order to detect substances with low air concentration at the same site, it is an option to install a second sampler at the same site with longer exposure time.

Improving PAS data - future work:

1. More data on different exposure times for PUF and PEF is needed.

2. Estimate of an air concentration (ng/m³) needs to be improved. **Herkert et al. 2018** developed a model for PUF

   It requires octanol-air partition coefficients (Koa's)
   currently available for only few frequently detected pesticides

3. Development of a similar model for concentration estimates in the PEF

4. The analytical methods is the key for PUF and PEF results.

   The BVL monitoring programme will set a standard for these analysis.

5. Direct comparison of the data of the TIEM-technic PAS with the results of an active sampler.

Thank you for your attention.

Monitoring results from France
National monitoring of the background impregnation of pesticides in ambient air in France

Caroline Marchand
Ineris

Summary of Ineris talk (Caroline Marchand for Ineris / caroline.marchand@ineris.fr)

National monitoring of the background impregnation level of pesticides in ambient air in France

The setting of a national exploratory measurement campaign on pesticides (CNEP) in ambient air is the result of the involvement, since several years, of the French agency for food, environmental and occupational health & safety (Anses), the French local air quality monitoring networks (AASQA) and the French reference laboratory for air quality monitoring (LCSQA)[1], in agreement with the various government objectives (National Health and Environment Plan 3, National Plan for the Reduction of Air Pollutant Emissions).

The goal of the CNEP was to establish the first national and harmonised inventory of pesticides levels in ambient air, based on measurement sites located out of the proximity or direct influence of a single crop. Measurements have been performed all over France (DROM included), in 50 locations over a 12-month period, in a synchronised way and according to a common protocol. During this campaign, 1,800 samples were analysed, covering a list of 75 substances, allowing more than 100,000 data to be entered into the French air quality database (Geod'air).

Another goal was to study the factors impacting the sampling strategy (choice of measurement sites, duration et frequency of sampling, analysis methods) in order to define a long-term national monitoring of pesticides in France, that was implemented in July 2021.

The presentation will focus on the design of the CNEP and its main results, as well as on the ongoing long-term national monitoring strategy.

Mini-Bio – Caroline Marchand / Ineris

Caroline Marchand, is since November 2015, the Head of the unit « Technical support for ambient air and surface water quality monitoring » at Ineris. She obtained her PhD in chemistry and physics in 2005 from Louis Pasteur university, Strasbourg (France).

It’s unit is in charge of evaluation of environmental measurement devices (air and water); studies for the French national reference laboratories in charge of air (LCSQA) and aquatic environments (AQUAREF); Comprehension of environmental chemistry; ILC (interlabories comparison) on indoor air, ambiant air, water with fortified authentic matrices.

In the framework of LCSQA, she is involved with Fabrice Marlière in the implementation of a long-term national monitoring strategy of pesticides in ambient air.

[1] LCSQA is composed of 3 institutes: Ineris, LNE and IMT Lille Douai (www.lcsqa.org)

European Symposium on atmospheric transport of synthetic pesticides

31st May and 1st June 2023

National monitoring of the background impregnation of pesticides in ambient air in France

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET DE LA COHÉSION DES TERRITOIRES

French Ministry of Environment

LCSQA INERIS

French National Reference Laboratory for ambient air

Atmo France

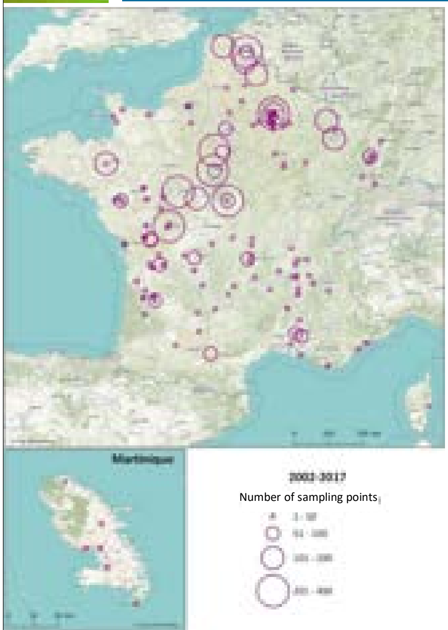
French air quality local networks

anses

French National Agency of Sanitary Safety

caroline.marchand@ineris.fr

Review of French works on pesticides before 2018



90's: wonderings about transfert of pesticides in air

Since 2000: development of sampling and analysis methods
➔ French standardisation in 2007 (XP X43-058 & 059)

2001: beginning of measurement campaigns by local networks
176 sites : [urban/rural] [background/proximity] [permanent/spot]

- 321 active substances (AS) / all agricultural activities
- data available in PhytAtmo on data.gouv (2020)

2015-2017: Proposal of a list of AS to be monitored and recommendations for monitoring strategies to assess general population exposure to pesticides (Anses)

2017-2021: National plan for the reduction of air pollutant emissions (PREPA)

2018: Government action plan on plant protection products

➔ Calls for working on the implementation of a periodic monitoring of pesticides on a national scale

LCSQA INERIS Atmo France anses

2

National exploratory campaign (CNEP)

Goals & Design (CNEP) :

- To have an **harmonised state of art** (synchronised measurements according to a common protocol) of **pesticides atmospheric concentrations** excluding sampling sites in the proximity of crop fields or influenced by only one type of crop
- **To study influence factors on sampling strategy** to help to define the design of pesticides periodic monitoring of on a national scale

Study partners

LCSQA-Ineris	Atmo France	Anses
• Coordination • Supervision of analysis laboratory (service provider) • Consolidation of the results database : global control of the banked data • National exploitation of the results	• Local expertise • Sampling • Approval of local data and data banking	• Funding & global supervision • Scientific contribution

3

CNEP protocol

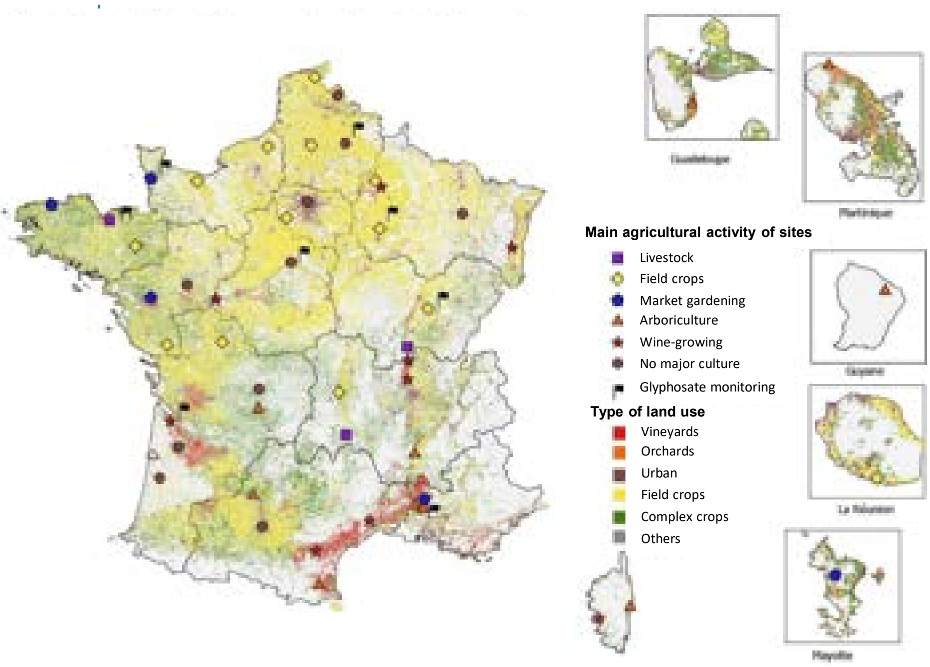
- **75 studied substances** (insecticides, fungicides et herbicides)
- Duration: **June 2018 - June 2019**
- Where: **50 municipalities working with local networks**
- **Temporal sampling strategy**
  - Sampling duration
    - **semi-volatile substances: 7 days** (gas & particulate phases (PM_{10})
    - **polar substances (glyphosate, AMPA & glufosinate): 2 days** (particulate phase - PM_{10})
  - Sampling frequency
    depending on substances/agricultural activity/known periods of treatment
    - **semi-volatile substances: 1 to 5 times per month**
    - **polar substances: 1 to 12 times per month**

→ **1348 validated samples (semi-volatile substances)**

→ **381 validated samples (polar substances)**

4

CNEP protocol



- ❑ **Spatial sampling strategy**
  - Depending on **residential areas**:
    50% of urban/peri-urban sites
    50% of rural sites
  - Depending on
    major agricultural activitiy:
    26% of field crop sites,
    18% of wine-growing sites,
    20% of arboricultural sites,
    10% of market-gardening sites
    6% of livestock sites
    20% of sites with no major agricultural activity

➔ **1 to 6 sites per region**
France = 18 regions

➔ **50 sampling sites distributed all over France (mainland + overseas (DROM))**

5

CNEP : national results – FQ & annual means

- ❑ Over **75** substances : QF = 0% ➔ 56 substances in DROM / 19 substances in mainland
- ❑ **9** substances with a QF > 20 %

		Substances								
		chlorothalonil	chlorpyriphos methyl	folpel	prosulfocarb	S-metolachlor	triallate	glyphosate	pendimethalin	lindan
QF (%)	mainland	22	25	27	35	35	40	**56**	64	**80**
QF (%)	DROM	0	2,5	0	0	**59**	0	X	34	11
LQ	*(ng/m^3)*	*0,238*	*0,119*	*0,179*	*0,149*	*0,030*	*0,060*	*0,009*	*0,060*	*0,030*

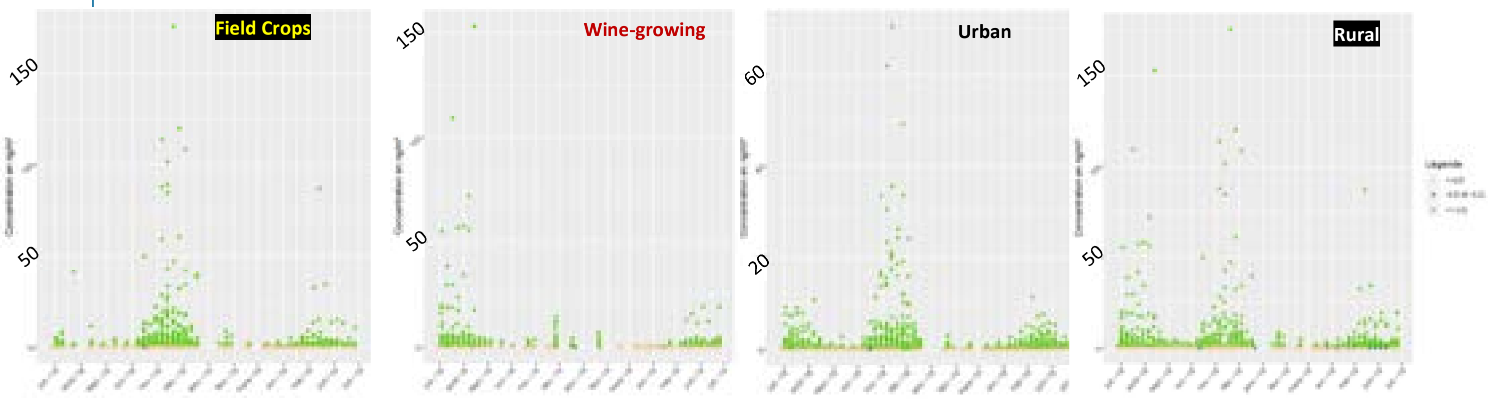
- ❑ **9** substances with annual means > 0,1 ng/m^3 (mainland or DROM)

	Substances								
Annual mean (ng/m^3)	S-metolachlor	fenpropidin	pyrimethanil	chlorpyriphos methyl	chlorothalonil	triallate	pendimethalin	folpel	prosulfocarb
mainland	0,10	0,15	0,18	0,21	0,24	0,27	0,66	**1,00**	**2,60**
DROM	0,29	0	0,005	0,05	0	0,001	0,14	0	0,001

6

CNEP : national results – variablity factors

- **Agricultural profile ⇔ substance**
  Prosulfocarb ⇔ field crops (mainland)   Folpel ⇔ wine-growing (mainland)
- **Site-dependence**
  Range of **annual mean per site** for **same substance** and **agricultural profile:**
  Prosulfocarbe : 0,40 to ~13 ng/m³   Folpel : 0,06 to ~13 ng/m³
- **Temporal variability**
  - Periods of highest concentrations ~ consistent with previous results and known traditional treatment periods
  - Comparison to historical data: for a same site, variability in weekly concentrations (weather, pests, …)



1 graph = about **15000** to **50000** data (weekly measurements)

Livestock & market gardening : max < 15 ng/m³   Arboriculture : max < 20 ng/m³

7

Initial health interpretations: main results

- **First approach:**
  comparison of exposures to TRV
  - Results:
    First estimation of ratio DED(air)/TRV = low
  - Limits & uncertainties of these approach:
    - ✓ Lack of respiratory toxicity data;
    - ✓ Age of certain TRVs and absence of non-threshold TRV;
    - ✓ "Worst case" scenario for DED but in "background situations"

  First indications on estimating risks via air

- **Second approach:**
  hazard study
  - Exercise outside the regulatory context: taking into account several sources of data (regulatory and academic);
  - Conservative assumptions concerning the choice of data used to prioritise substances*

  **Approaches dependent on the analytical performance of each substance*

  Prioritisation of substances to identify substances of interest for in-depth assessment

- **Results :**
  - **32 substances (9 forbidden) of interest requiring in-depth assessment:**
    Deltamethrin, Diuron, Epoxiconazole, Etofenprox, Fenarimol, Iprodione, Lindane, Linuron, Metribuzin, Myclobutanil, Pentachlorophenol, Phosmet, Permethrin, 2,4-Di, Boscalid, Chlorothalonil, Chlorpropham, Chlorpyriphos-ethyl, Cyprodinil, Fenpropidine, Fluazinam, Folpel, Glyphosate, Metazachlor, Oxadiazon, Pendimethalin, Propyzamide, Pyrimethanil, S-metolachlor, Spiroxamine, Tebuconazole, Triallate
  - **6 substances with QF > 0% classified in the category of "Insufficient data or substances not classified" for carcinogenic, mutagenic, reprotoxic (including on or via breastfeeding), endocrine disruptor & neurodegenerative effects**

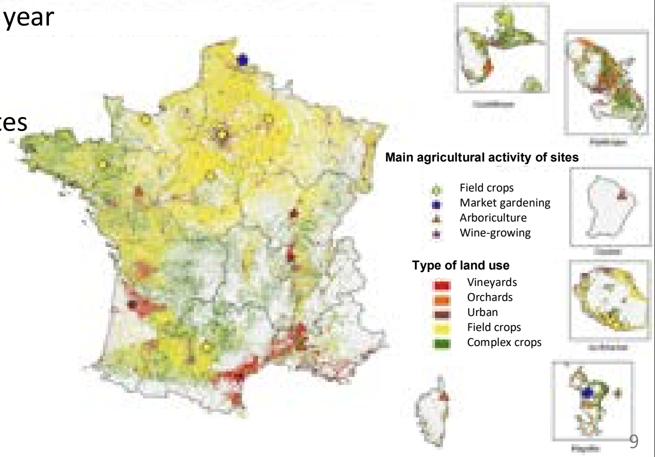
📖 ➲ https://www.anses.fr/fr/system/files/AIR2020SA0030Ra.pdf

8

Design of a long-term national monitoring - feedback from CNEP

- **Goal:** periodic update of the national « photography » of the CNEP
  ➔ evolution of concentrations over years

- **Measurement strategy:**
  Substances : = CNEP (75 substances : 72 semi-volatiles, 3 polars)
  Agricultural profiles: field crops, viticulture, arboriculture, market gardening (~~livestock~~)
  Measurement methods: = CNEP
  Measurement frequency: semi-volatiles: between 18 and 26 weekly samplings per year
  polars: 40 samplings of 48h per year
  Site selection:
  ✓ 1 site per region
  representative of an urban/peri-urban living area ➔ 18 sites
  ➔ number of inhabitants within 5km:
    - mainland France > 20,000 (min 15,000)
    - DROM, Corsica > 10000
  ✓ Distance from sampling point to station - 1st plot:
  > 200m (min 150m)
  ✓ Proportion of agricultural profil ~ CNEP



9

Long-term national monitoring of pesticides

Beginning of the long-terme monitoring in July 2021
- Data are aggregated in the national air quality database geodAIR
- Data available in PhytAtmo and on the websites of the local network (open data)

First overview of the results
- 29 substances are not detected
- 46 substances are detected and quantified
  - Highest FQ : glyphosate (75%), lindane (62%), metolachlor (47%), pendimethalin (74%), prosulfocarb (37%) and triallate (43%) ➔ consistent with CNEP results
  - Highest concentration (>5 ng/m^3) : deltamethrin, folpel, metolachlor, pendimethalin, prosulfocarb and triallate ➔ consistent with CNEP results

➔ Consolidation of these results in progress
Detailed comparative study with the data obtained in 2018-2019 (LCSQA report in 2023)

10

Study in synergy : PestiRiv (sites close to vineyards)

Joint study
French public health agency / Anses

Partners for ambient air part :
Local networks / LCSQA-Ineris

Main objective:
To identify a possible overexposure to pesticides of people living near vineyards compared to people living far from any crops.

Secondary objectives:
- *To gain a better understanding of the determinants of exposure in order to propose recommendations for reducing exposure.*
- *To study the effect of distance on the exposure of local residents*
- *To study the links between the various exposure routes and their associations with levels of impregnation*
- *To describe the seasonal variation in exposure among people living near vineyards*

Study population

The PestiRiv study is taking place in **6 wine-growing regions**.
It concerns adults aged 18 to 79 and children aged 3 to 17.
Households are randomly selected in **wine-growing areas** or in **areas far away from any crops**.

Survey periods

The large-scale PestiRiv study was carried out in two phases:
- *October 2021 - March 2022 among people living near vineyards*
- *March - September 2022 among people living near vineyards and those living far from any crops.*

https://www.santepubliquefrance.fr/etudes-et-enquetes/pestiriv-une-etude-pour-mieux-connaitre-l-exposition-aux-pesticides-des-personnes-vivant-en-zones-viticoles-et-non-viticoles

11

Thanks for your attention

Anses contact : fabrizio.botta@anses.fr

Local network contact: emmanuelle.drab-sommesous@atmo-grandest.eu, colin@ligair.fr, ssocquet@atmo-aura.fr

LCSQA/Ineris contact : fabrice.marliere@ineris.fr, caroline.marchand@ineris.fr

12

Monitoring results from Portugal and Netherlands
Occurrence and Distribution of Pesticides and their Metabolites in the Atmosphere of two European Agricultural Regions

Freya Debler
Helmholtz Zentrum Hereon

Occurrence and Distribution of Pesticides and their Metabolites in the Atmosphere of two European Agricultural Regions

Freya Debler[1], Juergen Gandrass[1], Nelson Abrantes[2], Isabel Campos[2], Paula Harkes[3]
[1]Helmholtz-Zentrum Hereon, Geesthacht, Germany, 21502, freya.debler@hereon.de
[2]University of Aveiro & CESAM, Aveiro, Portugal, 3810-193
[3]Wageningen University & Research, Wageningen, the Netherlands, 6700

Introduction: Pesticides are widely used to control pests in agriculture. However, their effects on the environment and human health have raised concerns. Some pesticides have been included in the Stockholm Convention due to their persistence, bioaccumulation, and toxicity, as well as their ability to undergo long-range atmospheric transport [1]. Despite this, the use of currently-used pesticides (CUPs) has increased in recent years, which may lead to exposure of pesticides, their metabolites and pesticide mixtures in the atmosphere. Pesticides can be transported over long distances from their application sites through various mechanisms, including spray drift, volatilization, and wind erosion [2]. Despite their widespread use, limited information is available on the occurrence, distribution, and transport behaviour of pesticides and their associated metabolites and mixtures in air.
This study aims to investigate the occurrence, distribution, and potential off-site transport of pesticides and their metabolites in the air in two agricultural regions in Europe (Aveiro District, Portugal and Drenthe, the Netherlands) over a 14-month period (April 2021 to June 2022).

Materials and Methods: 96 air samples were collected using high-volume air samplers. The samples were analysed for pesticides in both the gaseous and the particulate phase. Pesticides in the gaseous phase were sampled using PUF/XAD-2 cartridges, while glass-fibre filters (GFFs) were used for the particulate phase. The analysis involved the detection of 319 different pesticides, including organochlorine pesticides, CUPs, and pesticide metabolites. Pesticides from the PUF/XAD-2 cartridges were extracted using dichloromethane through a cold-column extraction method, while the QuEChERS approach was employed for extracting pesticides from the GFFs. A dispersive solid-phase extraction (d-SPE) was carried out to clean the GFFs prior to gas chromatography (GC) analysis. Liquid chromatography (LC) coupled to a time-of-flight mass spectrometer (QTOF) and gas chromatography coupled with tandem mass-spectrometer (GC-MS/MS) were used for instrumental analysis.

Results: A total of 96 different pesticides and pesticide metabolites were detected in the air samples collected from the Netherlands and Portugal. Concentrations of these pesticides varied between 1.5 pg/m^3 and 10 ng/m^3, with the highest levels observed during the spring and summer when pesticides were applied. In the Netherlands, 63 pesticides and their metabolites were found in the particulate phase, and 29 were detected in Portugal. In the gaseous phase, 53 different pesticides were detected in the Netherlands and 24 in Portugal. Pesticides were present in 89 % of the particulate samples and 97 % of the gaseous samples. In 73 % of particulate phase samples and 92 % of the gaseous phase samples, multiple pesticides were detected. Pesticide metabolites were found in 56 % of the particulate phase samples and 55 % of the gaseous phase samples. The distribution between the gaseous and particulate phase was determined by calculating gas-particle partitioning coefficients for pesticides found in both air phases.

Discussion and Conclusion: Pesticide mixtures were present in around 70 % of the particulate phase and 90 % of the gaseous phase samples. Furthermore, pesticide metabolites were detected in over 50 % of the samples. These findings offer important insights into the occurrence and behaviour of pesticides, their mixtures, and metabolites in the atmosphere.

Acknowledgments: The research leading to these results has received funding from the European Union Horizon 2020 programme under grant agreement n°862568 (SPRINT project, https://sprint-h2020.eu/).

References:

[1] Stockholm Convention. All POPs listed in the Stockholm Convention. [April 21, 2023]; Available from: http://chm.pops.int/TheConvention/ThePOPs/AllPOPs/tabid/2509/Default.aspx

[2] FOCUS Working Group, Pesticides in Air: Considerations for Exposure Assessment, European Union, Brussels, SANCO/10553/2006 Rev, June 2, 2008.

Monitoring results from Netherlands
Comparison of pesticide uptake by PUF/Grass/Oak leaves at 7 locations in 2 provinces

Jelmer Buijs
Buijs AgroServices

Comparison of pesticide uptake by PUF/Grass/Oak leaves at 7 locations in 2 provinces of the Netherlands

With the association Meten=Weten[1] (Measuring brings knowledge) we conduct pesticide measurements since 2018 of water, soil, air, vegetation, hair and various other matrices. The members of the association are mainly living in the Dutch province of Drenthe. Recently also many new members were registered from other provinces, where citizens experience negative impacts and stress from farmers near their homes who treat their fields with pesticides. The association is also active on the political and juridical levels. It was decided in 2022 to conduct 1 year measurements of air at 7 locations in two provinces, which are located 10-1500 meters from conventionally managed arable fields. Four locations are in so called Nature2000 areas. At present I can report to you the results that we obtained with half of the number (70) of samples that were planned (140). In the summer of 2023 the measurements will be stopped and the results elaborated.

The association Meten=Weten wants to collect hard data about the pollution of our living environment and of the nature located nearby our villages and about its impacts. Until 2022 we collected single samples (vegetation, manure, soil etc.) at different locations. In this new project we wanted to create timelines of the pollution throughout a period of one year from August 2022 till July 2023. We sampled each location with a six week interval. Until 2022 we did only occasionally measurements with Poly Urethane filters (PUF) and with Poly Ethylene Filters (PEF). In the new project we combined this with the measurements of grass and oak leaves sampled near to the PUF/PEF filters, in order to understand the relation between their results. If oak/grass samples can be used instead of PUF filters it would become cheaper and easier for citizens to get an impression of the quality of their environment. In addition, oak and grass samples might have a higher biological significance.

In 28 grass samples 21 pesticides were found, in 21 oak leave samples 28 pesticides and in 25 PUF filters 54 pesticides were found. In total, so far, 60 pesticides were found in the three matrices from 7 locations. In the Power Point presentation, the preliminary results will be explained.

Researchers; Jelmer Buijs & Margriet Mantingh

May 2nd 2023

[1] https://metenweten.nl/

Comparison of pesticide uptake by PUF/Grass/Oak leaves at 7 locations in 2 provinces

Society Meten=Weten, Westerveld, Netherlands

Processing of measurements: Jelmer Buijs, Buijs Agro-Services

Preliminary results, April 28th 2023

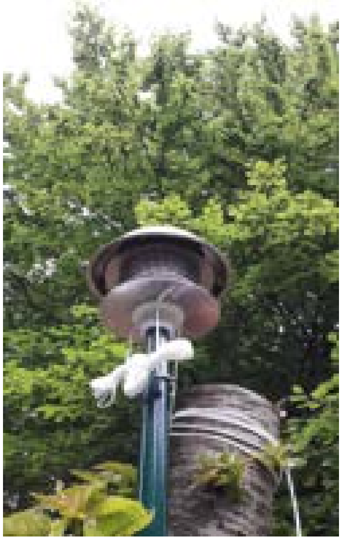
on basis of half of the number of samples

BUIJS AGRO-SERVICES

METEN = WETEN

7 sampling locations; max. 110 km between them; Sampling with 6 week intervals

Four (out of seven) sample locations in Natura2000 areas

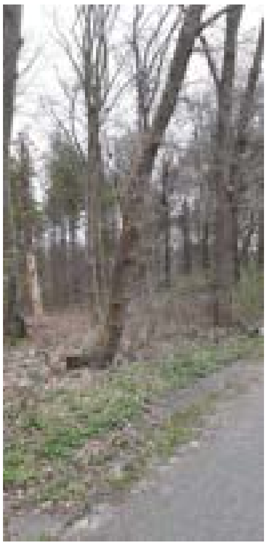


Number of pesticides measured:
in PUF-707
In PEF filters-6

Symposium Atmospheric Transport Pesticides, Schwedt
31/5/23 - 1/6/23

3

Oak leaves harvested by hand of lowest branches, within 100 meters from PUF

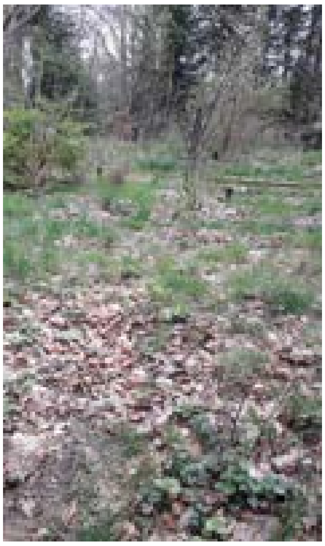


Number of pesticides measured: 707

Symposium Atmospheric Transport Pesticides, Schwedt
31/5/23 - 1/6/23

4

Gras harvested by hand within 100 meters from PUF/Oak



Number of pesticides measured: 707

Filters after 6 weeks exposure became slightly yellow

Total catch in 4 matrices 24/5/22-15/12/22

matrix	Number of samples	Total number of pesticides found	Number positive hits	Average number hits (substances) per sample
PUF	25	54	315	12,6
PEF (for glyphosate)	6	0	0	0
Oak leaves	21	28	158	7,5
Grass	28	21	103	3,7

Some top scorers (Incidence among all samples of the same matrix)

matrix	prosulfocarb	fluopyram	DEET	1,4-dimethylnaftalene	pendimethalin
PUF	88%	28%	100%	84%	84%
Oak	100%	100%	28%	0%	76%
Grass	82%	25%	0%	0%	46%

Substances not found in PUF filters

- In Oak: cypermethrin (1x)
- In Grass: diphenylamine, fipronil-sulfide, fipronil-sulfon, fluazifop, fludioxonil & propiconazole

Substances found in all three matrices

- Chloorprofam
- Fipronil (3 times in grass, 1 time in oak, 3 times in PUF)
- Fluopyram
- Fthalimide
- Pendimethalin
- Permethrin cis & trans (3 times in grass, 1 time in oak, 4 times in PUF)
- Prosulfocarb
- Prothioconazole-desthio
- Triallate

Number of pesticides caught by oak and grass in comparison with PUF

- Oak 50% of number of substances
- Grass 30% of number of substances

Total concentrations of pesticides absorbed by oak, grass, PUF at 7 locations (microgram per kg dry matter)

Matrix	May	August	September	November	December	Average
Puf	294,3	109,5	116,2	317,6	224,1	212,4
Oak	7,14	83,0	66,4	71,4	29,7	51,6
Grass	32,5	12,5	4,7	51,6	44,6	29,2

Insecticides, fungicides, herbicides

- At all locations we found fungicides, herbicides and insecticides
- It occured that at some dates we found single samples without fungicides, insecticides & herbicides

(dis)advantages of oak versus PUF matrix

Advantage Oak in comparison with PUF	Disadvantage Oak in comparison with PUF
Biological relevance to ecosystem	Less pesticides caught
Matrix everywhere available in forested areas	Matrix is not available from November-April
No matrix costs involved	Oak trees may be too high to sample
Already data available about other locations, analysed with the same LC and GC method	No information available about inter/intra-tree variation of pesticide concentrations

Limitation of both methods

- No information yet available about the ecological meaning of different measured values of pesticides and biocides to biodiversity and chemical stress to living organisms

Preliminary conclusions

- Large discrepancies were found between concentrations found in oak, grass and PUF
- There is only low correlation between substances found in oak, grass and PUF
- Some components are always & everywhere, like prosulfocarb, pendimethalin and fluopyram
- Some components have been found only in one or two matrices
- Seasonal patterns of the matrices are very different
- Concentrations in oak leaves vary less than in grass
- For the understanding of the ecological impact of pesticides from air, it is necessary to sample biotic samples as well

Goodbye

- Thank you for your attention

Report is expected in the autumn of 2023

Contact: jelmerbuijs@gmail.com

BUIJS AGRO-SERVICES

ADESSIUM FOUNDATION

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METEN = WETEN

Symposium Atmospheric Transport Pesticides, Schwedt
31/5/23 - 1/6/23

17

Monitoring results from the state Brandenburg
Monitoring on active substances of pesticides in Brandenburg 2021/2022

Rudolf Vögel
Landesamt für Umwelt Brandenburg

Datum 24.5.2023

Dept. Technical Environmental Protection 1

Unit T14 - Air Quality, Climate, Sustainability

Rudolf Vögel

E-Mail Rudolf.voegel@lfu.brandenburg.de

Tel. 03334 .2778423

Information:

https://lfu.brandenburg.de/lfu/de/aufgaben/immissionsschutz/luftqualitaet/luftguetemessung/

Monitoring on active substances of pesticides in Brandenburg

Contribution to the European symposium on atmospheric transport of pesticides

Organizer Brandenburgische Akademie "Schloss Criewen" and Bündnis für enkeltaugliche Landwirtschaft e.V., Criewen, 31.5.-1.6.2023,

For the environmental authority of the Brandenburg Ministry in cooperation with the plant protection service of the state a contamination case of organically produced fennel by a cereal herbicide in a large organic arable farm in northeast Brandenburg in the fall of 2013 brought the motive to deal with volatile pesticides in concern of environmental risks and against the background of coexistence with organic agriculture.

The herbicides pendimethalin and prosulfocarb, which were found as product contamination, were intensively monitored in the following years using various investigation methods. A so-called bark monitoring (http://tieminfo.de/.cm4all/uproc.php/0/Publikationen/Bericht-H18-Rinde-20190210-1518-1.pdf?_=16e5a98b3af&cdp=a) was used for this purpose, combined with passive samplers with polyurethane and polyester filter cartridges, exposed over an entire growing season and specific raw product and vegetation analyses. Exposure data from market samples taken by state testing agencies, which are regularly sampled there, were also requested.

The results obtained are in line with other studies and measurement series in Europe on so-called volatile active substances and confirm the assumption of a frequently uncontrolled spread of these active substances beyond the area of application, which are frequently also provided with high persistence beyond the necessary period of action.

These results, technical policy decisions at European, national and state level (BMEL – Plant protection - National Action Plan for the Sustainable Use of Plant Protection Products / European Green Deal: Less chemical pesticides, extensive renaturation (europa.eu) as well as the intensive discussions on biodiversity and insect protection that have taken place in the meantime gave reason to comprehensively investigate the spread and fate of a more extensive list of active ingredients of agricultural pesticides in various regions and to compare it with actual applications.

Only passive samplers with a 4-week filter change were used, and the analysis was carried out according to a multi-analysis (BVL-ASU L 00.00-115, https://www.methodensammlung-bvl.de/de/dokumente/gesamtinhalt/wdc-beuth:din21:296997774/directPdf-3003722) by an accredited, experienced special laboratory.

In 2021, analyses on 2 sites were started directly in large-scale agricultural landscapes, partly characterized by fruit cultivation in the north and east, and in 2022, 2 additional sites were added in 2 biosphere reserves (BR) buffered by extensive organic farming (BR Schorfheide-Chorin) and by permanent grassland and wet forest (BR Spreewald). Utilization data (crop and applications made) were determined for all sites in a 1 km radius, as well as in a 2 km radius for the additional sites in 2022. The evaluated data from 2021 were evaluated and discussed with the participating farmers.

Results:

The determined land use data of the farmers correspond to the agricultural structure of Brandenburg, which is predominantly characterized by large-scale arable farming.

In 2021, 23 and 28 commercial compounds with 25, respectively 30, active ingredients were used by 5 and 9 farms at both study sites. At one site, 8 active substances were in use in close proximity, at the other site there were 13 substances. 12 or accordingly 11 active substances, were detected without any known application in the 1 km radius. These substances are predominantly known to be highly semi-volatile and, due to mostly high physical vapor pressure, show a high tendency to be carried over long distances, as well as a greater persistence over time, which is indicated by multiple analytical evidence. Found contaminants such as DDT/DDE have been shown to be strongly associated with tillage activities and airborne dust contamination. Soil drying due to climate change will remain responsible for this in the future. Active substances that are no longer approved or not approved in Germany, some of which are very persistent, were also found.

One site is marginally characterized by special crops such as fruit and berry cultivation. Remarkably, the residue analysis draws predominantly on herbicides, slightly on fungicides whose both use is mostly to be assigned to one-two-year-old arable crops. The insecticides used in fruit growing are missing.

The load data found in the ng range refer to the active substances bound in the filter samples and can therefore not be interpreted as air load data.

With the additional measurement data of both BRs collected in 2022, however, a comparison to spatially significantly better buffered landscapes is available. Thus, pollution data from agricultural regions show significantly higher ng values compared to the sites in the BRs, which are isolated to a radius distance of 1-2 km. Nevertheless, a large number of active substances are also found there, albeit within the analytical detection limits, due to long-distance transport from the surrounding agricultural region.

Prospect and summary:

The use of passive samplers is a simple, also relatively cost-efficient method for the semi-quantitative determination of PPP contamination via the air path and with the possibility of temporally narrow frequency (<4 weeks). It is suitable for determining the cause and spreading tendencies of particularly problematic plant protection products by including other agrometeorological and environmental data (humidity, solar radiation, temperature, wind and dust contamination).

Such results should find their way into a more differentiated plant protection advisory service of the federal states, which should also be more oriented towards environmental and biodiversity aspects, because it is predominantly financed by the state. The use of pesticides should be understood more in terms of phytomedicine and less as a means of production.

The pesticide monitoring, which was started in Brandenburg on a trial basis, should be continued in the following years and integrated into the environmental research tasks of the biosphere reserves of the state as a contribution to environmental monitoring.

Monitoring auf Wirkstoffe von Pflanzenschutzmitteln in Brandenburg 2021/2022

Fachsymposium zum atmosphärischen Transport von Pestiziden, Criewen/U. 31-5.-1.6.2023

Rudolf Vögel, Ref. T 14, Luftqualität, Klima, Nachhaltigkeit

Rudolf Vögel, T 1.4

Monitoring flüchtiger Pflanzenschutzmittel

Konzept, Arbeitsansatz und Ergebnisse 2021/2022

Anlass und Problem:

2013 Kontamination von Sonderkulturen durch flüchtige Herbizidwirkstoffe, Vermarktungsschaden, Abstände zu möglicher Applikation >>2 km, Verursacher unbekannt,….

Seitdem sind viele ähnliche Fälle in D und auch A dokumentiert

Ziel: ein landesbezogenes Monitoring auf volatile PSM aufzubauen,

Erkennen von Problemstoffen,

Hinweise für Zulassungsverfahren,

Verbesserung der Beratungshinweise und Applikationsvorgaben

Rudolf Vögel T 1.4

Durchführung PSM-Monitoring 2021
3-jährig, verschiedene Standorte

Erfassung 2021/2022

2/4 Standorte (Barnim, Potsdam, BRSC, BRSW),

Passivsammler mit Spezialfiltern,

Monatlicher Probenwechsel

Analyse nach Ende durch ein Speziallabor

Begleitdaten

Meßdaten der LfU-Luftgütemessung, DWD-Stationen

Applikationsdaten der Landwirte

(1-2 km-Radius)

Anbaudaten (Auswertung INVEKOS)

Durchführung PSM-Monitoring 2021
3-jährig, verschiedene Standorte

Aspekte ökotoxikologisch

Persistenz der Stoffe,

Belastungshöhe (ng-Bereich!)

Flüchtigkeit, Verbreitung abseits der Anwendungskultur

Verhalten und Konzentration nichtapplizierter Mittel in der Umwelt

Altlasten?

Agronomische Einsatzaspekte

Ausbringtechnik

Ausbringbedingungen

Ersatzmittel, Alternativen

Durchführung PSM-Monitoring 2021/2022
Luftgütemeßstationen und Passivsammler

LAND BRANDENBURG

LfU Landesamt für Umwelt

Standorte und Meßeinrichtung

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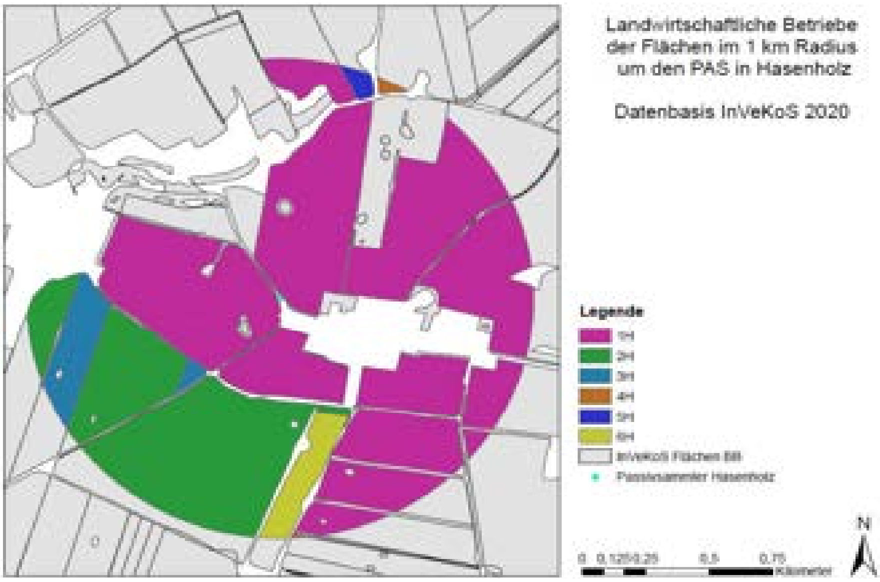
Durchführung PSM-Monitoring 2021

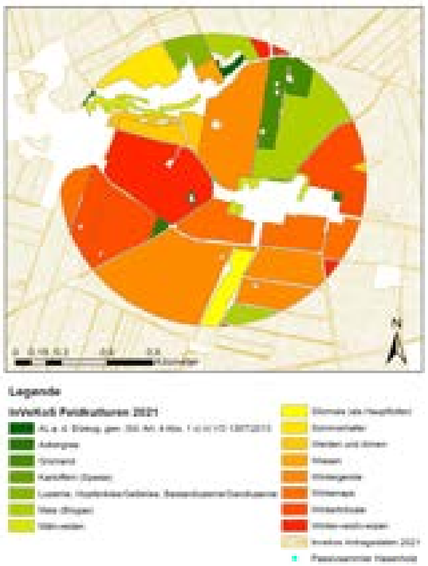
LAND BRANDENBURG

LfU Landesamt für Umwelt

Nutzer und Nutzung, 1 km-Radius



Feldkulturen im 1 km Radius um den PAS in Hasenholz
Datenbasis InVeKoS 2021



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Durchführung PSM-Monitoring 2021

Daten der Luftgütemeßstation

Messart: Automatische Messwerterfassung, Manuelle Probennahme

Gemessene Parameter:

Parameter aktiv von bis Gebiet
Schwefeldioxid (SO_2) nein 2001 2008 ---
Feinstaub (PM10) ja 2000 DEZAXX0015S
Feinstaub (PM2.5) ja 2006 DEZAXX0015S
Ozon (O_3) ja 2000 DEZAXX0003S
Stickstoffdioxid (NO_2) ja 2000 DEZAXX0015S
Stickstoffoxide (NO), (NO_2), (NO_x) ja 2000 ---
Deposition ja 2002 ---
Meteorologische Parameter ja 2000

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Was sind Passivsammler?

Relativ einfache, auf Filterakkumulation beruhende Meßgeräte

Als Filter werden hochaufgereinigte PU oder PE-Schaumstoffe verwendet

Ermittelt werden Rückstände im Filtermedium (nG/X), keine Luftkonzentrationen,

In monatlicher Auflösung

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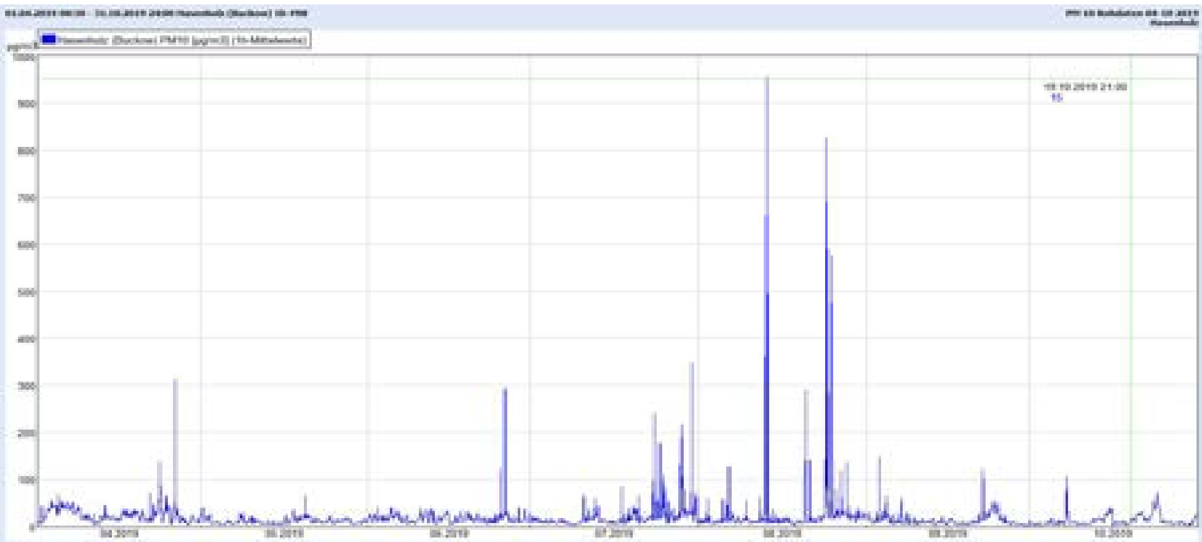
Durchführung PSM-Monitoring 2021

Beispielsdaten Staubdeposition PM 10 /2,5   stündliche Auflösung



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Durchführung PSM-Monitoring 2021
3-jährig, verschiedene Standorte

LAND BRANDENBURG

LfU Landesamt für Umwelt

Ergebnisse 2021 Barnim, Labordaten

20 Wirkstoffe analysiert,

8 durch Applikationen bestätigt

12 ohne flächennahe Applikation

Applikationen 2021, Barnim

Einsatz von 23 Handelspräparaten in der Zeit von April-Oktober

mit 25 Wirkstoffen (davon 8 analytisch nachzuweisen)

Rudolf Vögel, T 1.4

Durchführung PSM-Monitoring 2021
Nachgewiesene Wirkstoffe, BAR April-Oktober

LAND BRANDENBURG

LfU Landesamt für Umwelt

Befund ng/Probe	217305-1	217305-2	217305-3	217305-4	217305-5	217305-6	217305-7
	HH 4-2021	HH 5-2021	HH 6-2021	HH 7-2021	HH 8-2021	HH 9-2021	HH 10-2021
Aclonifen	24,8						
Azoxystrobin			10,5				
Clomazon					22,5	23,7	
DDE-pp	10,3			10,3	25,3	38,0	24,5
DDT-pp	22,6	20,4	23,7	24,0	69,8	55,4	36,0
Diflufenican							34,3
Dimethenamid			29,8			43,6	
Ethofumesat							
Fluazinam							
Flufenacet			10,5				44,2
MCPA		28,6					
Metazachlor						73,5	
Metolachlor		214,8	313,3	27,1			
Pendimethalin	401,0	97,0	16,2	13,6	30,3	33,9	462,1
Propyzamid							
Prosulfocarb	21,9	54,2				22,8	887,5
Prothioconazol-desthio		147,8	463,1				
Tebuconazol			128,5	26,8	59,5		23,3
Terbuthylazin		196,2	896,3	50,9	12,9		
Terbutylazin-desethyl			48,9				
Triallat							84,3
Trinexapac-ethyl	23,2	39,9					
Glypho	30,3	34,5	33,2	78,7	200,3	66,4	37,2
AMPA	16,4	25,8			26,5	25,5	23,7
CCC	678,6	92,7		20,6	37,7		

Grün: Nachweis applizierter Stoffe

Orange: Nachweise für nicht applizierte Stoffe (1km-R.)

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Durchführung PSM-Monitoring 2021

Nachgewiesene Wirkstoffe, BAR April-Oktober

LAND BRANDENBURG

LfU Landesamt für Umwelt

Analysefunde KWALIS-HH-2021	Art	Handelspräparate	Einsatz in HH	Kultur	Hinweise, Zulassungsende
Aclonifen	H				
AMPA	H				
Azoxystrobin	F	ZEUS	20.4., 1.6.		
CCC	WR	Stabilan 270	19.4., 22.4.		30.11.2022
Clomazone	H				leichtflüchtig!
DDE-pp	I alt				Altlasten!
DDT-pp	I alt				
Diflufenican	H	Carmina 640, ALLIANCE	30.10.		31.12.2023
Dimethenamid	H				
Flufenacet	H				
Glypho	H	Duran, Profi 360	30.3.	WW, Mais	31.12.2023, vorb.
MCPA	H				
Metazachlor	H				
Metolachlor	H				
Pendimethalin	H				
Prosulfocarb	H				
Prothioconazol-desthio	F	Protendo 250 EC	25.5.		
Tebuconazol	F	Folicur, TEBUCUR 250 PI-130	20.4., 25.5., 2.6.		
Terbuthylazin	H	ZEAGRAN ultimate, Calaris	20.5., 1.6.		k.Z., Frist 17.9.2021 (Zeagran u.)
Terbutylazin-desethyl	H				
Triallat	H alt				
Trinexapac-ethyl	WR	Calma	4.5.		

Grün: Nachweis applizierter Stoffe

Orange: Nachweise für nicht applizierte Stoffe (1km-R.)

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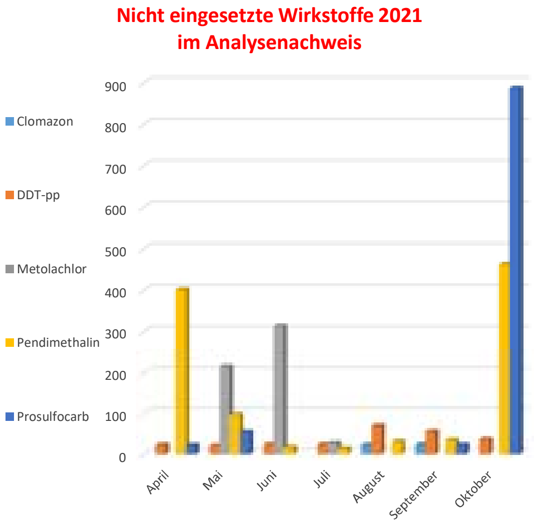
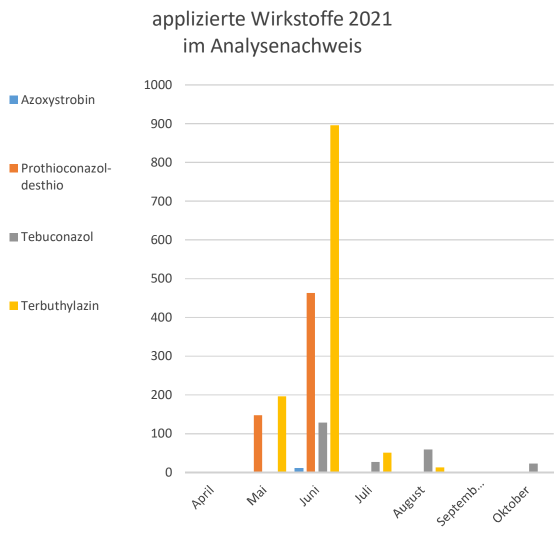
Durchführung PSM-Monitoring 2021/2022

Funde applizierter und nicht eingesetzter Wirkstoffe,
BAR April-Oktober

LAND BRANDENBURG

LfU Landesamt für Umwelt





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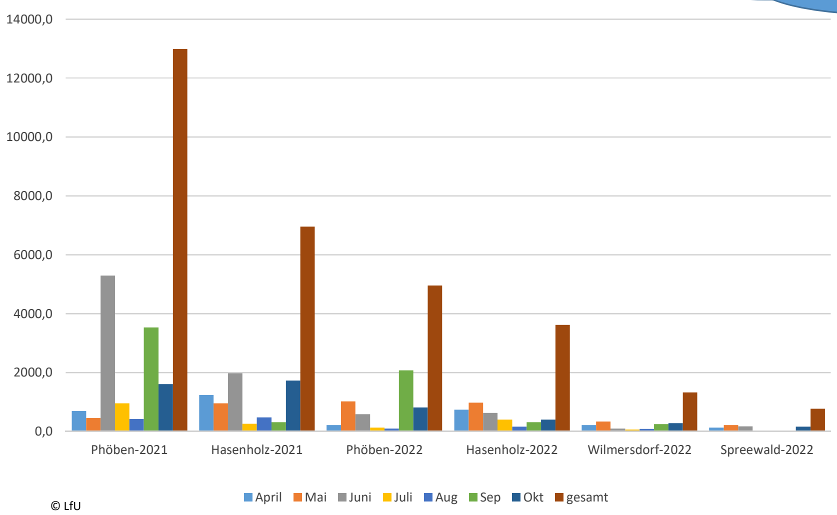
Durchführung PSM-Monitoring 2021/2022

Untersuchungsstandorte im Vergleich

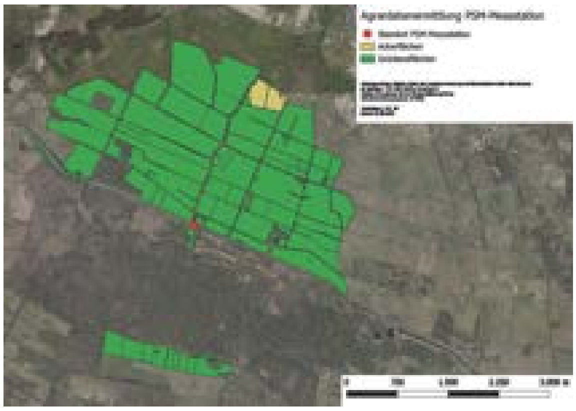
Landesamt für Umwelt

Passivsammlerstandorte 2021-2022
Wirkstoffe ng/Probe

Abstand halten....



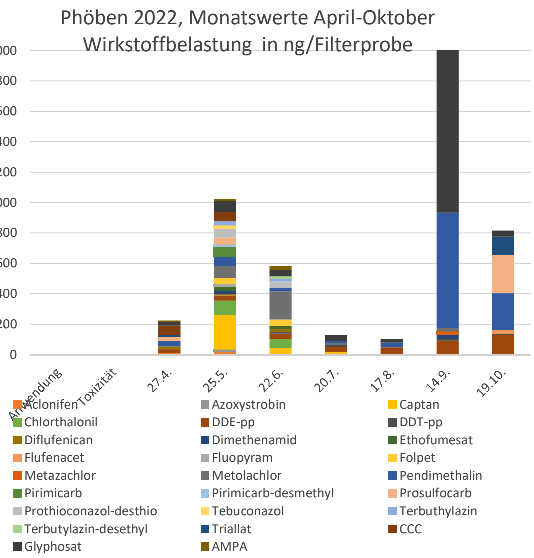
Standort Neuzauche/BR Spreewald, 2 km-Radius

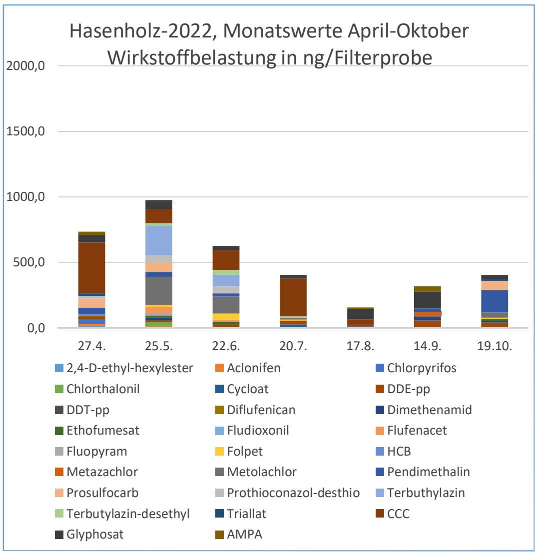


Erfassung BR Spreewald, 2 km-Radius
Rudolf Vögel, T 1.4

Durchführung PSM-Monitoring 2021/2022

Landesamt für Umwelt





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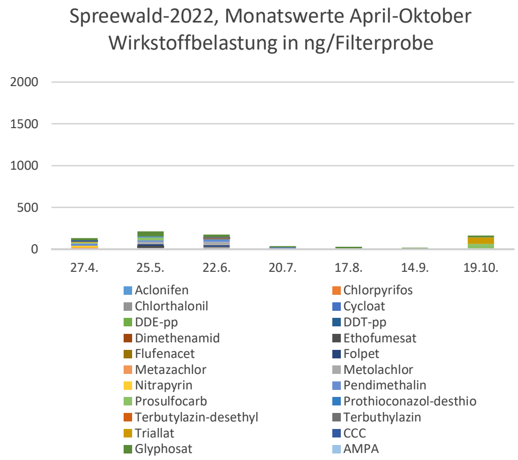
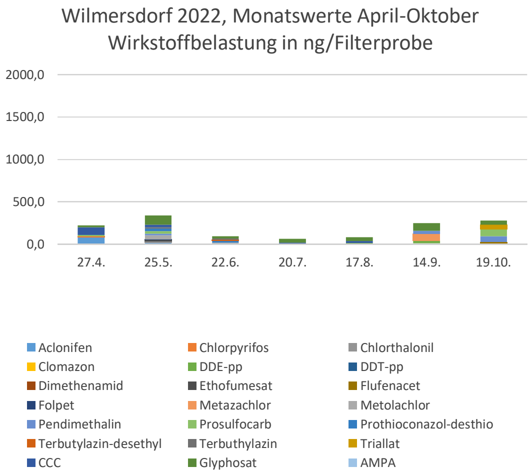
Durchführung PSM-Monitoring 2021/2022





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Durchführung PSM-Monitoring 2021/2022
Ergebnisse und Hinweise:

Problemwirkstoffe zeichnen meist durch hohen Dampfdruck aus (Angaben in hPa, Zulassungsdatenblatt)

Persistenz und Verbreitung sind abhängig von unzureichendem chemischen Abbau

Abbau und Abbinden von PSM wird begünstigt durch Luftfeuchte bei moderaten Temperaturen, ggf. durch Sonneneinstrahlung

Rudolf Vögel, T 1.4

Durchführung PSM-Monitoring 2021
Erste Ergebnisse und Hinweise:

LAND BRANDENBURG
LfU Landesamt für Umwelt

Verbleib und Verbreitung verstärkt sich durch hohe Wirkstoffkonzentrationen, Wind, Thermik, Bodentrockenheit

Besondere Probleme bestehen oft bei Sonderkulturen mit affiner Oberflächenstruktur (Fängereffekte)

Probleme ergeben sich auch durch Ernte- , Bestellarbeiten mit hoher Staubentwicklung bei Trockenheit

Verbreitungseffekte werden durch Windeinwirkung verstärkt

Rudolf Vögel, T 1.4

Durchführung PSM-Monitoring 2021/2022
Alternativen und Reaktionsmöglichkeiten

LAND BRANDENBURG
LfU Landesamt für Umwelt

Ausbringzeiten an Witterung orientieren: Kühl, feucht, windstill, nachts oder frühmorgens….

Bei Bodenherbiziden auf vorhandene Bodenfeuchte achten

Möglichkeiten mit Ausbringdüsen, Druck, Verdünnung

Beratungshinweise des staatlichen Pflanzenschutzdienstes (PSD)

Hinweise an Hersteller: bessere Formulierungen, Zulassungshinweise

Kombipräparate?

Verzicht auf … durch weitere Fruchtfolge, tolerante Sorten…..

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Durchführung PSM-Monitoring 2021/2022

LAND BRANDENBURG

Ministerium für Ländliche Entwicklung, Umwelt und Landwirtschaft

LfU Landesamt für Umwelt

Pflanzenschutzpräparate als Medikament anwenden,

nicht als billiges Produktionsmittel verwenden….

Herzlichen Dank für díe Aufmerksamkeit

Rudolf Vögel, T 1.4

Monitoring results from Europe
Long range atmospheric transport of currently used pesticides over Europe

Ludovic Mayer
RECETOX

Title: Long-range atmospheric transport of currently-used pesticides over Europe

Ludovic Mayer

RECETOX, Faculty of Science, Masaryk University, Brno, Czech Republic

Currently-used pesticides are semi-volatile organic compounds widely used in agriculture. Upon their emissions into the air, pesticides are influenced by several processes affecting their atmospheric fate. Pesticides in air partition between the gaseous and particulate phases depending on their physico-chemical properties, meteorological conditions, and aerosol surface and composition. This partitioning affects the elimination of pesticides from the air through degradation and deposition processes. Each of these processes will affect the atmospheric residence time of pesticides and therefore their potential to be transported over long distances, even to remote areas where these substances have never been used. For many years, it has been largely considered that currently-used pesticides were not prone to long-range atmospheric transport (LRAT) due to their short atmospheric half-lives (i.e., < 2 days). However, in recent years, it has been shown that more than 20 currently-used pesticides have reached the Arctic via air. Therefore, current knowledge on pesticides LRAT seems to be flawed and calls for additional scientific evidence.

The aims of this study are (i) to identify pesticides prone to long-range atmospheric transport and (ii) to characterize the pesticide distribution at the continental European scale.

Pesticides were simultaneously sampled at 16 rural, 4 coastal, 6 high mountain and 3 polar sites in 17 European countries and the European Arctic in spring 2020 (28/04- 28/05). All 29 sites sampled the particulate phase using glass fibre filters and six sites additionally sampled the gaseous phase using a combination of polyurethane foam and XAD2 resin. 77 samples were extracted with 5 mM of ammonium acetate in methanol using a warm Soxhlet extraction. Samples were then cleaned-up and analysed by four chromatographic methods coupled to mass spectrometry (LC- and GC-MS/MS). A total of 76 pesticides were quantified in these samples, including 35 herbicides, 22 insecticides and 19 fungicides.

At polar and high mountains sites, 22 pesticides were identified as prone to LRAT. 19 pesticides were observed at polar sites, including 15 never reported previously, and 14 pesticides were observed in the free tropospheric air samples collected at mountain sites, including 11 also found at the polar sites. Moreover, out of the 22 pesticides identified as prone to LRAT, 15 were approved for agricultural use and 7 were banned in the European Union.

Altogether throughout this sampling campaign, out of the 76 targeted pesticides, 58 were detected at least one site. In the particulate phase, the number of particulate pesticides detected, and their concentrations decreases with the latitude and increases with proximity to agricultural fields. Additionally, the variation across sites ranged widely, indicated by relative standard deviations of 105-623% for the 11 pesticides with a quantification frequency over 50%. The most homogeneous distributions suggest widespread, continental-scale distribution or particularly long atmospheric lifetimes.

According to the current European risk assessment method, all the pesticides identified as prone to LRAT in this study had a theoretical half-life below the 2 days threshold used to assess their atmospheric persistence and potential for LRAT. Our results call for a revision of the risk assessment methods employed during pesticide registration.

Long-range atmospheric transport of currently-used pesticides over Europe

Ludovic Mayer[a], Petr Šenk , Petr Kukučka, Petra Přibylová, Amandine Durand, Sylvain Ravier, Andres Alastuey, Pernilla Bohlin-Nizetto, Darius Ceburnis, Sébastien Conil, Anna Degórska, Konstantinos Eleftheriadis, Grant Forster, Korbinian Freier, François Gheusi, Adéla Holubová Šmejkalová, Urmas Hõrrak, Christoph Hueglin, Heikki Junninen, Adam Kristensson, Olav Lien, Reidar Lyngra, Ulla Makkonen, Nikos Mihalopoulos, Veronika Mináriková, Wolgang Moche, Tuukka Petäjä, Véronique Pont, Laurent Poulain, Etienne Quivet, Stefan Reimann, Ivan Simmons, Ronald Spoor, Kjetil Tørseth, Henri Wortham, Margarita Yela, Claudia Zellweger, Paolo Laj, Jana Klánová, Gerhard Lammel and Céline Degrendele

[a] *RECETOX, Faculty of Sciences, Masaryk University, Czech Republic*

1

31.05.2023

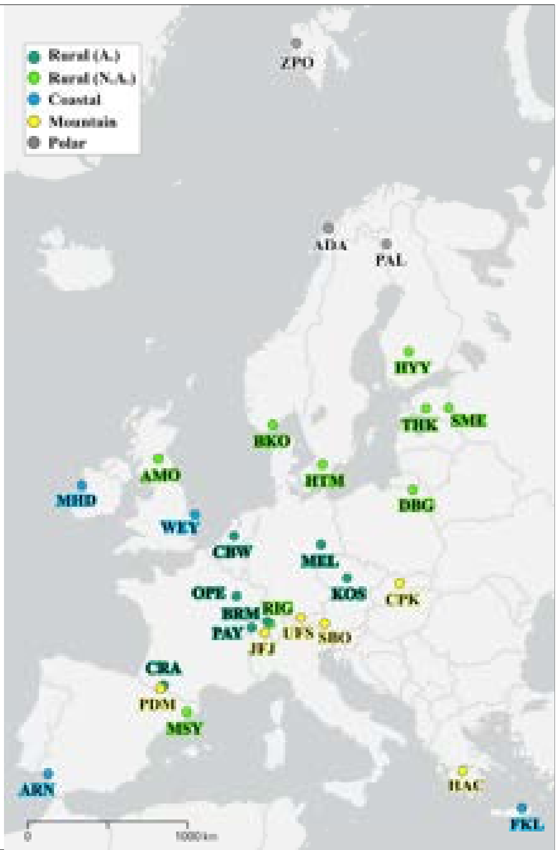
Pan-European Study of Pesticides long-range Atmospheric Transport (PESPAT)

- Air sampling campaign
  - **Active air samplers**
- Spring 2020
  - **Simultaneously**
- 29 sampling sites in 17 EU countries
  - **30+ partner institutions**

Aims:

- Investigate occurrence and spatial variations of pesticides profiles in Europe
- **Identify pesticides prone to long-range atmospheric transport**

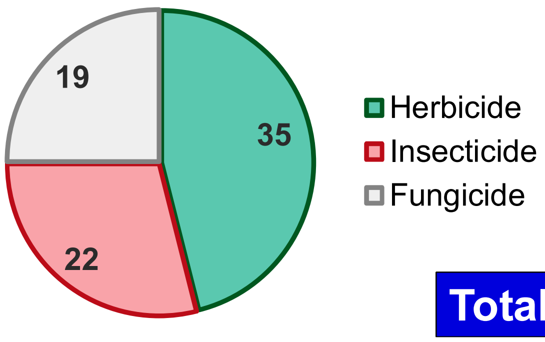
2



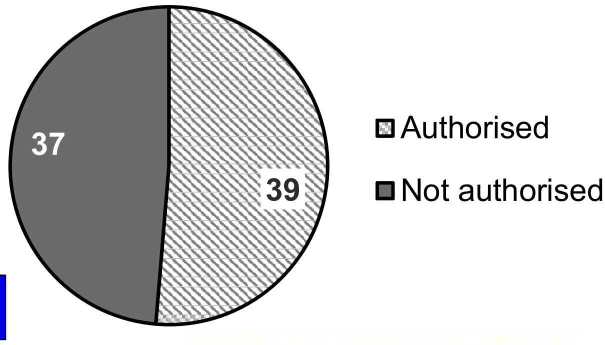
Analysed currently-used pesticides

Chosen according to:

- Previous research and monitoring studies
- Potential harmful effect to environmental and human health
- National usage of individual substances



Total: 76 CUPs



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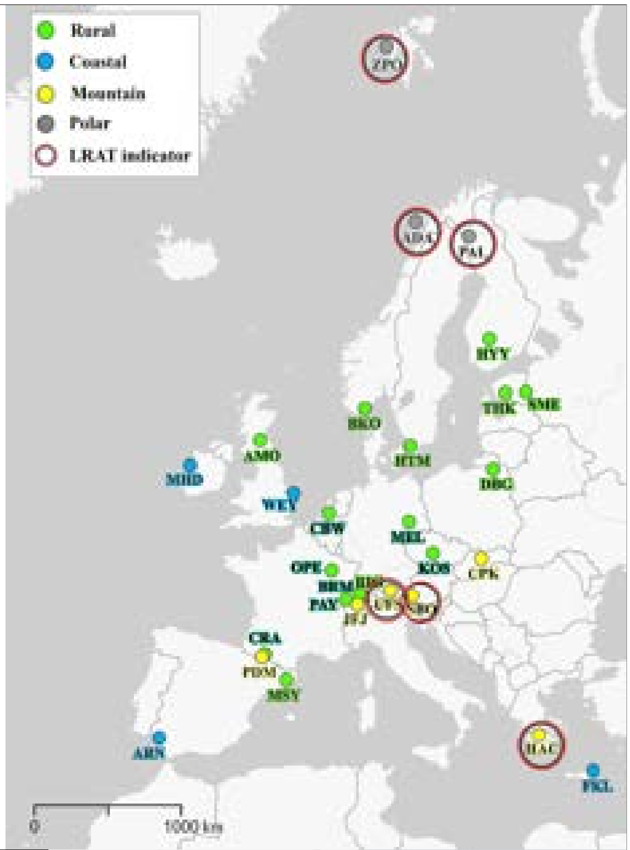
Pesticides prone to LRAT

- **Rural sites?** ✗
  - → Primary sources of pesticides
- **Coastal sites?** ✗
  - → Air masses continentally influenced
- **Polar sites?** ✓
  - → Remote from application area
- **Mountain sites?** ✓
  - → Free tropospheric air sampled



4

Pesticides prone to LRAT

22 pesticides identified as prone to LRAT: 15 approved for use by EU

5

Summary & Conclusion

- Snapshot of pesticides present in European atmosphere
- **New evidence: presence of pesticides in remote locations**
- **Showcasing the LRAT potential for 22 pesticides (≈70% authorized in EU)**

- Reg. (EC) 1107/2009: concerning the placing of PPP on the market
  - Current risk assessment methods: regarding **atmos. deg. & LRAT potential: Insufficient**

- **To ensure that authorized pesticides do not contaminate the environment:**
  - Continue providing empirical evidence in direct contrast to current model predictions
  - Generate more experimental data on atmospheric degradability of pesticides
  - While including pesticides formulations and metabolites

6

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Thank you for your attention!

PESPAT partners:

7

Monitoring results from Italy
Monitoring of Pesticide Drift Residues in “Sensitive Zones” in South Tyrol (Italy)

Caroline Linhart
Environmental Science & Research Consulting

Monitoring of Pesticide Drift Residues in "Sensitive Zones" in South Tyrol (Italy)

C. Linhart
Environmental Science and Research Consulting, GmbH

Pesticide levels are monitored in agricultural areas, but rarely in public places. To assess contamination of non-target areas, grass samples were collected from 71 playgrounds1 adjacent to apple and wine orchards in four valleys of South Tyrol (Italy) in spring 2017. The impact of environmental factors on the number and concentration of pesticide residues was assessed. Grass samples from the selected public sites were collected and analyzed for 315 pesticide residues using standard GC/MS analysis. Following the publication of the results of this collaboration between academic institutions and several European NGOs, the government of South Tyrol decided to focus on the improvement and implementation of mitigation measures and started an official monitoring of "sensitive zones". Starting in 2018, less than half of the previously sampled playgrounds and public places will be selected for year-round sampling and pesticide screening2. In 2021, monitoring data from 2014, 2016, 2017, 2018/19 and 2020 were available for further analysis. The 2018 and 2021 data were kindly provided by the Department of Environmental Medicine of the South Tyrolean Health Service, which also published the complete monitoring results for the years 2018-2021.

In spring 2017, almost half of the public playgrounds (45%) were contaminated with at least one pesticide and a quarter with more than one1. In 2018, 96% of sensitive sites were contaminated with at least one pesticide, and 79% had multiple contaminants2. Pesticides were predominantly endocrine disruptors (>80%). The insecticide phosmet and the fungicide fluazinam showed the highest concentrations in 2017 (0.26 mgkg-1), and the insecticide chlorpyrifos-methyl and the herbicide oxadiazon in 2018 (0.71-0.64 mgkg-1). Pesticide residues were positively associated with apple orchard area, rainfall, and wind, while irradiance, distance to agricultural land, and higher wind speed decreased contamination. Residues were detected at distances ranging from five to 600 meters from agricultural fields. As expected, the highest number of different pesticides and concentrations were found in the spring, but pesticide residues were detected throughout the year. Despite a slight decrease in pesticide residues over the study period (2014-2020), residues of at least one pesticide were detected in 73% of the sampled sites, and multiple residues were found in 27% of the sites.

Fluazinam, a fungicide suspected of harming the unborn child and linked to cancer in animal studies, was found in 74% of contaminated sites. Other harmful pesticides such as the fungicide captan (60%) and the insecticide phosmet (49%) were also frequently detected. The percentage of residues with the potential to cause harm to human reproduction increased significantly, from 21% in 2014 to 88% in 2020. The percentage of residues with the potential to cause damage to certain organs also increased from 0% in 2014 to 21% in 2020. The percentage of substances with the potential to cause endocrine disruption (89%) or cancer (45%) in humans remained constant over the study period. If these levels of pesticide residues were found in locally grown food, they would be several orders of magnitude higher than those considered safe for consumption in the EU. The percentage of pesticide residues found to be acutely toxic to honeybees remained high.

This study is one of the first to look at pesticide contamination in public areas, along with environmental factors in areas of pesticide-intensive agriculture. We recommend a minimum distance of 100 m between "sensitive areas" and agricultural sites, or at least other mitigation measures such as natural corridors and buffer zones. In addition, independent assessments are needed and should include monitoring of public sites. Monitoring should be consistent, considering the timing of spring sampling, appropriate sample size analysis, and selection of sample matrices. Grass samples reflect the drift situation and provide a surrogate matrix for foods such as lettuce, thus allowing comparison with MRLs. However, the combination of environmental samples (grass, water, soil) and biosamples (human hair, bioindicators) is strongly recommended, as well as the cooperation of different stakeholders (government, academia, agribusiness, and NGOs).

Publications:

Linhart, C., Niedrist, G. H., Nagler, M., Nagrani, R., Temml, V., Bardelli, T., et al. (2019). Pesticide contamination and associated risk factors at public playgrounds near intensively managed apple and wine orchards. *Environmental Sciences Europe* 31, 28. doi: 10.1186/s12302-019-0206-0.

Linhart, C., Panzacchi, S., Belpoggi, F., Clausing, P., Zaller, J. G., and Hertoge, K. (2021). Year-round pesticide contamination of public sites near intensively managed agricultural areas in South Tyrol. *Environmental Sciences Europe* 33, 1. doi: 10.1186/s12302-020-00446-y.

Cech, R., Zaller, J. G., Lyssimachou, A., Clausing, P., Hertoge, K., and Linhart, C. (2022). Pesticide drift mitigation measures appear to reduce contamination of non-agricultural areas, but hazards to humans and the environment remain. *Sci Total Environ*, 158814. doi: 10.1016/j.scitotenv.2022.158814.

Prechsl, U. E., Bonadio, M., Wegher, L., and Oberhuber, M. (2022). Long-term monitoring of pesticide residues on public sites: A regional approach to survey and reduce spray drift. *Frontiers in Environmental Science* 10. Available at: https://www.frontiersin.org/articles/10.3389/fenvs.2022.1062333 [Accessed May 20, 2023].

Monitoring of Pesticide Drift Residues in “Sensitive Zones” in South Tyrol (Italy)

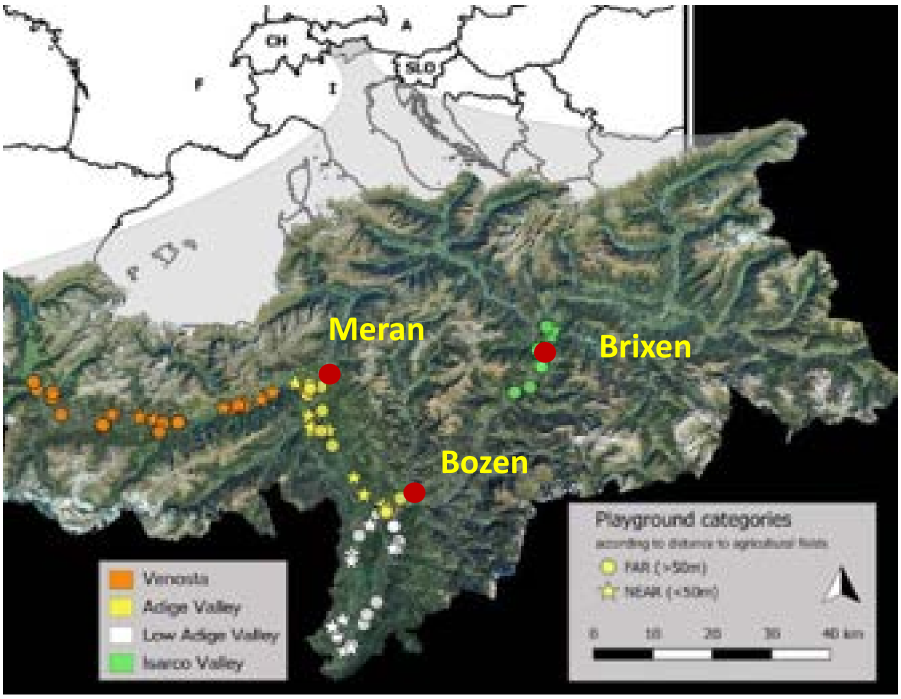
Caroline Linhart, PhD

Environmental Science and Research Consulting, GmbH

Linhart@environmental-science.ch

Linhart@research-consulting.org

Study area (2014-2021)



South Tyrol’s agriculture

- apple orchards & vineyards
- 40 kg ha^{-1} per year

Monitoring

- “sensitive” places
- grass samples
- UNI EN 15662
- GC/MS & LC-MC/MS
- < **315** substances

South Tyrol Pesticide Drift Monitoring

"Playground Study"

Linhart *et al. Environ Sci Eur* (2019) 31:28
https://doi.org/10.1186/s12302-019-0206-0
Environmental Sciences Europe
RESEARCH Open Access

Pesticide contamination and associated risk factors at public playgrounds near intensively managed apple and wine orchards

Caroline Linhart[1*], Georg H. Niedrist[2], Magdalena Nagler[3], Rajini Nagrani[4,5], Veronika Temml[1], Tommaso Bardelli[3,6], Thomas Wilhalm[7], Andreas Riedl[7], Johann G. Zaller[8], Peter Clausing[9] and Koen Hertoge[10*]

Linhart *et al. Environ Sci Eur* (2021) 33:1
https://doi.org/10.1186/s12302-020-00446-y
Environmental Sciences Europe
RESEARCH Open Access

Year-round pesticide contamination of public sites near intensively managed agricultural areas in South Tyrol

Caroline Linhart[1*], Simona Panzacchi[2], Fiorella Belpoggi[2], Peter Clausing[3], Johann G. Zaller[4*] and Koen Hertoge[1]

- **Comprehensive study design, sample size analysis**
- **Number and concentration of detected pesticides** per playground, valley, season, distance category, year
- Overview on chemical & toxic **substance characteristics**

Monitoring & Methods **Results** Discussion Summary Outlook

Linhart *et al. Environ Sci Eur* (2019) 31:28
Environmental Sciences Europe
RESEARCH Open Access

Pesticide contamination and associated risk factors at public playgrounds near intensively managed apple and wine orchards

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- **Is drift a real problem?** Distance to agricultural field:
  close (≤ 50 m) versus **away (≥ 50 m)**
- **Factors of pesticide contamination and drift -> Drift model**

Linhart *et al. Environ Sci Eur* (2019) 31:28 Environmental Sciences Europe

1 Pesticide contamination and associated risk factors

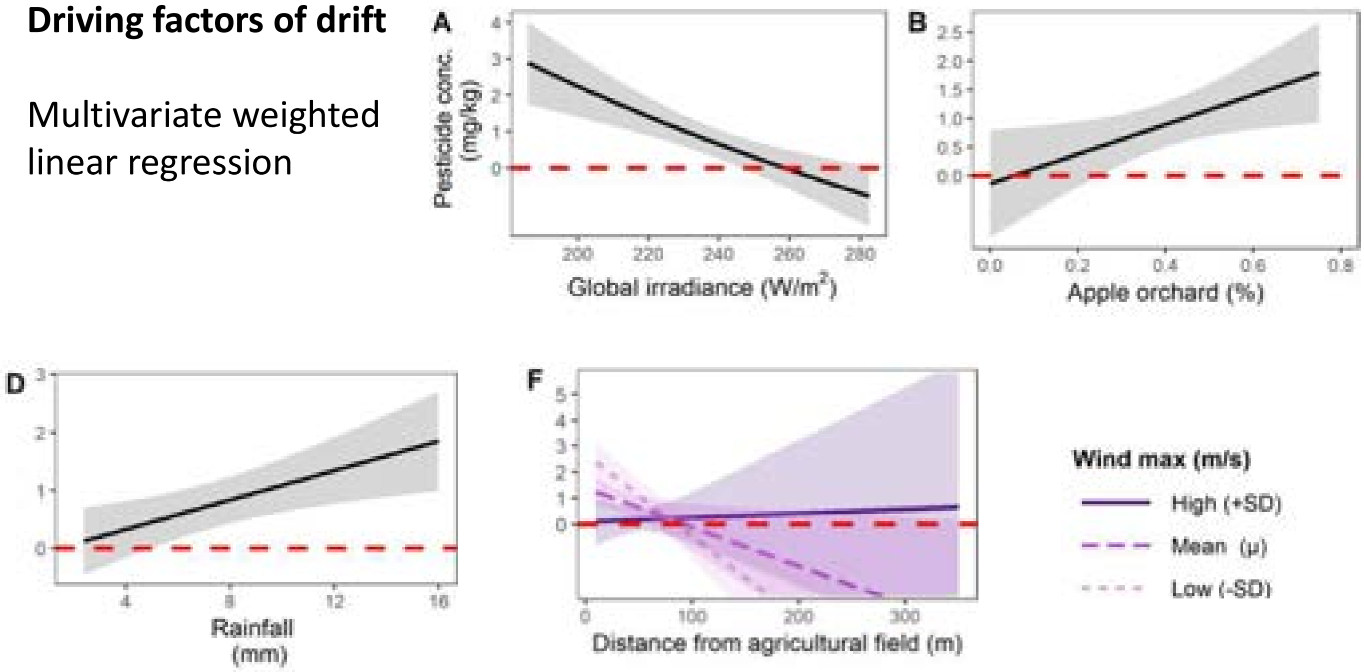
- **45% of places with residues**
- **24% places with more than one residue**
- **14 substances**
- **11 endocrine active (92%)**

More than 3 times higher pesticide concentrations on places close to agricultural sites.

Linhart *et al. Environ Sci Eur* (2019) 31:28 Environmental Sciences Europe

Driving factors of drift

Multivariate weighted linear regression



Linhart *et al. Environ Sci Eur* (2021) 33:1
https://doi.org/10.1186/s12302-020-00446-y

Environmental Sciences Europe

RESEARCH Open Access

Year-round pesticide contamination of public sites near intensively managed agricultural areas in South Tyrol

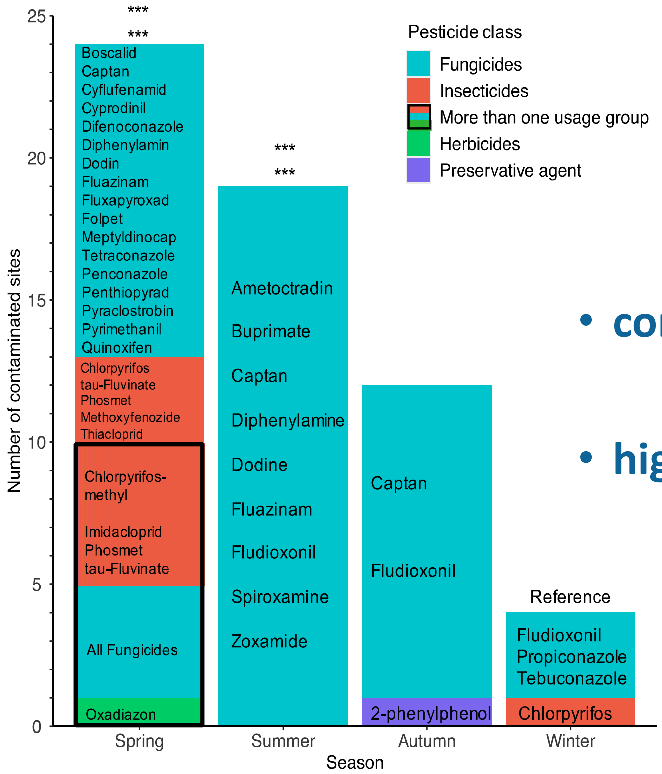
Caroline Linhart[1*], Simona Panzacchi[2], Fiorella Belpoggi[2], Peter Clausing[3], Johann G. Zaller[4*] and Koen Hertoge[1]

- **96% of places with residues**
- **79% places with more than one residue**
- **33 substances - 25 endocrine active (76%)**

> 3 times higher pesticide concentrations on places close to agricultural sites.

Linhart *et al. Environ Sci Eur* (2021) 33:1 Environmental Sciences Europe

2 Year – round pesticide contamination



- **contamination year round**
- **highest in Spring**

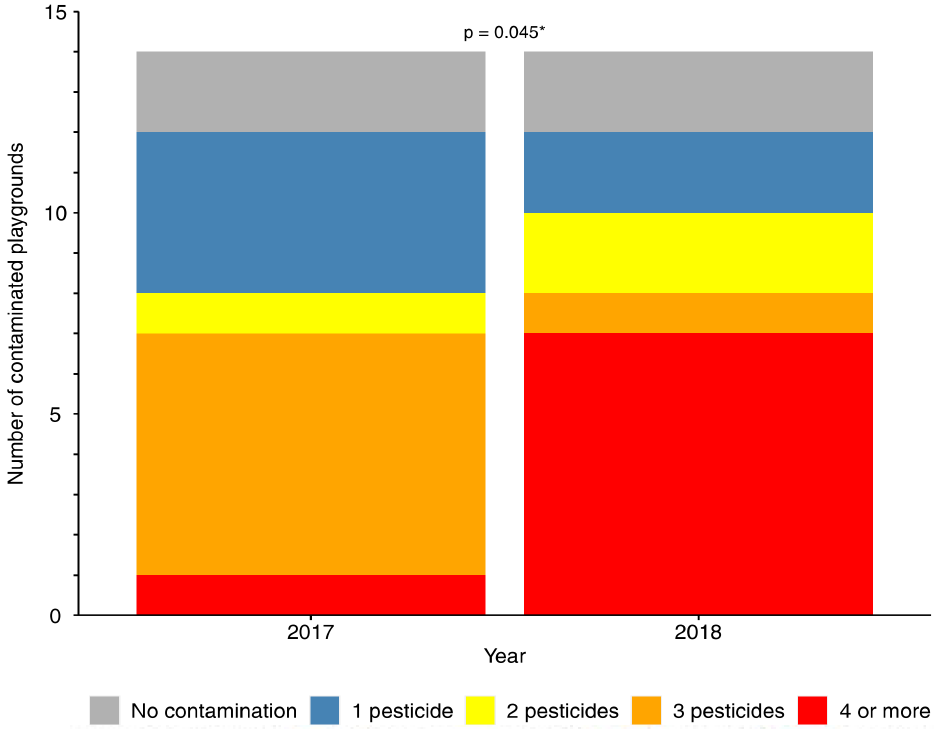
Linhart et al. Environ Sci Eur (2021) 33:1 Environmental Sciences Europe

2 Year – round pesticide contamination

Multiple residues

- **up to 19 places with multiple residues**
- **up to 11 residues on one site**

→ **cocktail effects?!**

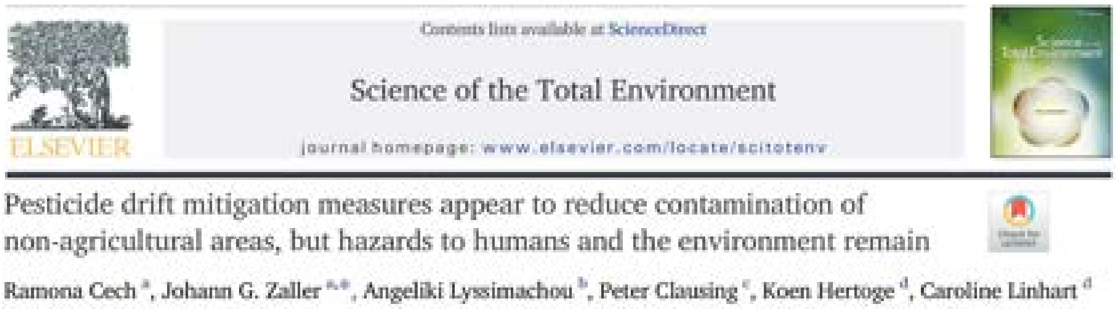


Linhart et al. Environ Sci Eur (2021) 33:1 Environmental Sciences Europe

2 Year – round pesticide contamination

MRL exceedance by 10-fold in average

Pesticide	Current MR (grass)	MRL according to EU database [30]			Relationship to lowest surrogate MRL
		Lettuce	Spinach	Strawberry	
Chlorpyrifos	*0.71*	0.30	0.01	0.01	71-fold over
Fluazinam	*0.24*	0.05	0.01	0.01	24-fold over
Dodine	*0.23*	0.01	0.01	0.01	23-fold over
Captan	*0.46*	0.03	0.03	5.00	15-fold over
Oxadiazon	*0.64*	0.05	0.05	0.05	13-fold over
Chlorpyrifos-methyl	*0.06*	0.06	0.01	0.01	Sixfold over
Folpet	*0.15*	0.03	0.03	1.50	Fivefold over
Penconazole	*0.04*	0.01	0.01	0.50	Fourfold over
Meptyldinocap	*0.15*	0.05	0.05	3.00	Threefold over


Science of the Total Environment 854 (2023) 158814

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

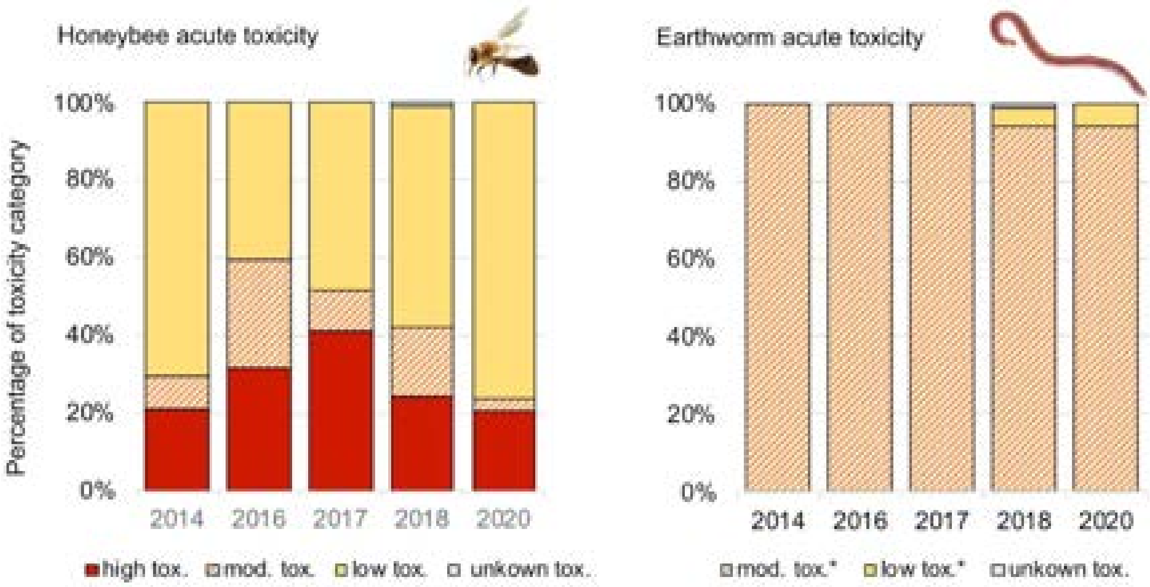
Pesticide drift mitigation measures appear to reduce contamination of non-agricultural areas, but hazards to humans and the environment remain

Ramona Cech [a], Johann G. Zaller [a,*], Angeliki Lyssimachou [b], Peter Clausing [c], Koen Hertoge [d], Caroline Linhart [d]

- **Decrease in contamination by drift:**
  - Number of pesticides
  - Number of multiple contaminated sites
- **Sites with MRL exceedance remained constant**
- **Substances with endocrine active and carcinogenic properties remained constant**
- **Residues with human hazard properties increased**
  - Reproductive toxicity
  - Organ toxicity

Science of the Total Environment 854 (2023) 158814

3 Hazards to Humans and the Environment



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Check for updates
OPEN ACCESS
EDITED BY
Liang Zhang,
Innovation Academy for Precision Measurement Science and Technology (CAS), China

Long-term monitoring of pesticide residues on public sites: A regional approach to survey and reduce spray drift

Government agencies and agricultural research center

Start of monitoring **after** Linhart et al. (2019)

24 to 38 sites, sampled **4** times per year

Data sharing

Missing information on spraying mitigation measures: where (sites) & when?

Only one place with complete sampling of 4 seasons & 4 years

Factor season is missing (spring !)

Focus on samples, not on places

N of 24 places is low

Very "slow" data release

Prechsl, U. E., Bonadio, M., Wegher, L., and Oberhuber, M. (2022). Long-term monitoring of pesticide residues on public sites: A regional approach to survey and reduce spray drift. *Frontiers in Environmental Science* 10.

Summary of Monitoring Results

45 - 96% of sensitive zones were contaminated (2016-2020)

Concentrations ranged from: 0.01-2 mg/kg

Exceedance of MRL's since 2016 in 40% of samples

Phosmet, Fluazinam, Captan

Recommendations

Application

100 m distance to public places

spraying events during:

- **longer period of sunshine**
- **low wind conditions**
- **without rainfall**

local wind conditions

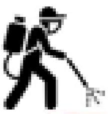
Monitoring

other sample matrices

Glyphosate + Glufosinate + AMPA

cooperation of stakeholders !

QUESTIONS & PROBLEMS



- Cumulative exposure unknown
- Drift – exposure contribution?

How to measure low-dose, diffuse pesticide exposure from multiple agricultural sources?

Thank you for your attention

Pesticide Action Network Europe

PESTICIDE ACTION NETWORK UK

HEAL HEALTH AND ENVIRONMENT ALLIANCE

Dachverband für Natur- und Umweltschutz in Südtirol

UMWELTSCHUTZ GRUPPE VINSCHGAU

DER MALSER WEG · LA VIA DA DAVAL · LA VIA DI MALLES

Gruppo Verde in Consiglio Provinciale Grüne Fraktion im Landtag

Environmental Science & Research Consulting

Istituto Ramazzini COOPERATIVA SOCIALE ONLUS

BOKU University of Natural Resources and Life Sciences, Vienna

universität innsbruck

MEDIZINISCHE UNIVERSITÄT INNSBRUCK

MEDIZINISCHE STATISTIK INFORMATIK GESUNDHEITSÖKONOMIE

Monitoring results from European Union
INSIGNIA-EU pesticide monitoring with honey bee colonies

Sjef van der Steen
INSIGNIA-EU

INSIGNIA-EU: A pan-European beekeeper citizen science pollution monitoring study 2022-2023

Van der Steen[1], F. Vejsnæs[2], Ole Kilpinen[2], F. Hatjina[3], R. Brodschneider[4], K. Gratzer[4], A.R. Fernández-Alba[5], M. Murcia-Morales[5], K.M. Kasiotis[6], I. Roessink[7], B. Buddendorf[7], Hans Baveco[7], Alison Gray[8], N. L. Carreck[9], V. Brusbardis[10], E. Danneels[11], Marco Pietropaoli[12], Alice Pinto[13], Andrea Quersma[13]

1. Alveus AB Consultancy Netherlands, 2. DBF Denmark, 3. ELGO Dimitra Greece, 4. University of Graz, Austria, 5. University of Almeria Spain, 6. Benaki Phytopathological Institute Greece, 7. Wageningen UR Netherlands, 8. Strathclyde University UK, 9. Carreck Consultancy UK, 10. Latvian beekeepers Association, 11. University Ghent, 12. IZSLT, 13. Institute Politecnico de Braganca

Corresponding representative of INSIGNIA -EU J. van der Steen. coordination@insignia-bee.com

The INSIGNIA-EU study is a pan-European beekeeper citizen science study, initiated by the European Parliament, to 1) monitor the environment for pesticides, microplastics, heavy metals, polycyclic aromatic hydrocarbons (PAHs), and volatile organic chemicals (VOCs); 2) describe the diversity of pollen available to honey bees and 3) predict the spatial and temporal exposure of honey bee colonies to contaminants and the spatial and temporal pollen availability for honey bee colonies by modelling. For the study in the 27 EU countries, apiary locations were selected based on land use and diversity of land use within the foraging area of the apiary. In total, 315 apiaries were selected. Each INSIGNIA-EU apiary is managed by citizen scientist beekeepers and houses 2 study colonies, which are being sampled bi-weekly from May until August 2023. The rationale to use honey bee colonies as a "tool" to monitor the environment is twofold. Firstly, airborne pollution is deposited on flowers where it is picked up by foraging honey bees, and all contaminants are brought into the hive. The majority of the individual foragers bring home immeasurably small amounts of contaminants, but the many thousands of foragers per colony accumulate the contaminants to measurable levels. The challenge in the INSIGNIA-EU study is to collect the pollutant information from the colony non-invasively. Therefore, we developed in-hive sampling tools: the APIStrip for the detection of non-polar pesticides, the APITrap for microplastics, and silicone wristbands for PAHs and VOCs. We also sample propolis for detection of heavy metals and honey for polar pesticides. Secondly, the physico-chemical conditions in the brood nest of the colony are very constant, from the north of Sweden to the south of Greece and from the west of Ireland to the east of Bulgaria, regardless of the climatic conditions. This consistency in brood nest conditions results in comparable data. Here we present the pesticide results of the preliminary 2022 study, conducted in Austria, Denmark and Greece of 16 freshly collected honey samples (1 sample per apiary), and 120 APIStrips sampled biweekly in June and July. The LOQ applied was 0.5 ppb. Pesticides < LOQ and > LOD are also included in this overview. All data are qualitative data, showing the presence of pollutants in the colony's environment. In honey, the herbicides glyphosate, AMPA, and chlormequat were detected and also the insecticide λ-cyhalotrin, the fungicide hexachlorobenzene, and the varroacides (residues) DMF (metabolite of amitraz) and tau-fluvalinate. Analyses of the APIStrips revealed a median of 7 pesticides per strip, ranging from 0 to 18. The differences between countries, apiaries, and timing of sampling were significant. However, there were no apiaries found to be completely free of the

investigated compounds. Of the 66 pesticides detected, 29% were fungicides, 17%, 11% and 2% were insecticides, herbicides, and acaricides respectively. 29% were EU-non-approved pesticides, 4% were EU-non-approved pesticides with a period of grace and 8% were varroacides. Some pesticides can be traced back to wax contamination due to varroa control. Although non-approved applications cannot be ruled out, detecting pesticides in environments where they have never been applied or have not been applied for several decades, are the result of airborne dissemination directly from spraying elsewhere, and indirectly from soil erosion.

Funded by the European Union

INSIGNIA-EU

INSIGNIA-EU
pesticide monitoring with honey bee colonies

The INSIGNIA-EU consortium
Represented by
J. van der Steen (coordinator INSIGNIA-EU)

European symposium on atmospheric transport of pesticides
Brandenburg Akademie
31 May – 1 June

Funded by the European Union

INSIGNIA-EU

Objective and Rationale

1. *A pan-European network of beekeepers citizen scientist to monitor the environment with honey bee colonies for*
   - *Pesticides, (insecticides, fungicides, biocides, acaricides, herbicides, PGR, veterinary products)*
   - *Microplastics,*
   - *Heavy metals,*
   - *PAHs and VOCs (air pollutants).*

3. *To describe the pollen diversity available for honey bees*

4. *Modelling to predict spatial and temporal exposure of honey bee colonies to pollutants and spatial and temporal availability of pollen*

Funded by the European Union

INSIGNIA-EU

Beekeepers citizen scientist network

Number of INSIGNIA apiaries.	
Country	Number of Apiaries
Austria	10
Belgium	10
Bulgaria	10
Croatia	10
Cyprus	5
Czech republic	10
Denmark	10
Estonia	10
Finland	10
France	20
Germany	20
Greece	15
Hungary	15
Ireland	10
Italy	15
Latvia	10
Lithuania	10
Luxembourg	5
Malta	5
Netherlands	10
Poland	20
Portugal	10
Romania	15
Slovakia	10
Slovenia	10
Spain	20
Sweden	10

Beekeeper citizen scientist

Foto Jelle Kampen

Location apiary selection based on

- land-use
- Land-use diversity

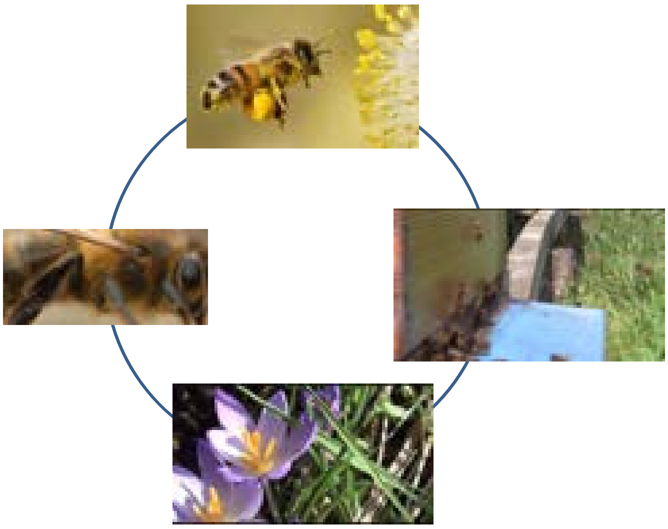
Per apiary: 2 INSIGNIA colonies

Nine (9) bi-weekly sampling from May – August 2023

Funded by the European Union

INSIGNIA-EU

Rationale to apply the honey bee colony as bio-monitoring tool: The honey bee colony reflects the environment



Funded by the European Union

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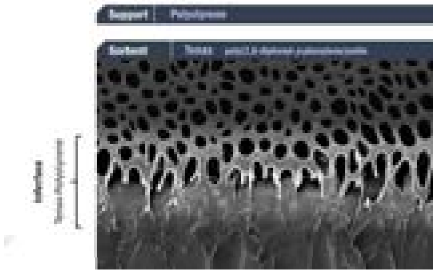
In-hive processes and tools to draw the pollutant information from the colony

Non invasively drawing information from the colony (in-hive passive samplers)

Best matrix-compound combination based on best science + best CS practice

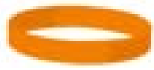
Pesticides (non-polar) - APIStrips (Tenax)



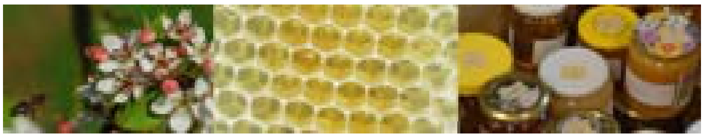
Maria Murcia

Microplastic: APITrap

PAH and VOC: PDMS



Pesticides - honey (polar)



Heavy metals: propolis

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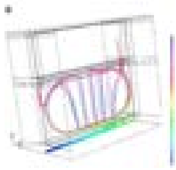
INSIGNIA-EU

In-hive processes and tools to draw the pollutant information from the colony

In-hive processes

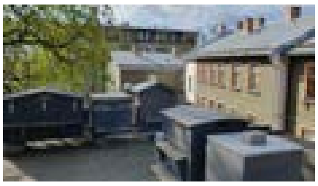
- Auto- and allogrooming
- Physical contact
- Honey processing
- Trophallaxis
- Air flow

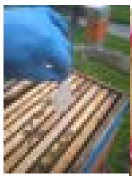


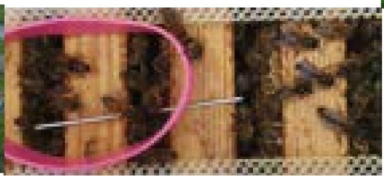
Physiolgia Comparata et Oecologia (Volume 3, 30 April 1954, Pages 343-364) Ventilation in a bee-hive during summer. Engel Henddrick Hazelhoff The airflow current at the exit was measured to be in average 0.1 L/s

Constant in-broodnest physical chemical kinetic conditions of T and RH

Applies for every *Apis mellifera* colony







Temperature. equation of Arrhenius:

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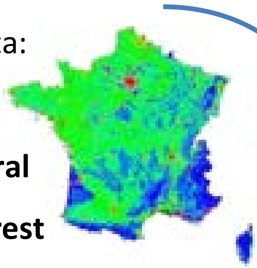
Apiary location selection

- Based on 2018 CORINE LULC data:
- Red: predominantly **artificial**
- Green: predominantly **agricultural**
- Blue: predominantly **natural/forest**



- NOT biodiversity, but **land-use diversity**
- Orange: **Low** diversity
- Yellow: **medium** diversity
- Green: **high** diversity

- 20 apiaries in total in France
- So ideally 2 in each group, and two additional locations

	Agricultural	Artificial	Forest/Natural
High	3	3	2
Low	2	2	2
Medium	2	2	2

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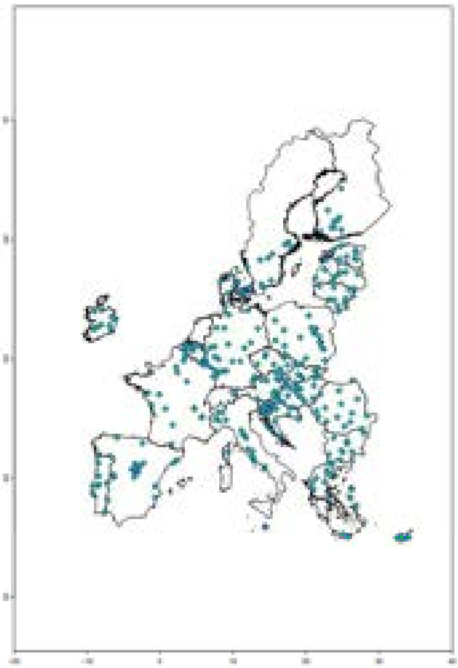
Preliminary citizen scientist locations planned for the 2023 sampling



	Agricultural	Artificial	Forest/Natural	
High	67	43	37	147 (49%)
Low	40	**7**	**10**	**57 (19%)**
Medium	55	**12**	29	96 (32%)
	162 (54%)	**62 (21%)**	76 (25%)	

- Some groups appear underrepresented
- Logical consequence of where beekeepers tend to keep their apiaries
- Provides relevant context for monitoring results

Funded by the European Union

INSIGNIA-EU

Pesticides in APIStrips and honey results 2022
Target list 452 pesticides
Denmark DK, Austria AT, Greece GR

Pesticides results 2022

- APIstrips (non-polar pesticides
- Honey (polar pesticides)

Funded by the European Union

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Pesticides in APIStrips and honey results 2022

Residues of pesticides in honey (polar pesticides)			
AT	**DK**	**GR**	**class**
Glyphosate	Glyphosate	Glyphosate	herbicide
AMPA*	AMPA*	AMPA*	herbicide
	Chlormequat		plant growth regulator
	l-cyhalothrin		insecticide
hexachlorobenzene			fungicide
DMF**	DMF**	DMF**	varroacide
tau-fluvalinate	tau-fluvalinate	tau-fluvalinate	varroacide
*	AMPA is derivate of Glyphosate		
**	DMF is derivate of Amitraz		

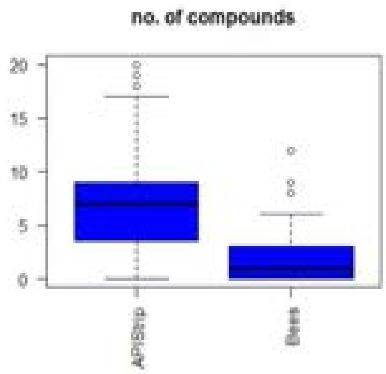
Target list: 10 pesticides:Chlormequat, AMPA, Glyphosate, Glufosinate, Fosetyl-Al, Phosphonic acid, Ethephon, Maleic Hydrazite, Mepiquat, N acetyl glyphosate

Funded by the European Union

INSIGNIA-EU

Pesticides in APIStrips and bees results 2022
Target list 452 pesticides

Table 1. Apiaries and bi-weekly sampling June-July 2022	
Denmark	5 apiaries, 4 sampling
Austria	5 apiaries, 4 sampling
Greece	5 apiaries, 4 sampling



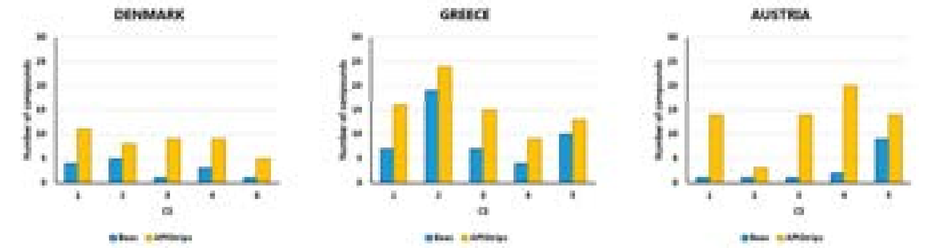


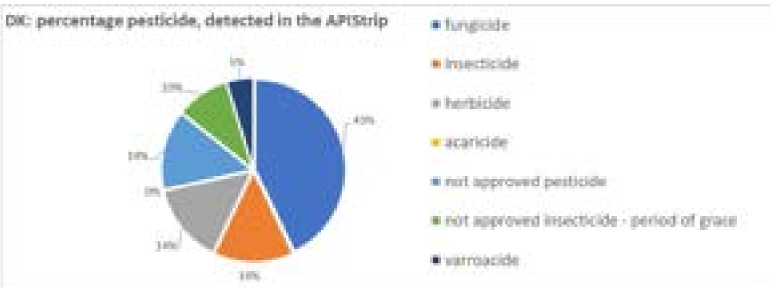
Figure 4. Number of compounds per beekeeper.

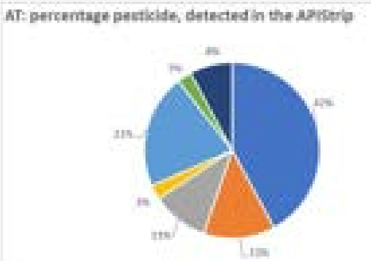
- Higher level for APIStrip
- Sig. difference, p<0.001

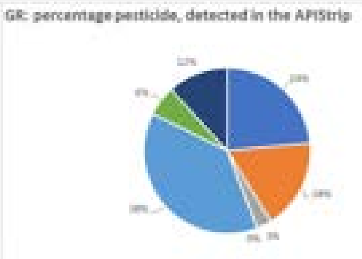
Funded by the European Union

INSIGNIA-EU

Pesticides in APIStrips results 2022 (june – july)
Target list 452 pesticides







Apiaries and bi-weekly sampling June-July 2022 And LOQ residue analyses, and totals	
Denmark	5 apiaries, 4 sampling
Austria	5 apiaries, 4 sampling
Greece	5 apiaries, 4 sampling
N analyses	120
LOQ	0.5 ppb
ng/APIStrip	92,5% < 5 ng/APIStrip

country	fungicide	insecticide	herbicide	acaricide	not approved pesticide	not approved insecticide period of grace	varroacide	total
DK	9	3	3	0	3	2	1	21
DK	43%	14%	14%	0%	14%	10%	5%	100%
AT	16	5	4	1	8	1	3	38
AT	42%	13%	11%	3%	21%	3%	8%	100%
GR	8	6	1	0	13	2	4	34
GR	24%	18%	3%	0%	38%	6%	12%	100%

Funded by the European Union

INSIGNIA-EU

Funded by the European Union

INSIGNIA-EU

Pesticides in APIStrips and honey results 2022
Target list 452 pesticides
Denmark DK, Austria AT, Greece GR

DK	GR	AT
Alachlor	Alachlor	Ametoctradin
Azoxystrobin	Azoxystrobin	Azoxystrobin
Boscalid	Bifenthrin	Bifenthrin
Diazinon	Boscalid	Boscalid
Etofenprox	Carbendazim	Bromopropylate
Etofenprox	Chlorantraniliprole	Chlorantraniliprole
Fenazaquin	Chlorpyrifos	Chlorfenvinphos
Fluazifop-p-butyl	Coumaphos	Coumaphos
Fluopyram	Cypermethrin	Cyflufenamid
Malathion	Cyprodinil	Dimethenamid
Picolinafen	Diazinon	Dimethoate
Propamocarb	Diflubenzuron	Dimethomorph
Prosulfocarb	DMF	Fenazaquin
Pyraclostrobin	DMPF	Fenpicoxamid
Tau-fluvalinate	Fenoxycarb	Flufenacet
Tebuconazole	Fenthion-sulfoxide	Fluopyram
Tetraconazole	Fluopyram	Fluxapyroxad
Thiabendazole	Imidacloprid	Hexythiazox
Thiacloprid	Metconazole	Imidacloprid
Thiamethoxam	Methiocarb	Iprovalicarb
Thiobencarb	Methiocarb-sulfoxide	Metamitron
	Omethoate	Metobromuron
	Oxamyl	Metolachlor
	Pendimethalin	Oxathiapipronil
	Phosmet	Pendimethalin
	Pirimiphos-methyl	Pirimicarb
	Propamocarb	Propamocarb
	Propargite	Propargite
	Tau-fluvalinate	Pyrimethanil
	Tebuconazole	Spirotetramat
	Tebufenpyrad	Spiroxamine
	Thiabendazole	Tau-fluvalinate
	Thiamethoxam	Tebuconazole
	Trifloxystrobin	Tebufenpyrad
		Terbutylazine
		Thiabendazole
		Trifloxystrobin

Introduction to the monitoring planned by the German Federal Office of Consumer Protection and Food Safety

Anna Peters
Federal Office of Consumer Protection and Food Safety

Summary

Dr. Anna Peters
Federal Office of Consumer Protection and Food Safety (BVL), Department of Plant Protection Products

The transport or volatilization of plant protection products is considered in the approval of plant protection products. Due to various findings and studies carried out or monitoring programs on this topic, it is under discussion whether airborne transport of active substances should be given more consideration for plant protection products.
Monitoring programs on long-distance transport have already been carried out by various institutions. For example, in 2020, the Munich Environmental Institute published a report "Pesticide Pollution in the Air." [1] In this research, 116 sites throughout Germany were investigated during 2019 as part of a "citizen science project." [1] The data already collected from the various studies in Germany demonstrate airborne transport of pesticide active ingredients. However, they do not provide sufficient information to draw conclusions on the approval in Germany. In particular, recent studies have used only passive measurement devices (including passive samplers and filter mats). However, this methodology does not provide quantitative statements, since no reference to the collected air volume can be established. The reference to the current use of a plant protection product, which alone is relevant for the evaluation in the approval procedure, can therefore not be established. Therefore, a nationwide state air monitoring with different measurement techniques should be carried out, which should provide a data basis that could contribute to a better and more efficient risk management in certain cases. In addition, the data collected could, if necessary, be incorporated into a suitable forecasting model yet to be developed. Nationwide governmental monitoring must meet certain requirements to enable decisions to be made. Purely qualitative measurements are not usable, because the detection of a substance alone does not necessarily imply (a) negative effect(s) and is therefore not helpful for a risk assessment. In a feasibility study (2020) [2] and a preliminary study (2022) [3], fundamental questions regarding a nationwide monitoring were clarified. Bulk samplers, active air samplers, and plant and soil samples are needed for nationwide air monitoring. [1] In addition, suitable sites should be selected which in total represent the conditions occurring in Germany. These were determined in a preliminary study [2] by a geodata-based analysis. Landscape characteristics, climatic conditions, agricultural use and the plant protection treatment index as well as suitable locations for the measuring instruments (such as connection to the measuring stations of the German Weather Service) were included. This resulted in a combination of 9 climatic zones (CZ) and 6 classes of the treatment index (TI). From this population of CZ/TI

combinations, 5 were selected for air monitoring of pesticides. The selection was based on the relevance of the CZ/TI combination in terms of area, the location in Germany and considering different treatment intensities. For the monitoring stations within these CZ/TI combinations, the three different distance classes "close range" < 100 m, "medium range" = 100 – 1000 m and "far range" > 1000 m should be included to the next agricultural area in main wind direction (distance classes are defined differently here than in the guideline including model FOCUS Air and in other comparable contexts).

In the presentation, the BVL shows how a concept for a nationwide state monitoring was developed and presents the preparations for the implementation of the monitoring.

Literatur

[1] Umweltinstitut München: „Pestizid-Belastung der Luft“ [Pesticide pollution of the air], 2020.
[2] Feasibility analysis for a monitoring on residues in untreated areas and on untreated crops on the transport of pesticide active substances, June 2020
[3] Preliminary study for the selection of suitable sites for a baseline monitoring „Verfrachtungsneigung” (transport tendency), September 2022

Federal Office of Consumer Protection and Food Safety

Preparations for a national air monitoring of the transport of plant protection products in Germany

Anna Peters

Federal Office of Consumer Protection and Food Safety

Content

- Current situation – observations of transport of (volatile) compounds
- Feasibility study and preliminary study to create a concept for a national air monitoring
- Pilot study
- Summary

Current situation – observations of transport of (volatile) compound

- Monitoring programs carried out in the past showed that active ingredients might be detected on non-target areas (e. g. organic farming areas)

  → Economic consequences for the marketability of organic and conventional agricultural products due to the presence of pesticide residues which are not conform with the requirement of diverse secondary standards

- Several monitoring programs or studies are carried out in various countries

  → In particular the report of the program in France was used as information for the preparation of a national monitoring in Germany

Current situation – observations of transport of (volatile) compound

- Volatilization is considered in the risk assessment for plant protection products → Maybe needs refinement
- Specific Risk Mitigation measures (RMM) for some active substances are applied, the RMM are adjusted to the findings
- Transport of (semi-)volatile compounds known and partly visible issue
- Most problematic active substance up to now: clomazone, prosulfocarb, pendimethalin

Clomazone typical bleaching (picture: E. Götz)

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Feasibility study and preliminary study to create a concept for a national air monitoring

- In the years 2020 to 2022 a **feasibility study** and a **preliminary study** were carried out:
  → Identification of prerequisites/parameters for a national air monitoring
  → The national air monitoring should examine whether and how the transport of plant protection products and their active substances via air need stronger consideration in the approval or registration process
- The data to be collected could contribute to a better and more efficient risk management
- The data could potentially feed into a suitable forecasting model. This

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Preliminary study

Preliminary criteria for the selection of parameters

- Suitable **locations** need to be identified with a geodata-based analysis
- Suitable **measuring points** need to be identified which, ideally, can be integrated into existing measuring networks
- **Method of collection** needs to be accredited
- Samples should be taken at **various distances from potential sources**: up to 100 m (short range), 100 m – 1000 m (middle range), > 1000 m (longer distance transport)
- **Analysis of substances** needs to be accredited: various selected active substances → needs prioritisation, depending on analytical and practical parameters

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Preliminary study

Determination of the measurement sites

- The monitoring locations are selected as a geodata analysis taking into account the following criteria:
  - Landscape types in Germany (Federal Agency for Nature Conservation 2011)
  - ATKIS data
  - Atlas Agricultural Statistics (Federal and State Statistical Offices 2018)
  - Treatment intensities from PAPA (Pesticide Application Panel) surveys (Julius Kühn Institute 2020) and data provided by the "The Thünen Institute"
  - climate data

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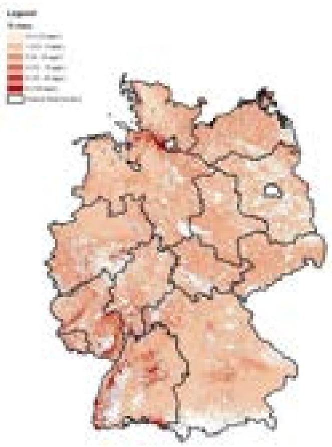
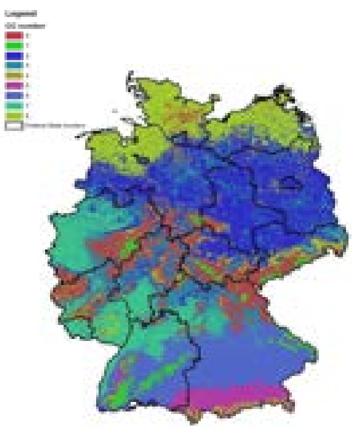
Preliminary study

Results of the determination of the measurement sites





→ 9 climate areas and 6 classes of the treatment index were identified in Germany.

→ These were combined, resulting in **54 possible combinations** of treatment intensity and climate area, of which **50 actually occur** on agricultural areas (arable crops and special crops) in Germany

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Preliminary study

How many measuring sites

- Since it was already determined in a feasibility study (2020) that at least 5 locations are necessary for a national monitoring, a selection was made from **50 agricultural areas**, which takes into account the situation in Germany with regard to climatic data and different treatment intensities
- The **three distance classes** to the next agricultural area in the main wind direction were taken into account by proposing **2 stations per distance** class for each of the 5 locations
- This results in **5 locations**, each with **6 measuring stations**

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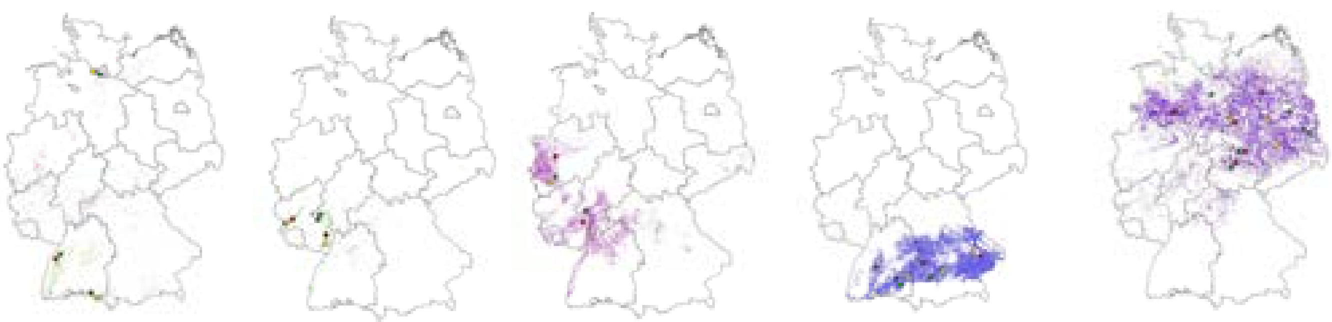
Preliminary study

Possible 5 locations, each with 6 measuring stations:



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Preliminary study

Measurement Technology

- According to the concept proposed in the report, a total of 1300 samples would be taken and analysed per year, with the **following measuring technology/procedure** being provided for each measuring point:
  - Bulk sampler (total deposition / m^2),
  - Active air sampler (concentration / m^3),
  - Sampling site for plants (curly kale),
  - Sampling site for soil deposition (soil surface)

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Preliminary study

Selection of parameters: active substances and their metabolites

- It is considered sensible to record as many of the approved active substances and relevant metabolites as possible in the first step of monitoring
- After analysing the first data, selection of monitored compounds might be
- Additional information:
  - Data collection for investigating the discovery of active substances in plant protection products in untreated areas: https://www.bvl.bund.de/SharedDocs/Fachmeldungen/04_pflanzenschutzmittel/2017/2017_12_22_Fa_Datenerhebung_%20Fundaufkl%C3%A4rung_unbehandelte_Fl%C3%A4chen.html;jsessionid=84E568195CDBCB52132CC2DC4A991B01.1_cid290

Pilot study

- A bulk sampler and an active air sampler are set up in Bavaria, Brandenburg and North Rhine-Westphalia.
- In addition, a sampling site for plants and for soil deposition (soil surface) is planed in North Rhine-Westphalia
- sampling frequency: 4 weeks
- In addition to the pilot study, there is a side project at the University of Trier → Here, the behavior of the PU foam with the corresponding air flow rate will be examined.

Bulk sampler in North Rhine-Westphalia picture: K. Hombrecher

Summary

- A concept for national air monitoring was drawn up
- Measuring devices/collecting devices are selected
- Measuring sites are selected or suggested
- Pilot study is in preparation
- Further preparations for the national air monitoring will be started in due course

Federal Office of
Consumer Protection
and Food Safety

Thank you for your attention!

Contact:
Monitoring.Verfrachtung@bvl.bund.de

Exposure and impact of synthetic pesticides on aquatic biodiversity

Jonas Gröning
Helmholtz Zentrum für Umweltforschung

Exposure and impact of synthetic pesticides on aquatic biodiversity

Jonas Gröning, Department System-Ökotoxikologie, Helmholtz-Zentrum für Umweltforschung

Pesticides applied to agricultural fields can reach surface waters and affect aquatic non-target organisms. To effectively mitigate these risks and achieve good ecological status, it is necessary to identify pesticide sources, input pathways, and ecological effects. Therefore, we have investigated more than 100 streams in Germany as part of the Kleingewässermonitoring project.

In agricultural areas, pesticides enter surface waters mainly through surface runoff induced by precipitation events. Concentrations after rainfall were on average 10 times higher than during dry weather. Vegetated buffer strips were found to be an effective measure to reduce peak inputs from surface runoff. However, high pesticide concentrations were also found in streams within nature reserves without adjacent agricultural land. Drift appears to be the main pathway there, as there is a significant correlation with proximity to cropland.

In 81% of the water bodies pesticide concentrations exceeded the regulatory acceptable concentration (RAC), in some cases by more than 100 times. We also found evidence of changes in species communities already at much lower concentrations. Pesticides were found to be the dominant stressor for vulnerable invertebrates in the streams. A clear influence of pesticide exposure on the composition of aquatic invertebrate communities was shown. The higher the exposure, the lower the proportion of pesticide-sensitive species such as caddisflies or dragonflies. Instead, pesticide-tolerant species such as snails or isopods predominated. These shifts can be captured using the SPEAR bioindicator, a powerful tool for monitoring the effects of pesticides on aquatic biodiversity.

UFZ HELMHOLTZ
Zentrum für Umweltforschung

Exposure and impact of synthetic pesticides on aquatic biodiversity

Jonas Gröning, UFZ, Department System-Ökotoxikologie

01.06.2023

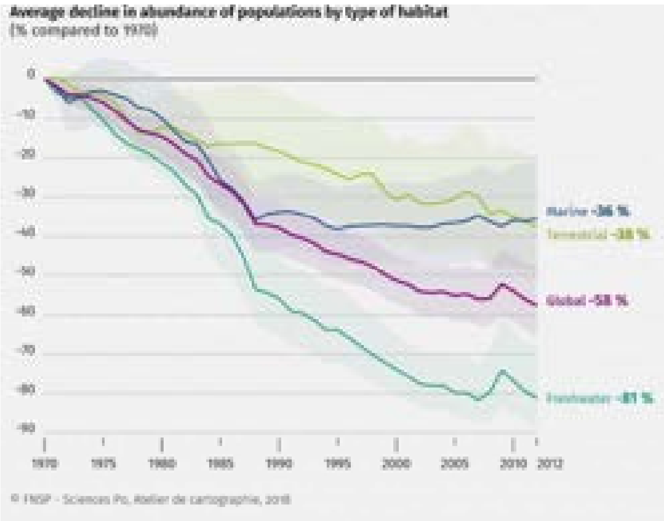
Exposure and impact of synthetic pesticides on aquatic biodiversity

Why should we protect aquatic organisms?

Aquatic organisms provide essential ecosystem services:

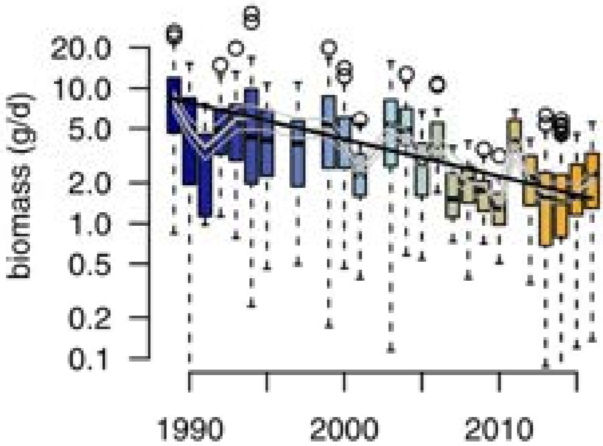
- Food source for other animals (fish, birds...)
- Decomposition of organic material
- Self-purification and bioremediation in aquatic ecosystems

Biodiversity loss



WWF, Living Planet Report 2016

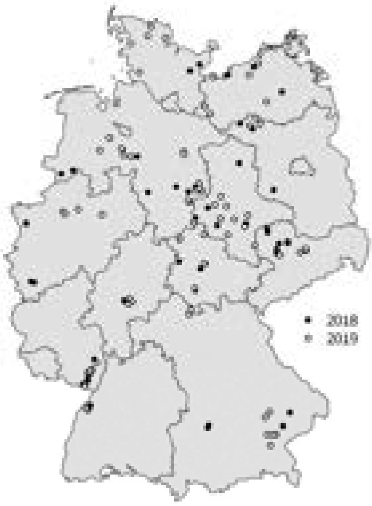
Biodiversity loss



Hallmann et al. 2017

Pesticide exposure in small streams

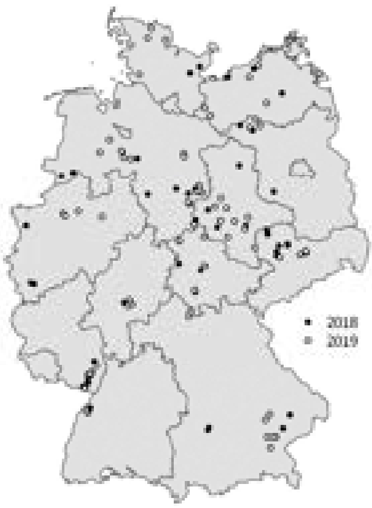
KgM Kleingewässer Monitoring



- Germany-wide monitoring in 2018 & 2019
- 124 stream sections, 1007 water samples
- Comprehensive recording of relevant anthropogenic stressors
- Investigation of the ecological status

Pesticide exposure in small streams

KgM Kleingewässer Monitoring



ELSEVIER

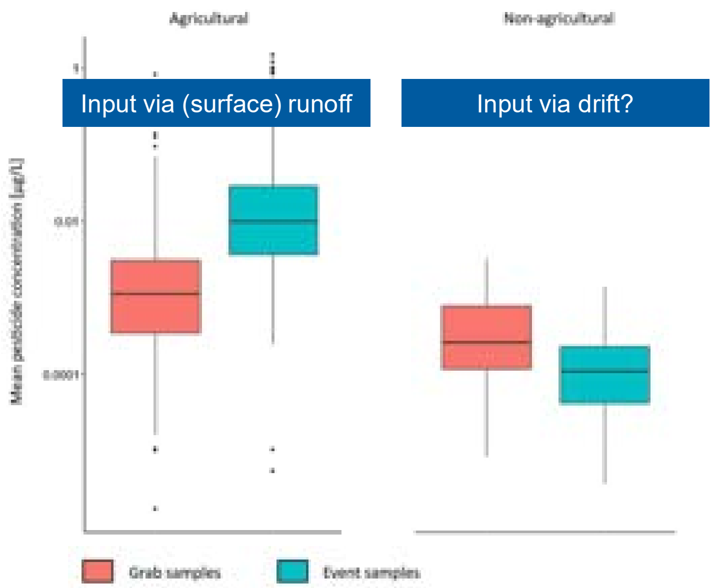
Water Research

Volume 201, 1 August 2021, 117262

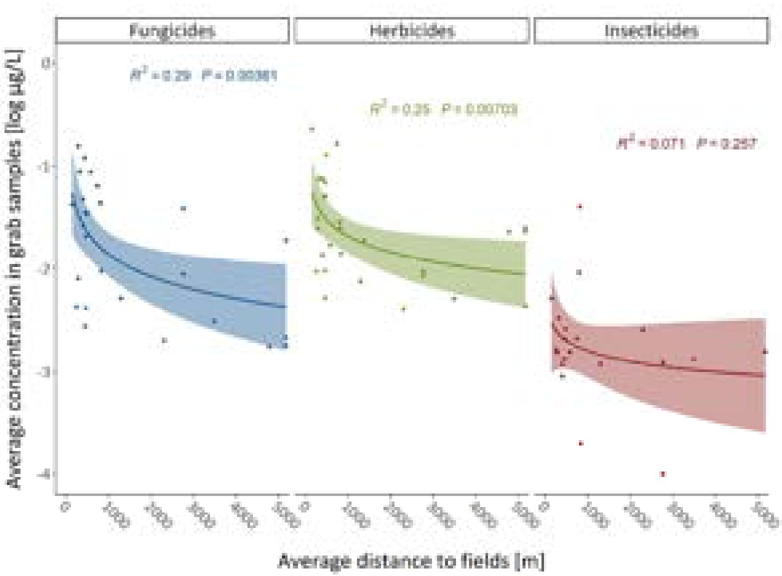
Pesticides are the dominant stressors for vulnerable insects in lowland streams

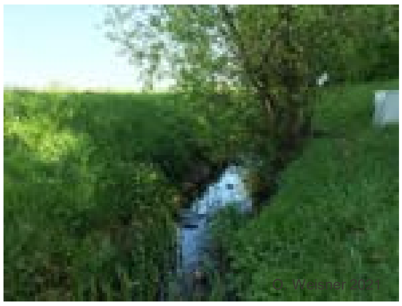
Matthias Liess[a,b], Liana Liebmann[a,c], Philipp Vormeier[a,b], Oliver Weisner[a,d], Rolf Altenburger[a], Dietrich Borchardt[f], Werner Brack[g], Antonis Chatzinotas[g], Beate Escher[h],

Pesticide exposure in small streams

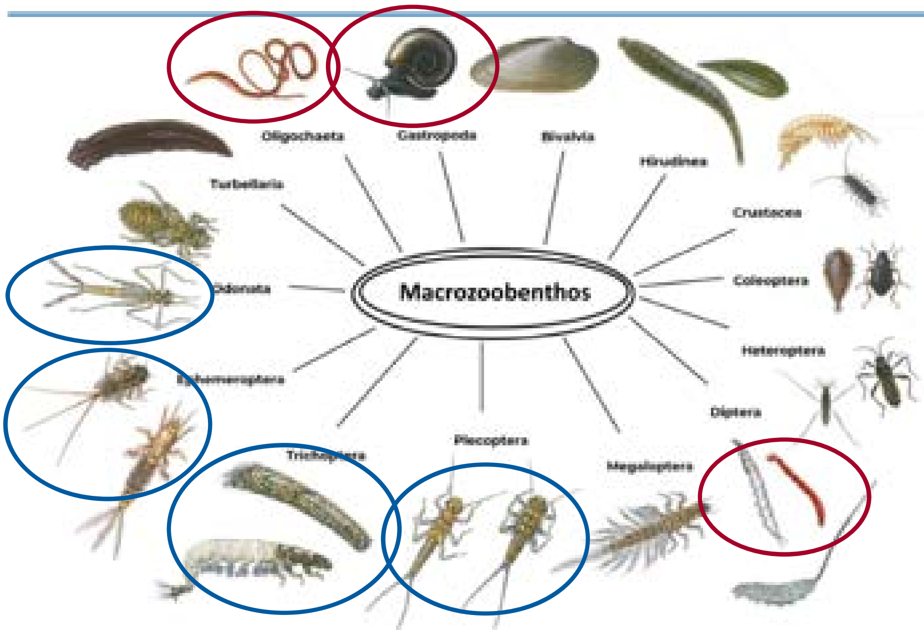


Pesticide exposure in small streams





Impacts on aquatic invertebrate communities

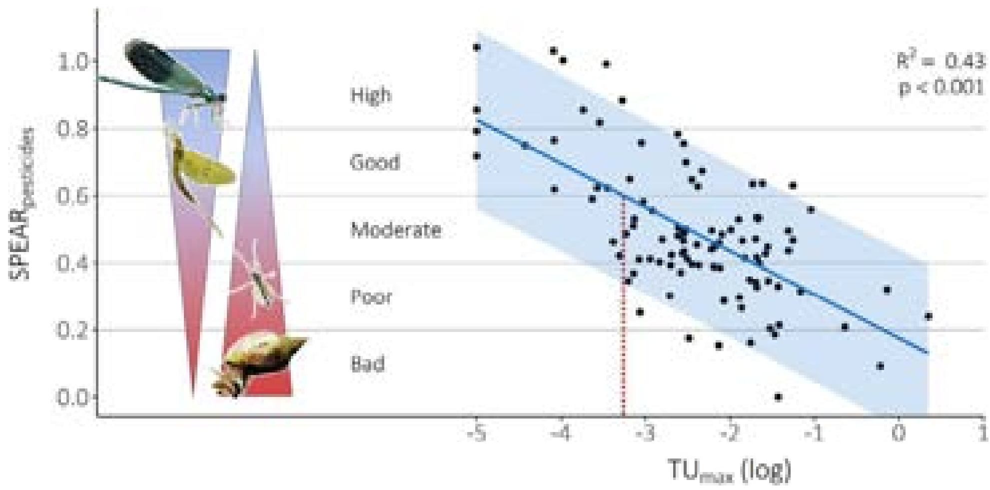


SPEAR (SPEcies At Risk)

- Sensitivity
- Generation
- Refuge
- Exposed

FLOW/v. Gönner 2023

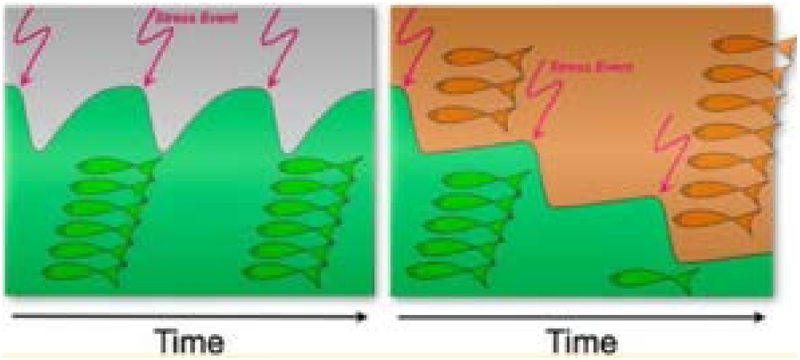
Impacts on aquatic invertebrate communities



Liess et al. 2021

Impacts on aquatic invertebrate communities

Sequential exposure

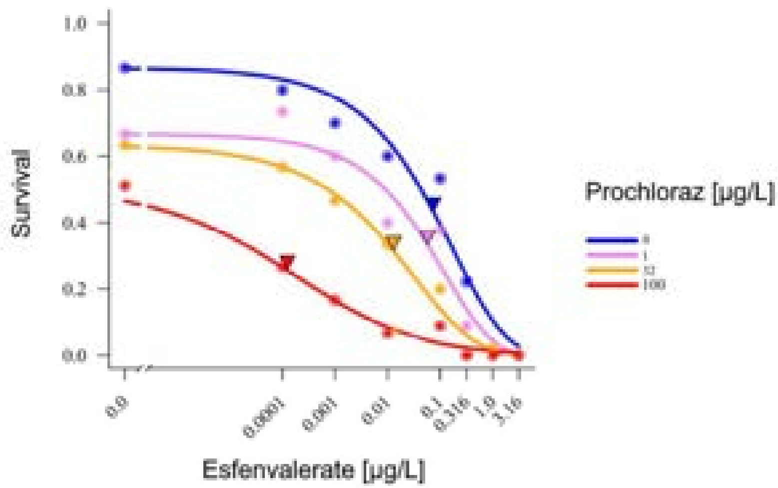


Liess et al. 2013

Impacts on aquatic invertebrate communities

Sequential exposure

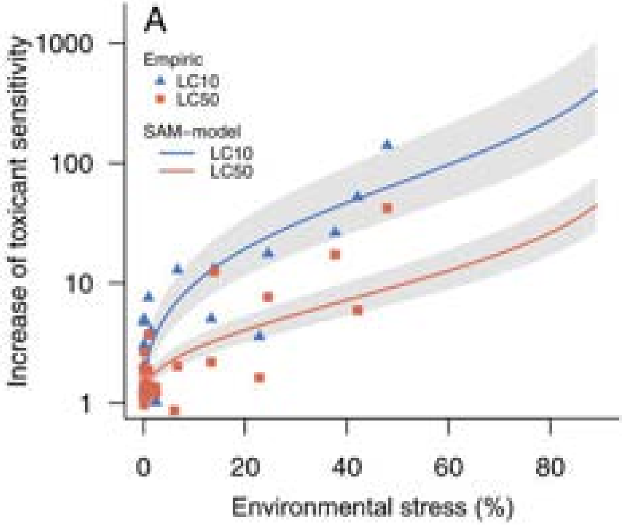
Mixture toxicity



Shahid et al. 2019

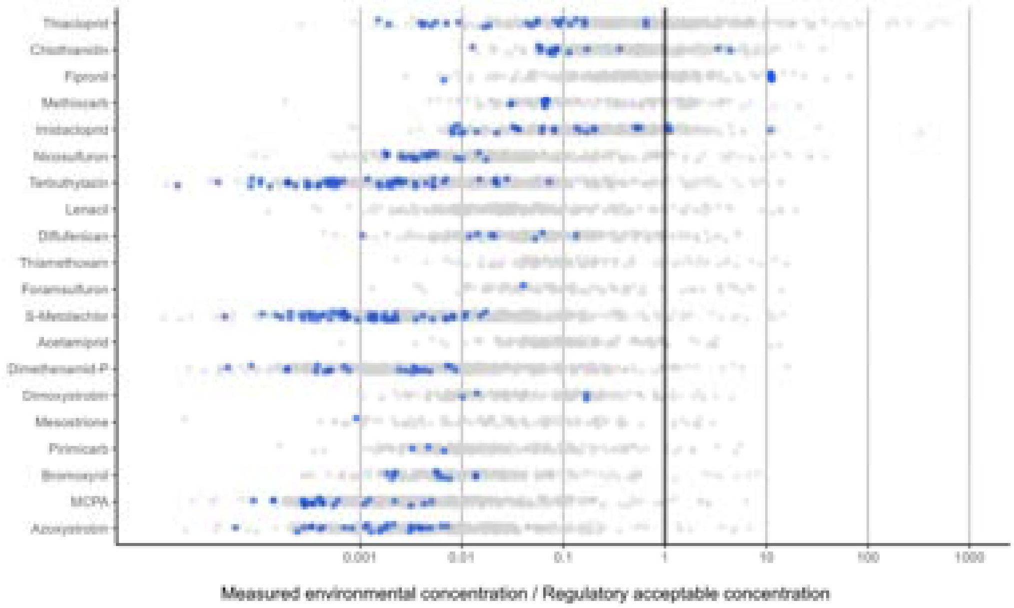
Impacts on aquatic invertebrate communities

- **Sequential exposure**
- **Mixture toxicity**
- **Multiple stress**



Liess et al. 2016

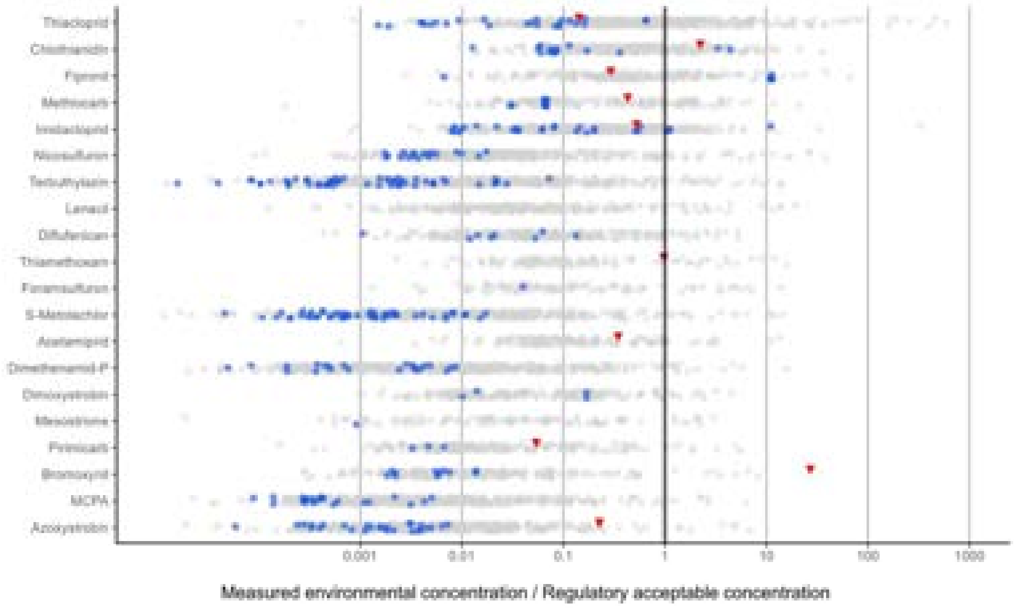
Regulatory vs. field-based acceptable concentrations



RAC

Regulatory Acceptable Concentrations

Regulatory vs. field-based acceptable concentrations



RAC

Regulatory Acceptable Concentrations

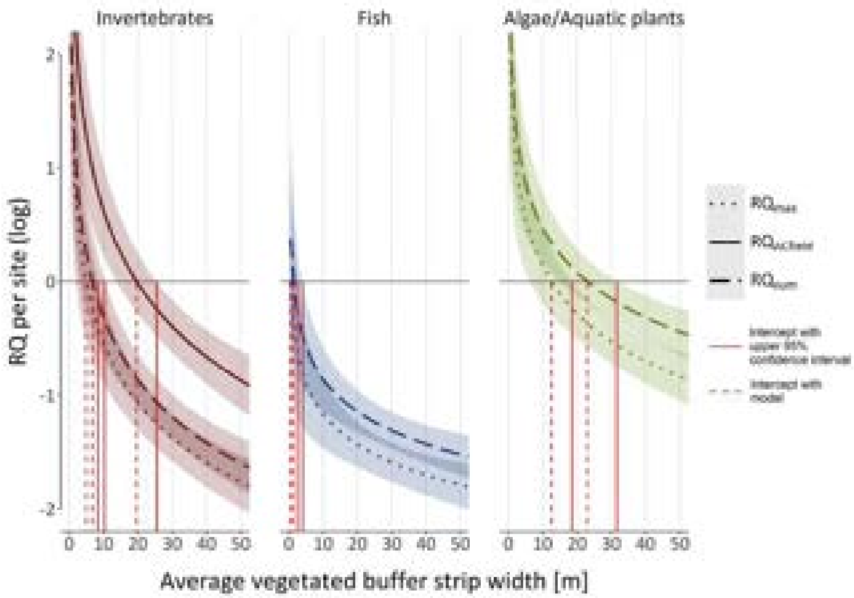
AC_{field}

Field-based Acceptable Concentrations

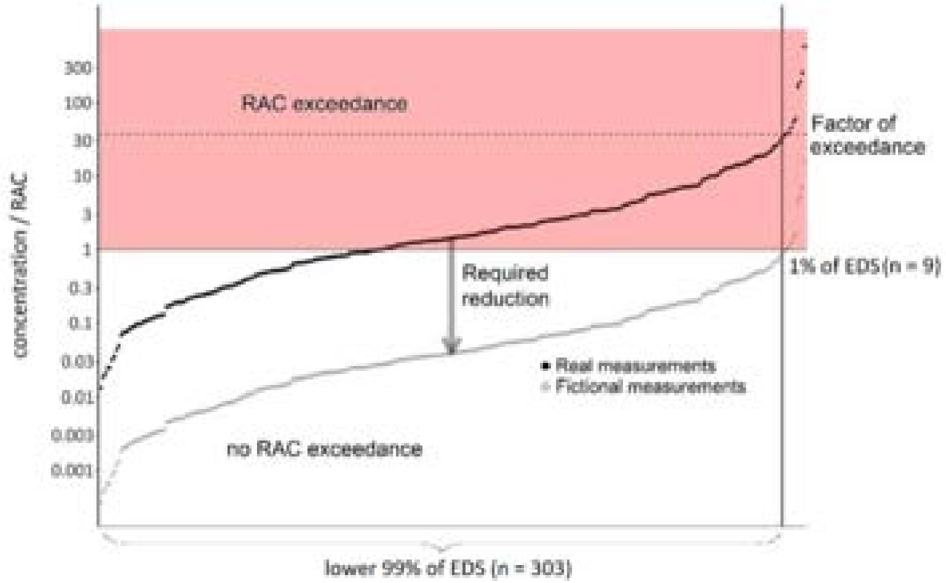
Conclusion

- Pesticide input into streams mainly via surface runoff
- Inputs through drift pollute streams in non-agricultural catchments and nature conservation areas
- Already very low concentrations alter the invertebrate species community

- Reduction of sources – Lower application rates (10.1016/j.scitotenv.2023.162105)
- Reduction of input – Vegetated buffer strips can effectively reduce inputs and peak concentrations (10.1016/j.scitotenv.2023.162105)



Vormeier et al. 2023



Vormeier et al. 2023

Pesticides in water – Looking for polluter pays principle and regulatory measures

Leonie Hilmers
Allianz der öffentlichen Wasserwirtschaft e.V.

Pesticides in water - Looking for polluter pays principle and regulatory measures

Germany's reliance on intensive agriculture has contributed to the widespread use of pesticides, resulting in their presence in various water sources, including rivers, lakes, and groundwater. Pesticides and their metabolites enter the water cycle via airborne transport, surface runoff, leaching and long-distance airborne transport.

Pesticides in water bodies have severe ecological implications. Pesticides disrupt aquatic ecosystems by affecting the biodiversity of fish, insects, and other aquatic organisms. They can also persist in the environment leading to long-term accumulation.

Therefore, there are regulatory limits for pesticides and their metabolites. However, the limits are not coherent within the legislation for agriculture, human health, groundwater and drinking water. Regulatory measures are not sufficient to keep the concentration of pesticides and their metabolites as low as the legislations for health require. Thence, drinking water operators cooperate with farmers and compensate them for spraying fewer pesticides than the legislation for agriculture allows or shut down effected wells. In order to protect water bodies better coherent and strong regulatory measures are needed, such as a ban of synthetic pesticides in water protection areas, reduction of pesticides, wide buffer strips along water bodies, and internalizing external costs with the polluter pays principle for pesticides.

Leonie Hilmers Alliance of public water sector (Allianz der öffentlichen Wasserwirtschaft, AöW)

PESTICIDES IN WATER

Looking for polluter pays principle and regulatory measures

Leonie Hilmers Alliance of public water sector (AöW)

OUTLINE

- Where are pesticides coming from?
- Do we need to panic: How many pesticides are in raw water?
- Regulatory measures: How is the water protected?
- Regulatory measures: How can we improve it?

WHERE ARE PESTICIDES COMING FROM?

aerial transport

surface discharge

infiltration

atmospheric transport

Leonie Hilmers Allianz der öffentlichen Wasserwirtschaft

HOW MANY PESTICIDES ARE IN RAW WATER

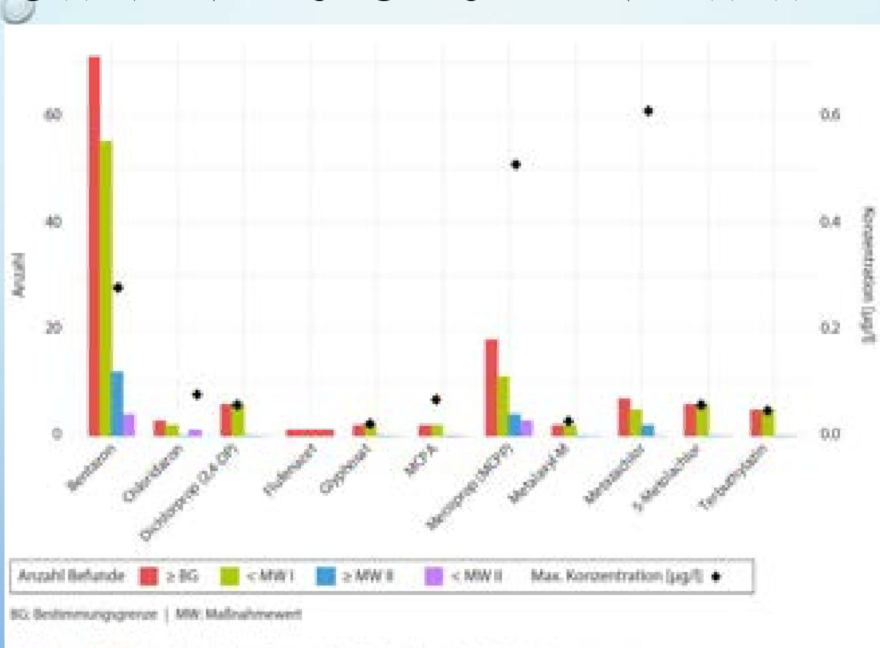


Abbildung 4: Befundlage bei Wirkstoffen mit aktuellstem Wert oberhalb der Bestimmungsgrenze (Anzahl Rohwasserentnahmestellen (RWEST, Grundwasser) mit Analysen ab 2010, Stand April 2019)

[Bundesverband der Energie- und Wasserwirtschaft e. V. (BDEW), Deutscher Verein des Gas- und Wasserfaches e. V. (DVGW), Industrieverband Agrar e. V. (IVA), Broschüre Pflanzenschutzmittel kompakt, Dez. 2020]

REGULATORY MEASURES: HOW IS THE WATER PROTECTED?

- Regular measurements
- Cooperations between farmers and water operators
- Limit value: 0,03-10 µg/L
- Reporting procedures to Federal Office of Consumer Protection and Food Safety (BVL)

REGULATORY MEASURES: HOW CAN WE IMPROVE IT?

- measurements → information to operators
- Cooperations → Ban of pesticides without compensation by the public
- Limit value: 0,03-10 µg/L → Lower limit value for nrM
- Reporting to Federal Office (BVL) → before limits are met

Thank you for your attention

Contact information

Leonie Hilmers

M. Sc. Environmental Technology

hilmers@aoew.de

Allianz der öffentlichen Wasserwirtschaft e.V.

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Impact of atmospheric transport on organic agriculture and coexistence

Lea Bauer
IFOAM

Impact of atmospheric transport on organic agriculture and coexistence

Lea Bauer, IFOAM Organics Europe, Belgium

IFOAM Organics Europe is the European umbrella organisation for organic food and farming. For 20 years, we have been and continue representing organic in European policymaking and advocating for a transformation of food and farming. Our work is based on the principles of organic agriculture – health, ecology, fairness and care. With almost 200 members in 34 European countries, our work spans the entire organic food chain.

Under the EU legislation organic farming is a comprehensive system that includes both agricultural and food production. Prohibiting the use of synthetic pesticides and artificial fertilizers is only one aspect of the requirements. In line with consumer expectations, the organic food sector itself does not only exclude the use but also tries to minimise contamination with such substances. Despite all efforts, synthetic pesticides are still regularly detected in organic products. According to the latest survey of the European market, this phenomenon affects around 6% of products.

The organic movement does not underestimate the complexity of the issue of pesticide residues. In order to explore the current situation and to come up with recommendations IFOAM Organics Europe launched its Pesticide Use & Contamination project, the main objective of which was to agree on a common approach of the organic sector and movement on how to deal with pesticide residue findings still before 2025, when the Commission will issue the report on implementation of the current rules and a possible legislative proposal for an improved harmonisation. One aim of the project was to understand the level of pesticide presence and contamination affecting the food and farming sector, with a focus on organic and the environment. In the project thanks to the collaboration with FiBL - among others - the following scientific reports were produced specifically in this context:

- a scientific article titled "Presence of pesticides in the environment, transition into organic food, and implications for quality assurance along the European organic food chain – A review", published in the scientific journal Environmental Pollution,
- a report on contaminants in food products based on a comprehensive survey broadly circulated to organic stakeholders and analysing 130 replies from 21 EU and non-EU countries, and
- a pilot study on spray drift on small organic vineyards in Switzerland.

Pesticides are used for a wide range of purposes: in conventional agricultural production, to protect harvested crops, in hobby gardens, public parks, forestry, road and railway maintenance, to preserve industrial products, or even for human and veterinary medicine. More than 333 000 tonnes of pesticides are sold in the EU every year. However, a significant proportion of this huge amount turns up somewhere in the environment far from the point of application. Consequently, pesticide residues in organic products may have many sources other than the obvious ones.

According to a survey carried out by the EOCC (European Organic Certifiers' Council), in a significant proportion (43%) of the recent residue cases identified by control bodies and authorities, the contamination was found to originate from the environment: 18% from spray drift and 8% from contact with contaminated soil or water in the field (unavoidable and outside the farmer's responsibility) and 17% from post-harvest contamination transferred by contaminated machinery or equipment (which would be avoidable by taking appropriate precautionary measures).

As the final outcome of the abovementioned project, based on the studies, reports and on a broad internal consultation process with our membership IFOAM OE launched its new position paper on the Management of pesticide Residues in Organic Products. The position paper represents a real milestone and provides for a guide that has been expected from many organic stakeholders within and outside the EU. With this position paper we aim to make it widely recognized that organic production is performed in a contaminated world with the omnipresence of pesticides having all its adverse consequences as well as we propose a harmonized approach to the management of residue cases under the relevant rules set by the EU Organic Regulation by operators and by control bodies/authorities.

Impact of atmospheric (and other) transport of pesticides on organic agriculture and coexistence

Lea Bauer - IFOAM Organics Europe, Belgium

European Symposium on atmospheric transport of synthetic pesticides

1 June 2023 Brandenburg Academy Schloss Criewen

Main topics

- IFOAM OE sector project on Pesticide Use & Contamination
- Operational conditions of organic production, findings of the project
- Legal framework
- IFOAM OE Position Paper on the Management of Pesticide Residues in Organic Products

Context

- Contamination was always present but growing challenges
- Increase of organic land – sporadical
- Increase of present pesticide use worldwide (however a slight decrease in EU)
- Persisting substances from past usage
- Improving analytical techniques
- Legal requirements

IFOAM OE Project on Pesticide Use & Contamination

- IFOAM Organics Europe's **Pesticide Use & Contamination project** closed December 2022.
- Activities on the management of residues continued in 2023.
- Main objective of the project: to agree on a common approach of the organic sector and movement on how to deal with pesticide residue findings before 2025, when the Commission will issue the report on implementation and a possible legislative proposal for harmonisation.

Project Objectives

- Understanding the level of pesticide presence and contamination affecting food and farming sector, with a focus on organic, and the environment;
- understanding how competent authorities, control bodies & authorities, and organic operators are dealing with pesticide presence and contamination;
- reaching a fair and harmonised legislative framework for the organic agri-food sector with harmonised procedures for operators, control bodies & authorities in case of residue findings;
- better integration of the IFOAM principles of organic farming into EU legislative frameworks (Regulation (EC) No 1107/2009 on Plant Protection Products) and stronger coherency of indicators in the framework of the application of the Sustainable Use of Pesticides Directive (SUD) 2009/128/EC.

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Project Results

- A scientific article on pesticide presence in the environment including surface water, ground water, air, soil, wild plants and post-harvesting activities. The article titled "**Presence of pesticides in the environment, transition into organic food, and implications for quality assurance along the European organic food chain – A review**" by Mirjam Schleiffer and Bernhard Speiser published in the scientific journal Environmental Pollution;
- a **policy brief** based on the article published in Agrar Forschung Schweiz;
- a **report on contaminants on food products** based on a comprehensive survey circulated to organic stakeholders, analysing 130 replies from 21 EU and non-EU countries;
- a **report based on a questionnaire sent to 220 Control Bodies & Authorities** (on 6 hypothetical residue cases) illustrating decisions taken by control bodies & authorities in Europe;
- a **pilot study on spray drift** on 5 small organic vineyards in Switzerland.

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Importance of the study

- Organic production does not allow the use of synthetic pesticides, artificial fertilizers or any herbicides. However, their widespread use by conventional farmers creates an **omnipresent risk of contamination** in the whole food supply chain
- Pesticides are used for a wide range of purposes. More than 333 000 tonnes of pesticides are sold in the EU every year. However, a **significant proportion of this huge amount turns up somewhere in the environment far from the point of application**. Consequently, pesticide residues in organic products may have many sources other than the obvious ones, and **do not necessarily indicate fraud**.
- **Deep knowledge is vital as EU Reg. requires precautionary measures by operators to avoid contamination (appropriate and proportionate).**

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Findings - air

- pesticides present in liquid (droplets of spray solution), solid (bound to soil particles) or gaseous form
- enter the air compartment during the process of spraying, or volatilization of pesticides deposited on crops or soil.
- during rain washed out of the atmosphere and reach the ground

- transport over a continuous range of distances:
- spray drift - short-range transport (depends on droplet size, wind speed, climatic conditions and the height of the crop sprayed)
- long-range transport if carried to higher atmospheric layers (observed with distances ranging from a few kms up to more than 1000 km)
- measurements suggest that pesticides are present in the air at the majority of European sites, likewise, also regularly found in rainwater

- enter crops via different uptake pathways:
- in the gaseous phase via stomata or diffusion through the cuticula
- in solid form (bound to soil particles) deposited on plant surfaces
- in rainwater are deposited on plant surfaces or on the soil

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Findings - soil

- deposition of pesticide spray
- direct treatment of soils (e.g. against weeds, slugs, nematodes, wireworms)
- pesticide-treated seeds

- rapidly disappear or persist - substances used in the past are regularly found, e.g. organochlorine pesticides (OCPs) some triazine herbicides such as atrazine
- pesticide residues found in 83 % of European soils - great majority of conventional soils contain pesticide residues, multiple residues are frequent, organic soils also often contain pesticides, but in lower numbers and at lower levels
- uptake or deposition on surface (OCPs by Cucurbit family, but organophosphates, pyrethroids and neonicotinoids and by a range of other crops)

9 1 June 2023

Findings - water

- not intentionally treated
- surface water: by run-off from agricultural fields, movement of fluids in drainage systems, spray drift or various point sources such as spillage, tank washing and waste disposal
- groudwater: by leaching from agricultural production sites, by bank infiltration from rivers and streams, heavy rains and strong irrigation may wash pesticides into water bodies (however, they dilute their concentrations)
- correlation between the pesticides found in water and those applied to crops nearby (exception: some pesticides can be found in water years after their application has stopped)

- 5 – 15 % of European streams, rivers and lakes the ‘safe drinking water limit’ is exceeded (many contain cocktails of pesticides)
- regularly found in water bodies all over Europe (atrazine, DDT, simazine, aldrin and alachlor) others sporadically or regionally
- ‘safe drinking water limit’ exceeded in 7 % of European groundwaters (numbers of substances and concentrations usually lower than in surface water)
- pesticides in aquatic environment reach crop plants mainly via irrigation (uptake into plants)

10 1 June 2023

Post harvest contamination

- food can be contaminated during storage, transport or processing
- major contamination pathways:

(i) cross-contamination, which means the direct or indirect contamination from treated to non-treated products in facilities or machinery

(ii) post-harvest treatments for the control of storage pests

- comprehensive risk management practices:

(i) risk based sampling of incoming lots

(ii) adequate cleaning procedures for all buildings and installations

(iii) adequate measures to separate organic and other food and to avoid cross-contamination

These measures come at a cost for the organic sector.

Consequences

Organic operators face constant threat of contamination and limitation to their freedom of business

- According to a survey carried out by the EOCC (European Organic Certifiers' Council), in a significant proportion (43%) of the recent residue cases identified by CB/CAs the contamination was found to originate from the environment:
  - 18% from spray drift and
  - 8% from contact with contaminated soil or water in the field (unavoidable and outside the farmer's responsibility)
  - 17% from post-harvest contamination transferred by contaminated machinery or equipment (which would be avoidable by taking appropriate precautionary measures).

Lp.	Substance	Result ± uncertainility [mg/kg]
1.	boscalid	0,007 + 0,001
	tetraconazol	0,008 ± 0,002
2.	pirymethanil	0,019 ± 0,003
3.	tebuconazol	0,006 ± 0,002
	tetraconazol	0,010 ± 0,002
4.	cyprodynil	0,025 ± 0,007
	tetraconazol	0,005 ± 0,001

Case study – small organic vineyards

- Vinegrowing region, small farms surrounded by conventional neighbours in Switzerland
- field study was carried out in 2021, extremely wet year, more frequent use of fungicides than usual
- leaf samples in July, fruit samples in September
- 'multiresidue screening' covering over 800 substances, also analysed for the presence of fosetyl and phosphonic acid

Detection in every sample!

From the >800 substances detectable with the multiresidue screening, a total of 20 substances were detected. These are given here in order of decreasing frequency (number of detections in brackets): folpet (19); cyflufenamid (10); fosetyl (6); amisulbrom (4); cymoxanil (4); fluxapyroxad (4); mandipropamid (4); myclobutanil (4); quinoxyfen (4); spiroxamin (4); zoxamid (4); 2,6-dichlorbenzamid (3); cyprodinil (2); difenoconazol (2); fenhexamid (2); penconazol (2); trifloxystrobin (2); ametoctradin (1); metalaxyl (1);

- Cost estimates were made – for two strategies of buffer zones (conventional sale/organic treatment of neighbour's border rows) – second is economically more beneficial but needs consent

Context of the Position Paper

New Organic Regulation

- EU Organic Regulation 2018/848 applicable since 1 January 2022 - new rules entered into force, also regarding the handling of pesticide residues.
- *Art. 28 & 29 of Regulation (EU) 2018/848* specify the measures and steps for operators as well as for CB/CAs in the case of the presence of non-allowed substances on organic products.
- The final legal text was reached as a compromise between Commission, European Parliament and Council, which led to the inclusion of Art 29(4).
  - *By 31 December 2025, the Commission shall present a report to the European Parliament and the Council on the implementation of this Article, on the presence of products and substances not authorised pursuant to the first subparagraph of Article 9(3) for use in organic production and on the assessment of the national rules referred to in paragraph 5 of this Article. That report may be accompanied, where appropriate, by a legislative proposal for further harmonisation.*

15 1 June 2023

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IFOAM OE Position Paper

- As final outcome of the project, IFOAM Organics Europe’s Position Paper is published now based on the outcomes of the project and on a broad internal consultation processes with our membership.
- The Position Paper represents a milestone and a guide that was expected from many organic stakeholders both in and outside the EU.
- With this position paper we aim to make it widely recognized that organic production is performed in a contaminated world with the omnipresence of pesticides having all its adverse consequences as well as we propose a harmonized approach to the management of residue cases under the relevant rules set by the EU Organic Regulation by operators and by control bodies/authorities.

16 1 June 2023

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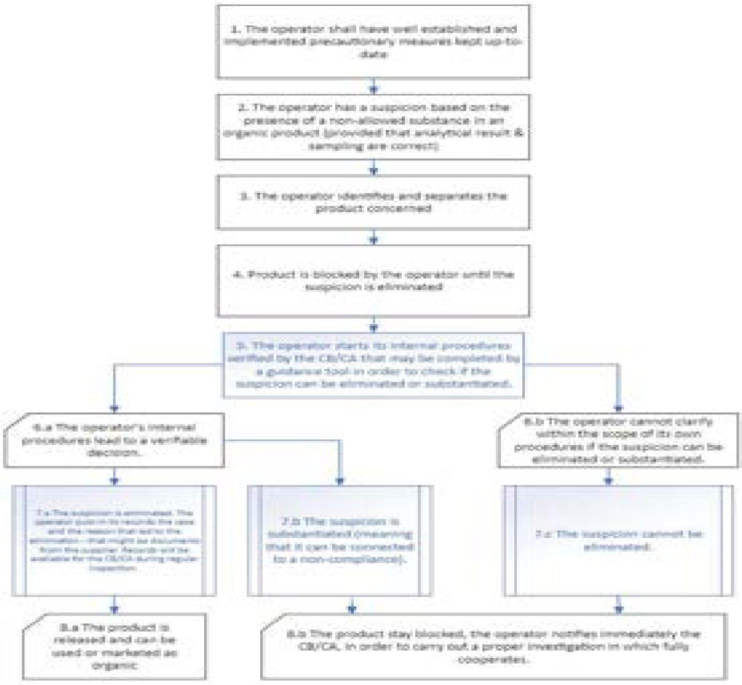

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Principles proposed

- Operators have the task to conduct their own checks before a substantiated suspicion is established.
- This internal assessment should be guided by the operator's own internal procedures verified by the CB/CAs and might be complemented by a guidance tool based on experiences with other investigations and scientific results.
- In the course of the assessment the operator is entitled to collect all necessary information from suppliers.
- The operator shall notify the presence to the CB/CA if there is a substantiated suspicion or if the suspicion cannot be eliminated.
- If the suspicion can be eliminated, the operator documents the results and the reason for the conclusion and the product can be used or marketed as organic. It is the task of the CB/CA to verify during the regular controls if the case is adequately documented and the suspicion has been eliminated on valid grounds.

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Examples of items to consider where the operators might withdraw the suspicion when the case and the circumstances are well documented:

- the substance detected occurs naturally in the product or derives from a processing technique;
- the substance detected is used against a disease which is not existent in the crop species in question;
- the substance detected is not allowed in the crop species in question – considering that the authorization of a pesticide for a specific crop can vary between countries – or not allowed at all in the EU (any longer);
- proven cases of false positive laboratory results;
- environmental pollution deriving from POPs;
- detection of substances that derive from human sanitary measures/products used or the treatment of water;
- proven and well-documented cases of systematic, unavoidable contamination from neighbours' overspray, short- and long-distance spray drift.

Principles proposed

- The investigation should determine the source and the cause of the presence of non-allowed products or substances, to ensure that operators comply with the requirements for organic production and have not used products or substances that are not authorised for use in organic production and to ensure that those operators have taken proportionate and appropriate precautionary measures to avoid the contamination of organic production with such products and substances.
- Investigations should be proportionate to the suspected non-compliance, and therefore should be completed as soon as possible within a reasonable period, considering the durability of the product and the complexity of the case.
- In case the source and cause cannot be determined conclusively, the CA/CB should be able to establish the "most probable cause and source" and thereby close the investigation.

Guidance tool

- Compile the most common detected residues and their origin, per crop species.
- general criteria (appliable to all the operators) e.g.:
  - latest available agronomic knowledge
    - Does analysed active substance make sense for application in the culture or food concerned, i.e., does its use make sense from an agronomic or technical point of view?
    - Are there different possible uses/purposes for the active substance?
    - What other sources of the active substance are possible?
  - scientific studies
  - frequency of contamination
  - national/regional contamination characteristics in the environment
- specific criteria (applicable to specific operators), e.g.
  - regional pedoclimatic conditions.
  - production-related (transport, storage, supply-chain)
  - known cases of fraud
- Consider processing factors, when applicable.
- Available for operators & CBs/CAs free of charge.

Thanks to the project sponsors!

DIMECOBIO IV 2021-2024

Project for the development and continuation of activities aimed at defining the economic dimensions of the organic farming sector at different levels of the supply chain.

Golden sponsors

Silver sponsors

Bronze sponsors

OTHER CONTRIBUTIONS

We thank KRAV for their support to the project

Legal background: What effects can monitoring results have on the approval?

Achim Willand
(GGSC)
(Gaßner, Groth, Siederer & Coll.)

Lecture 2:
Legal insight: Which implications can monitoring results have for regulatory approval?

The experience of the past decades has shown deficits in the approval process for pesticides. Again and again **unexpected, serious effects of approved** (partly widespread) **pesticides** have emerged (example: bee-harmful neonicotinoids). **Risks** that were **not sufficiently investigated in the approval process** were often only discovered after damage had occurred (e.g. contamination of products) - and this on the initiative of those affected (rather than through a "monitoring"). The problematic effects of the long-range atmospheric dispersal of pesticides were also discovered through cases of damage in food production (organic farmers).

The task of systematic monitoring (still to be established) is in particular **to detect unexpected effects at an early stage**, so that authorities, authorization holders, users and those affected can react quickly.

At the level of **pesticide authorization**, **"new scientific and technical knowledge"** and **"monitoring data"** are reasons for a review of the authorization (Art. 21, 44 Regulation 1107/2009). According to the jurisprudence of the European Courts, results of the **monitoring** that may have an influence on the risk assessment are a reason for the review of the authorization. This can also be based on findings about the atmospheric dispersion of a pesticide, about its residues on food or about the interaction with other substances existing in the air.

In the review procedure, the **burden of proof** lies on the **applicants** (usually manufacturers). They have to prove that the **pesticide** is safe, i.e. that it continues to meet **all the approval criteria**. **In case of doubt** (e.g. relevant data gaps), the **approval may be restricted or (partially) revoked** (according to the European Courts in the proceedings concerning neonicotinoids, cf. **ECJ C-499/18**).

However, it is doubtful whether the atmospheric dispersion of pesticides within the framework of the assessment methods used so far will lead to authorizations being restricted.

Results of the **monitoring** can also be used to further develop the **risk assessment** regarding the determination and evaluation of atmospheric dispersal (especially methods) in the **approval process** and, if necessary, to restrict the use of pesticides on site.

Perspectively, the question is whether the large **dispersion** of pesticides far away from regions with intensive land use should be **mitigated** by appropriate regulations (e.g. **quantity control**) - **independent of concrete risks**. One approach for this is the precautionary principle (also for quantity control). An example can be the **minimization obligation** for pesticides in sensitive areas according to Art. 12 of Directive 2009/128.

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2. Teil: Auswirkungen des Monitorings auf Zulassungen - ein Zitat zur Einstimmung (BfR, Mitteilung Nr. 045/2020)

*„Die **gesundheitliche Risikobewertung berücksichtigt** Abdrift und **Verflüchtigung**. Dabei geht sie als ´**worst case**´ davon aus, dass die räumliche und zeitliche Konzentration nicht durch Verfrachtung vermindert wird. Der **verfrachtete Anteil** ist somit durch diese **Risikobewertung** mit **abgedeckt**....Ein gesundheitliches Risiko wird bei sachgerechter und bestimmungsgemäßer Anwendung daher insgesamt als unwahrscheinlich angesehen.“* (Hervorh. d. Verf.)

- Risiken durch **Kumulations-/Synergieeffekte** verschiedener PSM,
- **permanente, ubiquitäre Exposition**
- ist die ubiquitäre Verbreitung insgesamt Ergebnis „sachgerechter, bestimmungsgemäßer Anwendung“? (polemisch gefragt)
- **Kontrollierter** Einsatz von PSM (
- **Vorsorge** und **Reaktionsfähigkeit** bei neuen Erkenntnissen?

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VI. Monitoring – was ist das? Wo geregelt?

- Art. 6 VO 1107/2009 – ggf. „Bedingungen und Einschränkungen“ der Wirkstoff-genehmigung: Maßnahmen Risikominderung und **Monitoring** nach Verwendung
  - ggf. vom Antragsteller (Hersteller) durchzuführen („Eigenüberwachung“)
- Anh. II Ziff. 3.7.1.3. „Potential zum Ferntransport.. wenn aus **Monitoring**daten hervorgeht, dass in der Umwelt ein weitreichender Transport des Wirkstoffs...“
- „**Überwachung**“ (= „Monitoring“) in VO 1107/2009: Erwägungsgründe 44, 46, 55; Art. 21 Abs. 1, Art. 43 Abs. 2, Art. 55 Abs. 5.....
- **EuG** T-429/13 und T-451/13: „**Überwachungsdaten**“ sind Daten, die nach der Verwendung im Freiland gesammelt wurden (im Rahmen eines Überwachungsprogrammes oder außerhalb)
  - keine **Feldstudien** (wissenschaftl. Studien mit klaren Parametern)
  - **Überwachungsstudien (Monitoringdaten):** sind **nicht geeignet**, **Risiken auszuschließen** (<u>aber</u>: **können Hinweise** auf bestehende **Risiken** aufzeigen)

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VII. Monitoring und unerwartete Auswirkungen

- Praxiserfahrung Zulassungsverfahren und Verwendung von PSM:
  - unerwartete, gravierende Auswirkungen zugelassener Pestizide, z.B.: z.B. bienenschädliche Neonicotinoide (nicht ausreichend bewertete Expositionspfade/Auswirkungen, vgl. EuGH C-499/2018)
- „**Lücken**" in der **Risikoprüfung** >> Defizite im urspr. Zulassungsverfahren
- ...nicht ausreichend untersuchte Risiken werden oft erst nach Schadenfällen - also **nicht durch (systematisches) Monitoring** erkannt
- **Reaktion/Regulierung** oftmals erst **Jahre später**

- **Aufgabe** eines **(noch aufzubauenden) systematischen Monitorings: unerwartete Auswirkungen frühzeitig feststellen**, damit Behörden, Zulassungsinhaber, Verwender und Betroffene rasch reagieren können
- Überwachung der Ausbreitung von PSM (regional/überregional)

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VIII.Monitoring und Überprüfung/Beschränkung von Zulassungen

Art. 21 (Wirkstoff)
Art. 44 (PSM)
VO 1107/2009

Anlass für eine Überprüfung der Genehmigung / Zulassung

„jederzeit" Überprüfung seitens EU-KOM / Mitgliedstaat zulässig

neue wissenschaftliche und technische Kenntnisse, Überwachungsdaten

- **Ergebnisse des Monitorings** mit Einfluss auf die Risikoprüfung – sind nach Rechtspr. der Unionsgerichte ein **Grund** für die **Überprüfung** der **Zulassung**
- Anlass für die Überprüfung können auch Erkenntnisse über die **atmosphärische Verbreitung eines Pestizids**, über **seine Rückstände (z.B. auf Lebensmitteln)** oder über **das Zusammenwirken mit anderen in der Luft vorhandenen Stoffen** (These).
- **Kriterium: Anzeichen** dafür, dass **nicht** mehr alle **Genehmigungskriterien** nach Art. 4 und sämtliche **Anforderungen** nach Art. 29 **erfüllt** sind? (Beweislast „Anzeichen": EU-KOM bzw. Mitgliedstaat)

VIII.Monitoring und Überprüfung/Beschränkung von Zulassungen

Art. 21 Abs. 3, Art. 44: EU-Kommission/Mitgliedstaat **heben Genehmigung/Zulassung auf** oder **ändern** sie, wenn im Ergebnis der Prüfung:

- **nicht** mehr alle **Genehmigungskriterien** des **Art. 4 erfüllt sind (Wirkstoff)**
- **nicht (mehr) alle Anforderungen** des **Art. 29 erfüllt sind (PSM)**
  - ➢ **gleiche Kriterien wie (Ausgangs-)Zulassung**

oder wenn

- im Überpr.-verfahren **angeforderte Informationen nicht vorgelegt** wurden

➢ Risikomanagement-Entscheidung

- **Beweislast**, dass Wirkstoff/PSM sicher ist - weiterhin **alle Kriterien erfüllt): Genehmigungsinhaber** (i.d.R. Hersteller/Inverkehrbringer)
- **im Zweifel** (z. B. relevante Datenlücken) darf die **Zulassung eingeschränkt** oder **(teilweise) aufgehoben werden** (so in den Verfahren btr. Neonicotinoide, vgl. EuGH C-499/18).

VIII. Monitoring und Verweigerung/Beschränkung von Zulassungen

Frage: Können **Monitoring-Daten** btr. PSM-Verbreitung via Luft zur Verweigerung/ **Beschränkung** von PSM-Zulassungen (bzw. Wirkstoffgenehmigungen) führen?

Zweifelhaft wegen…

- ➢ **des vorgegebenen Bewertungsschemas**: **Exposition Anwender /Nicht-zielarten** am Ort der Anwendung als **„worst case"** (Verfrachtung „abgedeckt")
- ➢ **der unklaren Ermächtigungen für weitergehende Beschränkungen:**
  - ➢ „…infolge seiner [PSM] technischen Formulierung sind die **Exposition** der Verwender oder **andere Risiken** so weit **minimiert**, wie es ohne Beeinträchtigung der Funktion des Produkts möglich ist (Art. 29 Abs. 1 d)
  - ➢ „…Zulassungen…sicherzustellen, dass …Rückstände von den Mindest-mengen des [PSM] stammen… und die **Verwendungsbedingungen** müssen die **Rückstände so gering wie möglich** halten" (Nr. 2.4.2.1 VO 546/2011)
  - ➢ **Maßnahmen zur Risikominderung** (zonale Zulassung) – Voraussetzung: spezifische Verwendungsbedingungen, Grund für Annahme eines unannehmbaren Risikos (Vorsorge?)

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VIII. Monitoring und Verweigerung/Beschränkung von Zulassungen

These: atmosphärische Verbreitung lässt sich über die **Risikoprüfung** und das Zulassungsverfahren nur **ansatzweise „fassen"**:

- Rahmen Zulassungsverfahren: einzelne Wirkstoffe/PSM unter bestimmten Verwendungsbedingungen für eine Zulassungsperiode;
- **Verbreitung** via Luft: **überregionale Kumulation/Synergien** einer Vielzahl von Pestizideinsätzen diverser Stoffe über „historische" Zeiträume
- „**Zurechnung**" (Kausalität) PSM-Einsatz >> Verbreitung >> Risiko/Schaden problematisch (vgl. Schadensfälle Pendimethalin usw.)

- **aber**: Neigung eines PSM zur **Verflüchtigung** ist ein **Risiko** (Verursachungsbeitrag für PSM-Verbreitung) und damit „**Anker**" für **Maßnahmen der Risikominderung** Zulassungsbeschränkungen (Problem: nicht eindeutige Rechtsgrundlagen, s. S. 23)
  - unterhalb der Schwelle unannehmbarer Auswirkungen

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IX. Fazit: Monitoring und Regulierung, Ausblick

Unabhängig von konkreten Risiken wirkende - Ansätze zur Eindämmung/Regulierung der atmosphärischen Verbreitung von PSM

Vorsorge und **Kontrolle** (Monitoring-basiert):

- **Zulassungsbeschränkungen** für „flüchtige" PSM, auch wenn keine schädlichen/unannehmbaren Auswirkungen (zum geltenden Recht s. S. 23)
- Besonders „flüchtige" und toxische PSM: **nicht zulassungsfähig** bzw. keine Verwendung im Freien, vgl. PBT, POP etc.
- **Minimierungspflicht** btr. **Verflüchtigung** und **Rückstände**
  - Ansätze in VO 1107/2009 und 546/2011 vorhanden (s. S. 23)
  - Konkrete Verwendungsbedingungen/Zulassungsbeschränkungen
  - Vorbilder: Minimierungspflicht in **Schutzgebieten** (Art. 12 RL 128/2008); **Emissionsbegrenzung** für (unerwünschte) Stoffe an der Quelle nach SdT (BImSchG, Wasserrecht); Schadstoffsenken", "ausschleusen" statt Verbreitung

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IX. Fazit: Monitoring und Regulierung, Ausblick

Unabhängig von konkreten Risiken wirkende - Ansätze zur Eindämmung/Regulierung der atmosphärischen Verbreitung von PSM

Vorsorge und **Kontrolle** (Monitoring-basiert):

- **Grenz-** und **Schwellenwerte** für verfrachtete PSM als „Luftschadstoffe" (Immissionswerte, z.B. Alarm-/Auslöseschwellen)
- **Maßnahmen(programm)** bei (regional) **hohen/steigenden PSM-Konzentrationen** bzw. bei Überschreitung der Grenz-/Schwellenwerte in der Luft (z.B. Beschränkung von Zulassungen / Verwendung von PSM)
- (ernsthafter) **Vollzug IPM**
- **Mengensteuerung** für PSM (Reduktionsziele und -maßnahmen)

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[Gaßner, Groth, Siederer & Coll.]
Partnerschaft von Rechtsanwälten mbB

Rechtsanwalt
Dr. Achim Willand

Wir bedanken uns für Ihre Aufmerksamkeit.

Gaßner, Groth, Siederer & Coll.
Partnerschaft von Rechtsanwälten mbB
EnergieForum Berlin
Stralauer Platz 34
10243 Berlin

Tel. +49 (0) 30.726 10 26.0
Fax. +49 (0) 30.726 10 26.10
E-Mail: berlin@ggsc.de
Web: www.ggsc.de

Modifying monitoring programmes to enable the investigation of pesticide transport

Werner Wosniok
Consulting statistician

Dr. rer.nat. Werner Wosniok
Statistical consultant
werner@wosniok.de

Modifying monitoring programmes to enable the investigation of pesticide transport

Summary of contribution to the
European Symposium on atmospheric transport of synthetic pesticides

May 31 – June 1, 2023
Brandenburg Academy "Schloss Criewen", Germany

Recent studies have shown the presence of synthetic pesticides at locations far away from the regions of their application. Pesticide presence outside the area of application is for obvious reasons not desired. To modify pesticide emission in order to avoid undesired immission, emission and the principle of transport must be known, at least approximately.

A typical monitoring programme for pesticides in ambient air generates data on the total amount of pesticides collected at the sampling location during a certain time span. This information describes immission. It does not describe pesticide transport from source to sampling location. Allocating samplers in the vicinity of potential sources and checking if the amount of pesticide decreases with increasing distance from the potential source seems a step towards recognising the principle of transport, but such a simple approach is prone to many errors. Ignoring weather conditions, predominantly wind direction and speed, is a main reason for wrong conclusions about transport. Missing knowledge about location and actual activity of potential sources is another one. And as always when random conditions are involved, the number of samplers may be insufficient to recognize the rule of transport with sufficient precision. Examples of erroneous conclusions due to an inappropriate study concept will be given in the talk.

A proposal will be given for modifying standard monitoring approaches that allows estimating a simple characterization of pesticide transport. The modification consists of obtaining additional data on wind direction and speed and on the location of potential emission sources and their actual emission activity during the monitoring phase. For calculating the required number of samplers, a (small) pilot study is proposed, which produces data on the uncertainty of sampling results as well as a first characterization of transport. This first idea together with the obtained uncertainty can be used to derive an optimal allocation of samplers, given the present knowledge. This would be done by Monte Carlo simulations using historic real wind data from the area. A central component in all calculations is a mathematical model that relates the amount of pesticide determined by a sampler to wind conditions and source activities during the sampling period. The model allows to separate short-distance transport (from known potential sources) and long-distance transport (from unknown far-away sources). Standard statistical methods can be used for checking significance of model components.

The application of the proposal will be illustrated by a numerical example involving real local data.

European Symposium on atmospheric transport of synthetic pesticides

Brandenburg Academy “Schloss Criewen”
31 st May and 1 st June 2023

Modifying monitoring programmes to enable the investigation of pesticide transport

Dr. Werner Wosniok
werner@wosniok.de

1

Pesticide monitoring: general features

- Generates information about the amount of pesticides collected by a sampler
  - at the sampler position
  - during the sampling interval
- This “amount” will for simplicity be termed here ”concentration”
- Important: the transport process
  - from where
  - on which way to the sampler

  is unknown

2

Why consider transport?

- Studies have documented pesticides in the air clearly outside of application areas
  ==> Clear need to reduce the amount of pesticides in the air
  ==> Whom to blame?
  - All worldwide pesticide users /producers?
    ==> Total ban: would solve the problem, but is unrealistic
  - Local pesticide users? (users underlying national legislation)
    ==> Only realistic if their contribution to pesticides in ambient air can be shown. Long-range transport may play a role.
- Suggests the investigation of the pesticide transport process:

  To what extent can monitoring results be explained by local pesticide application?

3

Standard monitoring and transport detection

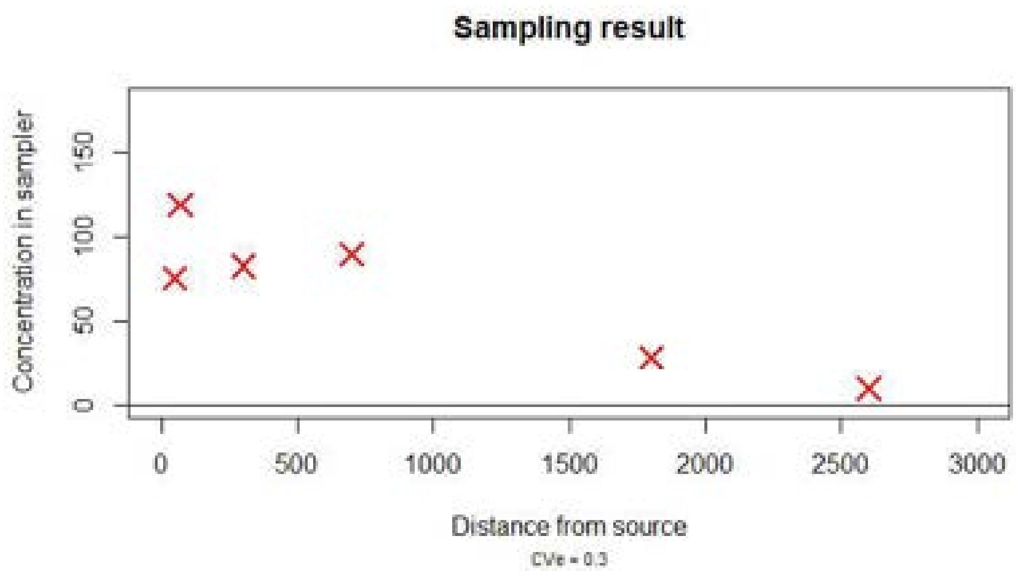
Though not designed to investigate transport, standard monitoring can provide information about pesticide transport, if some strong conditions hold:

- A1: Wind has known constant speed and known constant direction in the area of interest
- A2: There is a sufficiently large number of samplers allocated in wind direction in cleverly selected increasing distance from the (known) application area
- A3: Samplers are active during pesticide application and the whole subsequent dispersion period

Given these conditions, sampling results should show a pattern of decreasing concentration with increasing distance from the source.

4

A fictitious standard monitoring result



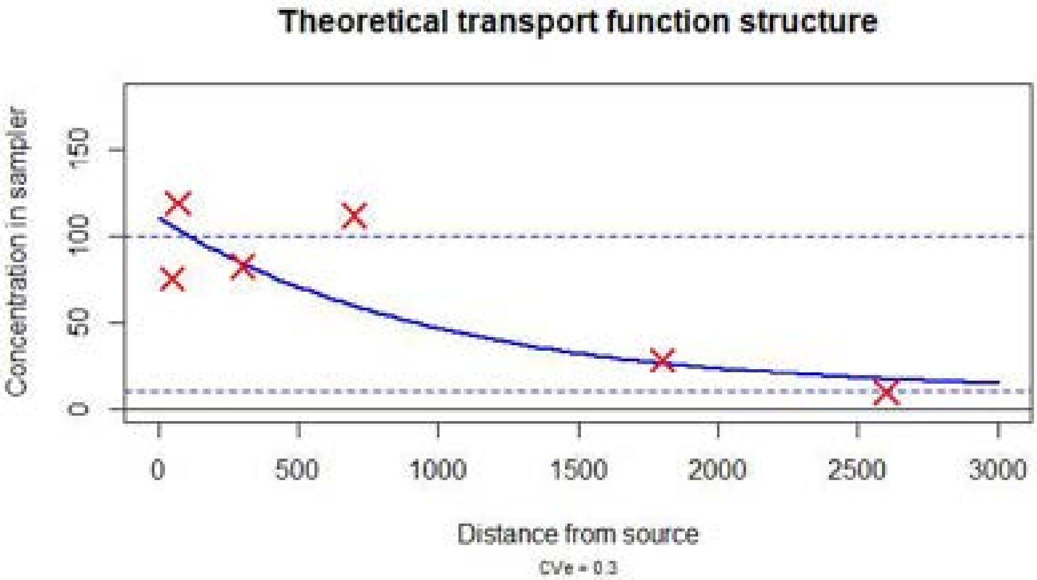
5

Typical features of pesticide monitoring results

- The observed concentration (red x) decreases with distance from source
- Observed concentration is never negative
- There may be a baseline concentration > 0 due to long-range transport from unknown far-away sources. Observed concentration then does not drop below baseline.

6

A theoretical transport function



7

A simple theoretical transport function has mathematical form …

$$y_{s,t} = b_1 + b_{2,t} \cdot \exp(-b_3 \cdot d_s) + \varepsilon_{s,t}$$ "Transport function"

$y_{s,t}$	Concentration measured by sampler *s* at time *t*	observed
b_1	Baseline concentration due to long-range transport	Estimated from data
b_2	Concentration at source during application	Estimated from data
b_3	Decay factor	Estimated from data
d_s	Distance between source and sampler *s*	known
$\varepsilon_{s,t}$	Random error term	

Parameter estimation:
constrained nonlinear regression

8

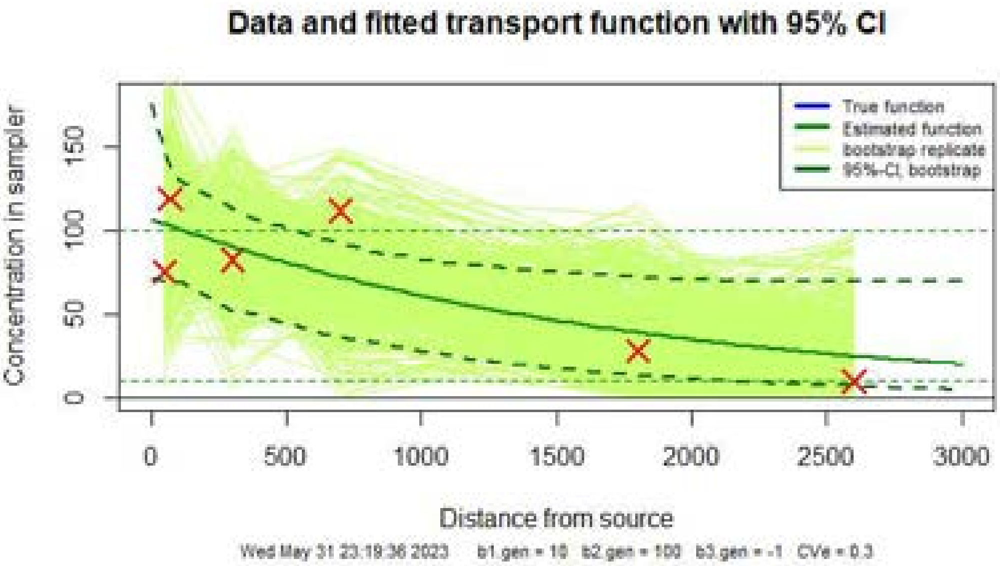
What is the transport function good for?

Answers the questions

- Was there a pesticide transport from application area to the sampler?
- Is long-range transport detectable, and if so, how large is its contribution to the total concentration?
- From what distance on is the local contribution below an acceptable level (if such exists…)

9

Fitted transport function with details



10

Adjusting standard monitoring: investigating transport under assumptions A1 – A3

Additional to assumptions A1 – A3, more is needed:

1) The number of sampler results must be made "large enough" because …

- If there is a relation between pesticide application and measured concentration, it should be recognized with sufficiently high probability
- If there is no such relation, this must be recognized with sufficient probability
- More sampler results: higher detection probability

11

2) The allocation of samplers in the area must be such that the concentration gradient along distance can be identified

- The necessary number of samplers and their optimal geographical allocation can be determined by methods of sampling design.
- Sampling design would be determined by stochastic simulation, which involves among other information the transport function.
- Initial "educated guess" about the size of the model parameters is needed.
  Can be taken from earlier experience, initial experimentation, or a pilot study.

12

BUT …

The assumption

- A1: Wind has known constant speed and known constant direction in the area of interest

is highly unrealistic.

In fact, wind direction and speed are highly variable and rarely, if at all, attain their mean values.

This can be seen in publicly available data provided by Deutscher Wetterdienst, ww.dwd.de.

As an example: data for Angermünde, 15 km from here.
Next plots show information on 10-minute means of wind speed and direction.

13

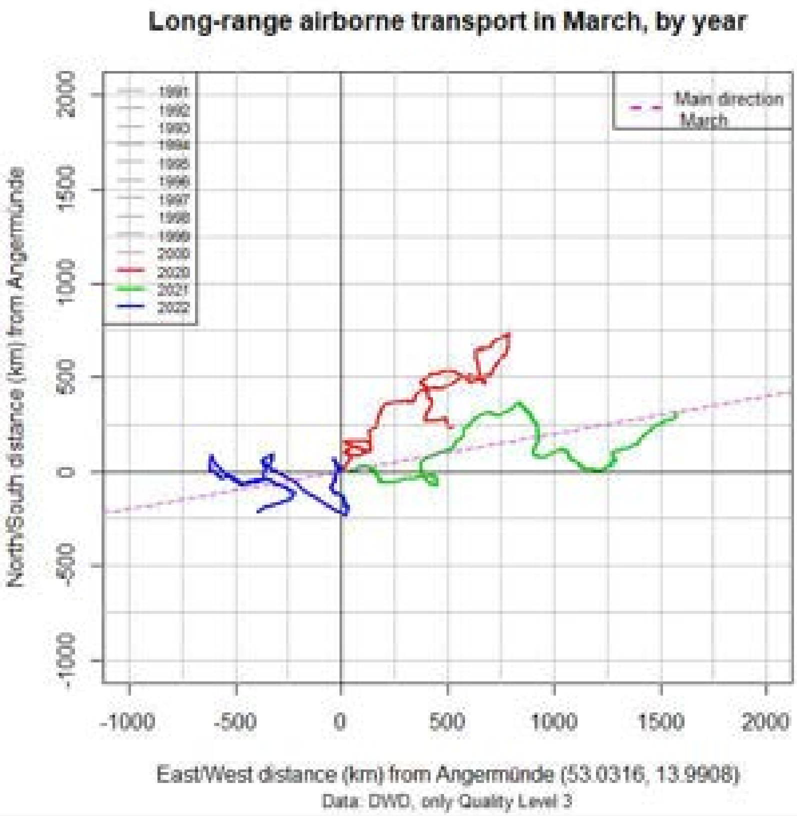


Figure 3a:
Long range transport of an air volume in March, by year, large scale

14

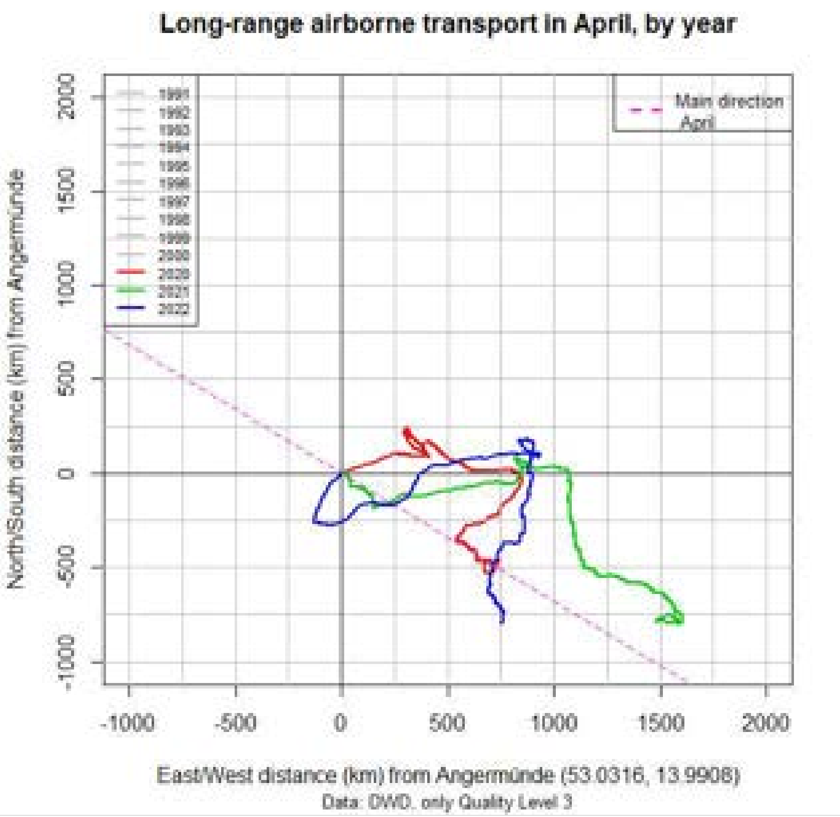


Figure 3b:
Long range transport of an air volume in April, by year, large scale

15

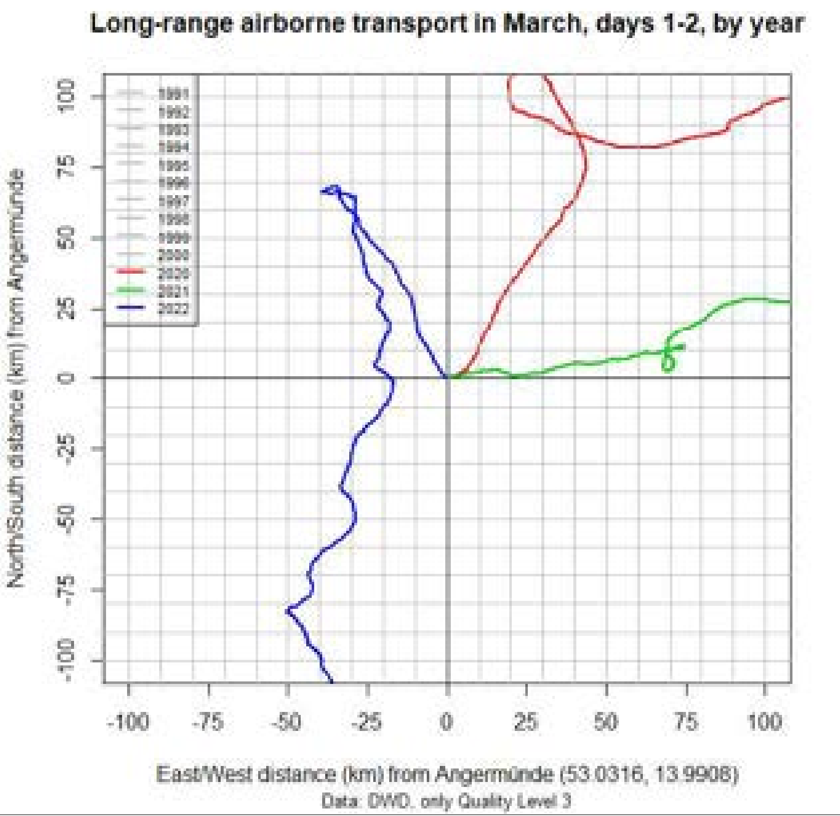


Figure 4a:
Long range transport of an air volume on March 1-2, by year, small scale

16

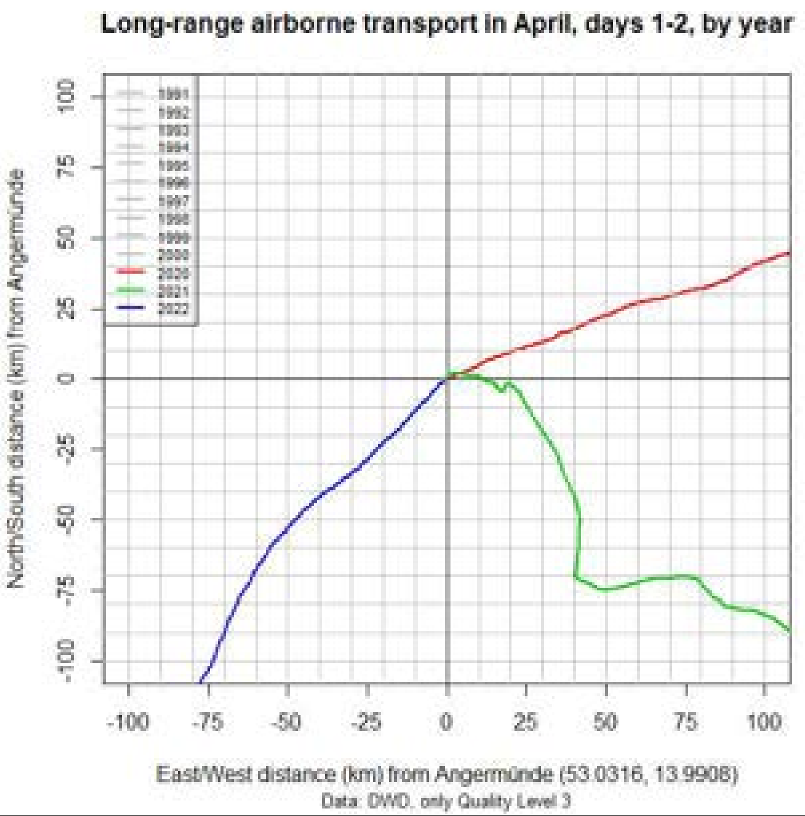


Figure 4b:
Long range transport of an air volume on April 1-2, by year, small scale

Main wind direction?

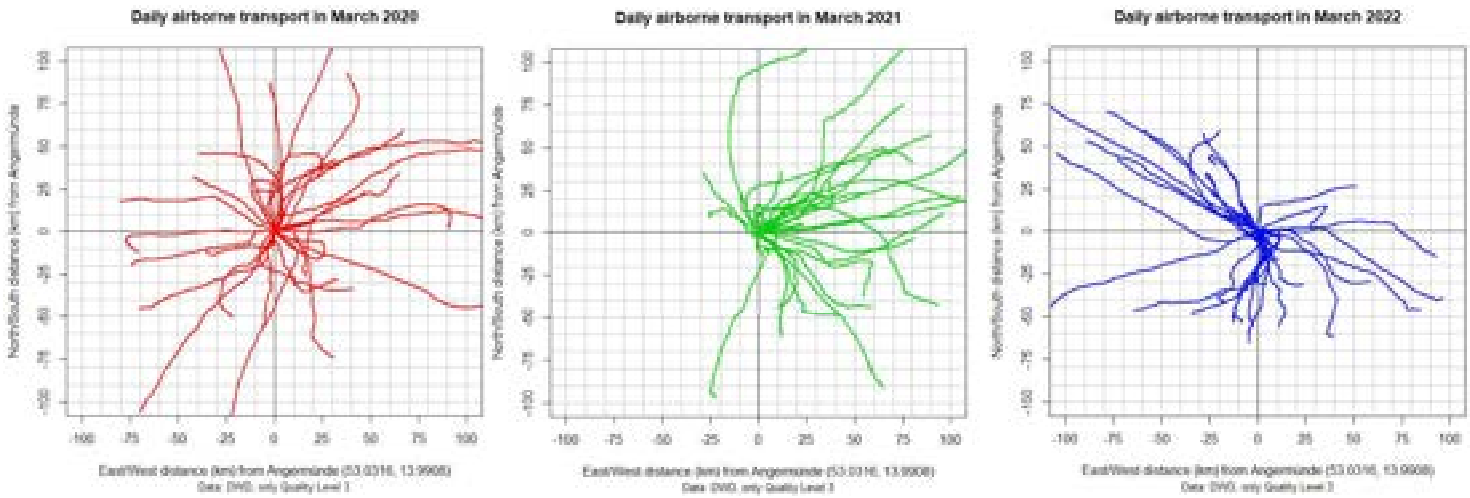


Figure 5a: Transport of an air volume within one day in March, years 2020-2022

Conclusion from inspecting wind data

Assuming constant wind speed and direction is likely to generate wrong conclusions about transport in several respects

- Observed **zero** concentration does not imply “no transport”: transport may have taken place, but
  - with other speed than assumed or
  - in other direction than assumed
- Observed **non-zero** concentration does not imply “transport from assumed source” because
  - transport occurred from other source than assumed

19

What to do?

- Use actual wind conditions to determine the way from source to sampler
- Use information about actual pesticide application (at least qualitatively)
- Replace “distance from source” by the “effective distance”, the way that the air volume has actually made on its way from source to sampler, and include the expected dilution on this way
- Use the “effective distance” in the transport function and do sampling design plus analysis as outlined before
- Optimize sampler allocation in 2 dimensions (not only on a line)
- Use historic wind trajectories from the vicinity of the sampling area

20

More about “effective distance” (this slide summarizes discussion after presentation)

- Movement of an air volume is, of course, a 3 dimensional process
- However, measuring the actual movement of an air volume in 3 dimensions is hard and expensive
- The same holds for modelling it (in order to save measuring) with sufficient resolution
- Therefore the previous slide proposes to use a 2 dimensional approximation of the air volume movement.
- This is certainly better than the completely unrealistic assumption of constant wind direction and speed, as is shown by e.g. slide 18
- Wind direction and speed in constant height can be obtained with relative small effort at each monitoring location, and preferably also at further locations in the area.
- Historic wind trajectories from public sources can be used for sampling design

21

Summary

- Assuming constant wind direction and speed is too optimistic, invites wrong conclusions
- Investigating pesticide transport needs knowledge about actual wind conditions and including these in the analysis, e.g. following the “effective distance” concept
- Knowledge about actual pesticide application (where, when) is needed
- The necessary number of samplers and their positions should be determined by methods of sampling design. This needs initial information from previous knowledge and / or a pilot study
- Collected data must evaluated by a mathematical model which allows quantifying local and long-range transport. Such an evaluation can be done by combining known statistical methods.

22

REPORT of the
European Symposium on atmospheric transport of synthetic pesticides
What are the implications of monitoring results for regulatory measures?

Contacts

Brandenburg Academy "Schloss Criewen"
Uta Böhme

+49 3332 838841

info@brandenburgische-akademie.de

Bündnis für eine enkeltaugliche Landwirtschaft e.V.
Anna Becker

+49 1516 5660990

anna.becker@enkeltauglich.bio

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