



In search of alternative herbicides to treat Swiss railway tracks

Valérian Zeender

SCS 2024, 05/09/24, Fribourg

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Maintenance of the railway infrastructure

- Visibility of signals
- Stability of the railway track
- Obstacle-free walkways



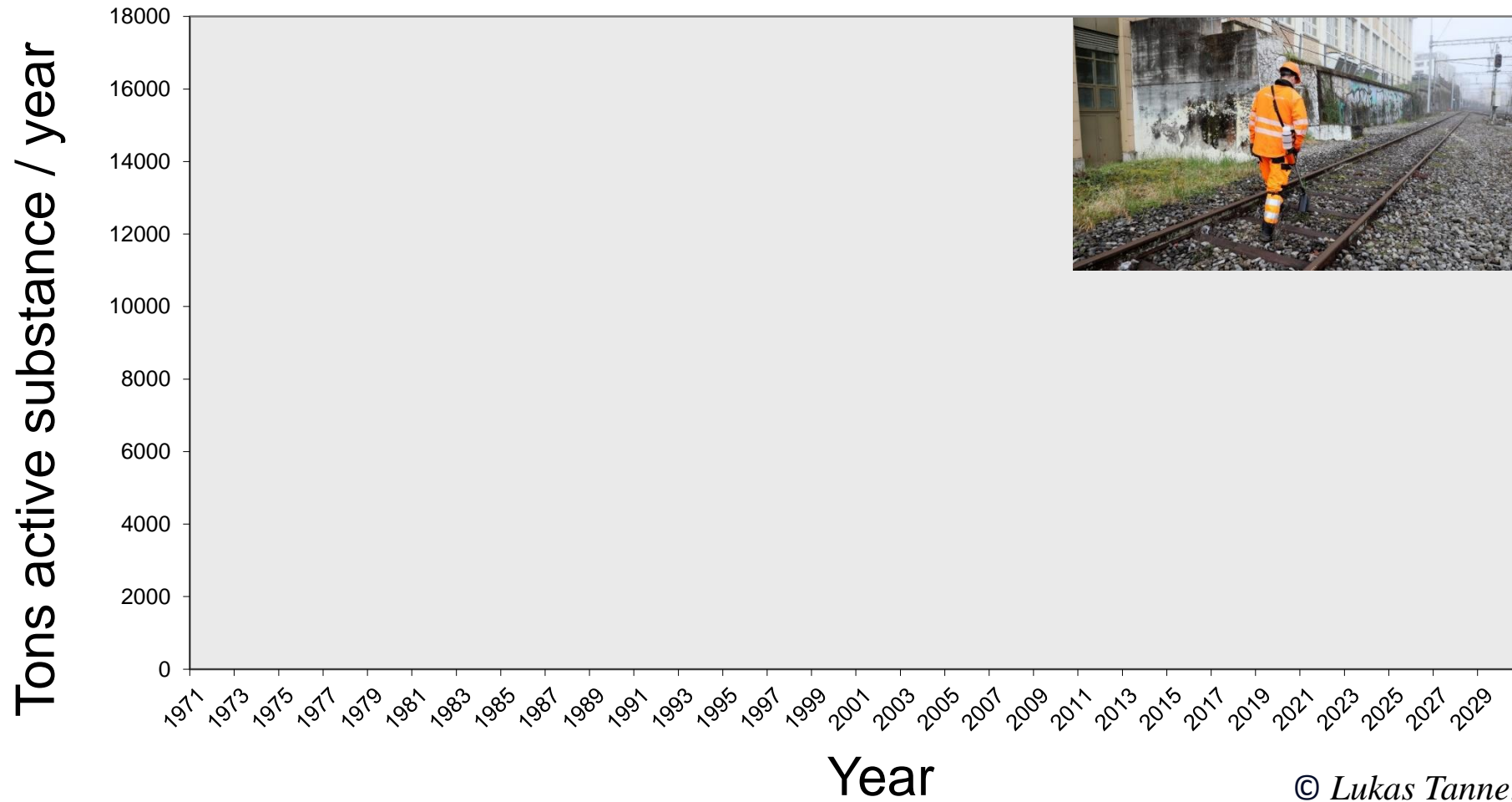
Vegetation management

- **Herbicides**
- Mechanical removal
- Growth-inhibiting materials
- Hotwater
- «Green carpet»
- Autonomous lawn-mowers
- Electric weeding





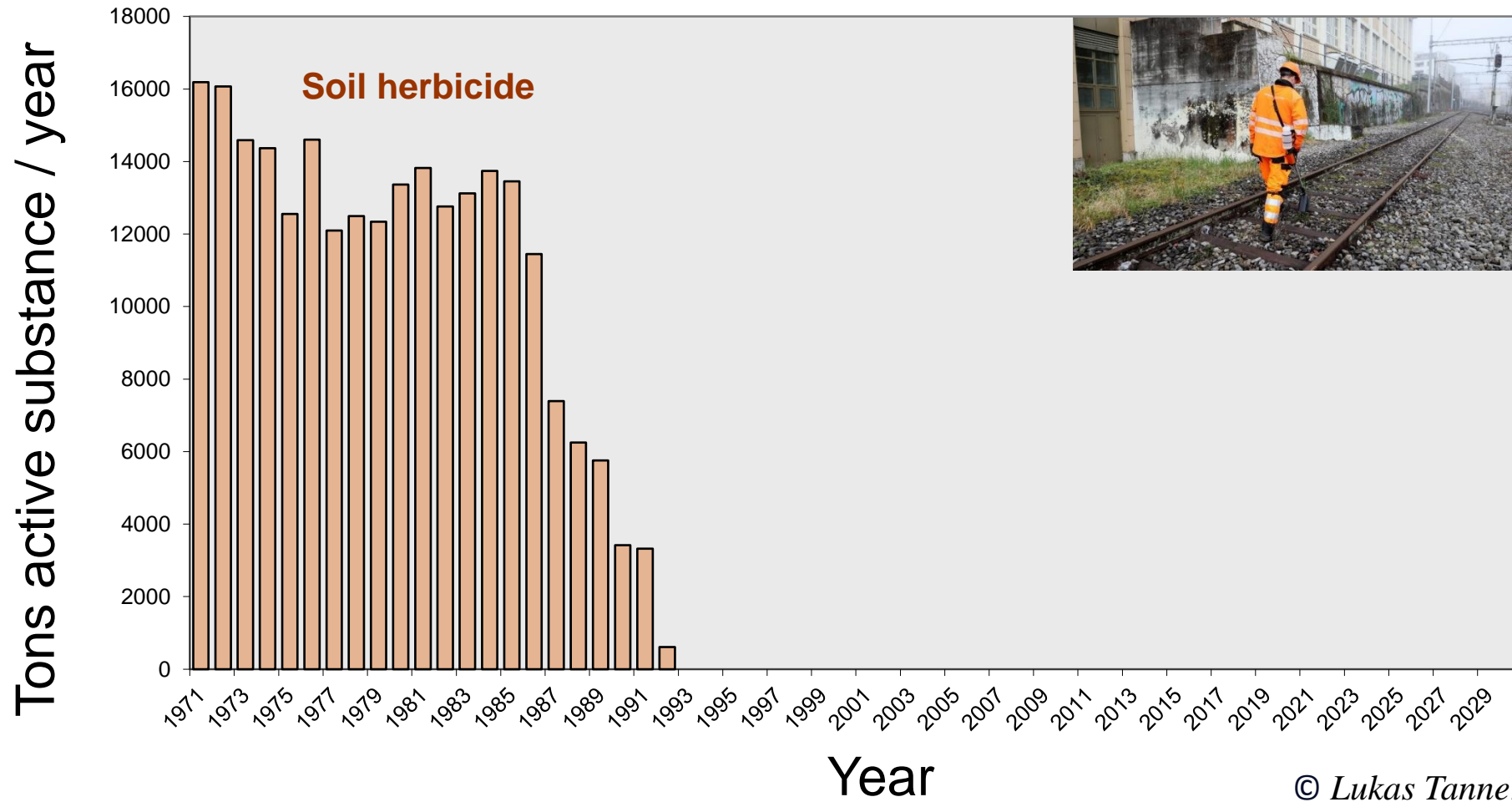
Herbicides used by the Swiss railways (SBB)



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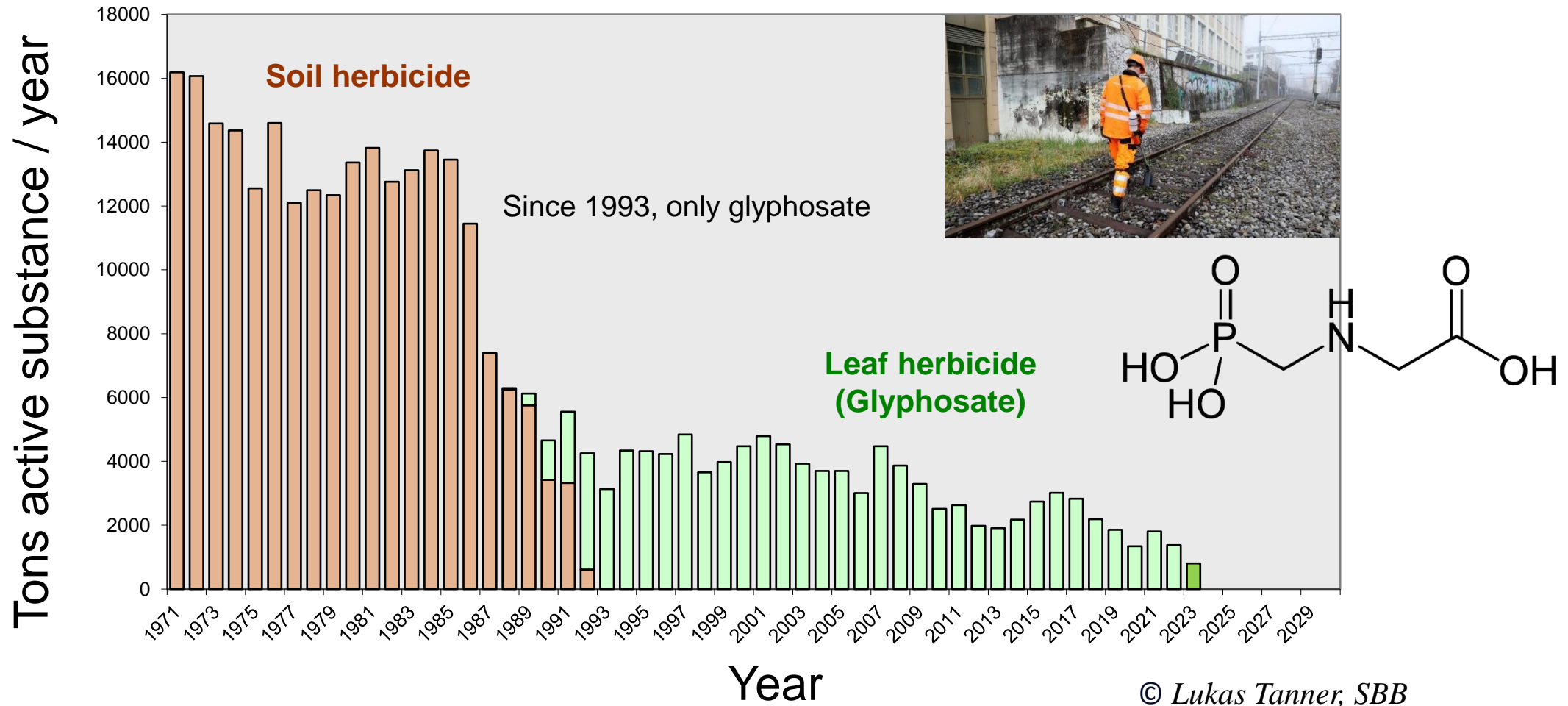
Herbicides used by the Swiss railways (SBB)



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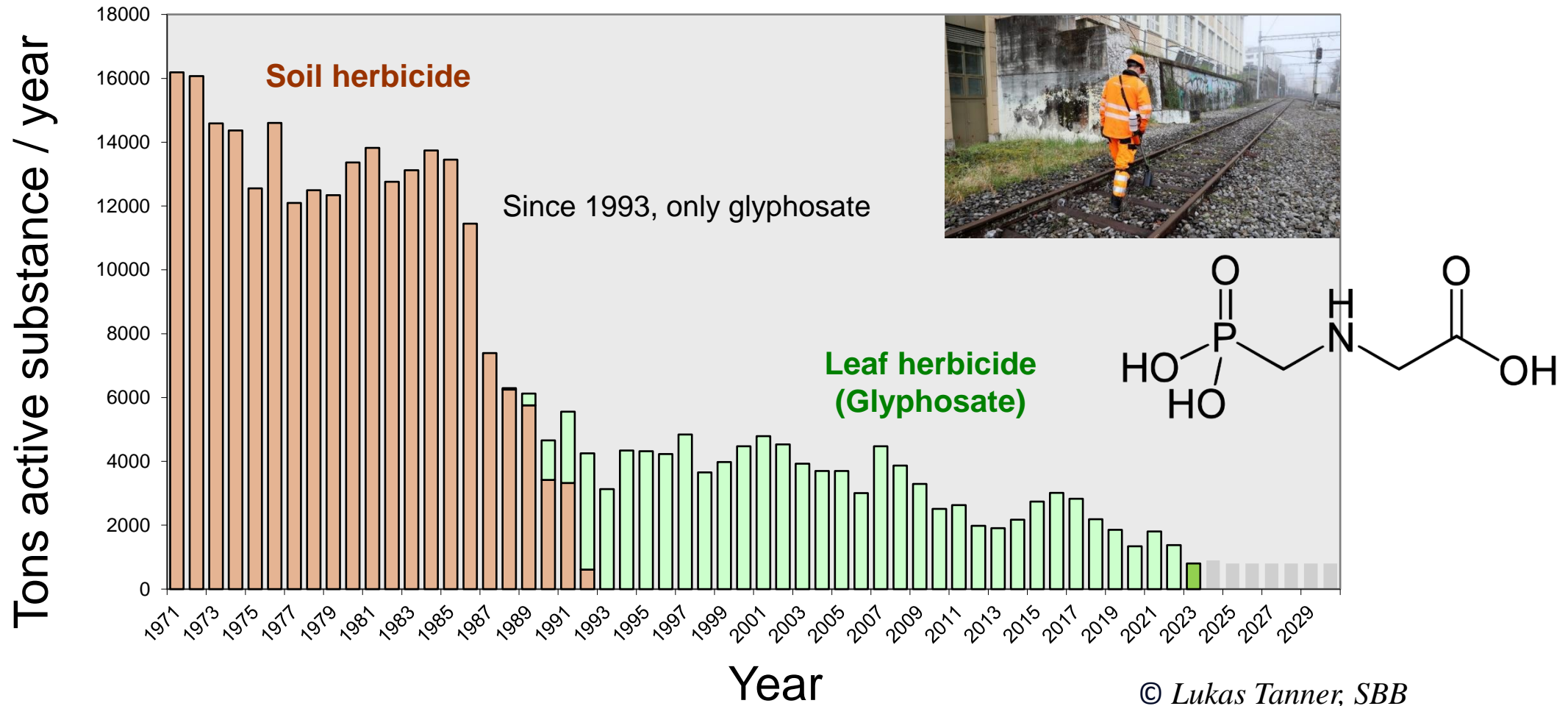


The only herbicide currently used by the Swiss railways (SBB) is **glyphosate**





The only herbicide currently used by the Swiss railways (SBB) is **glyphosate**



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The problem

- Glyphosate is under pressure
- The SBB is searching for alternative herbicides
 - To replace glyphosate if its use was restricted
 - To fill gaps in efficacy
 - To prevent herbicide resistance development



Alternative herbicide from a **groundwater** perspective

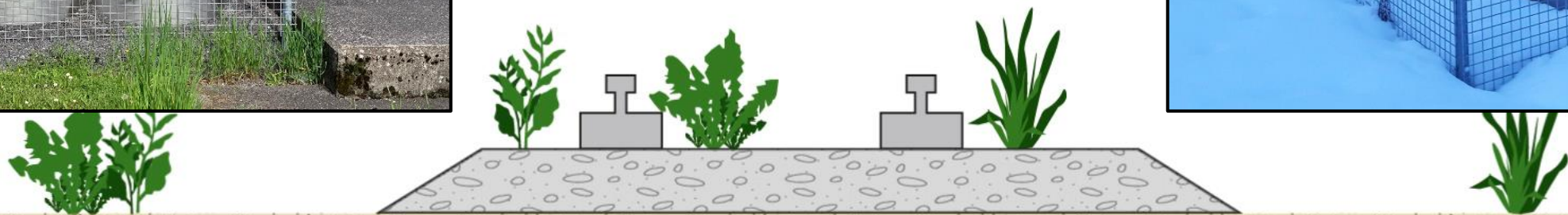
- Herbicides that meet specific criteria to ensure effective and safe use in the context of railway tracks (strong draining potential):
 - High sorption in the soil
 - Rapid degradation (also for metabolites)
 - Low application rates

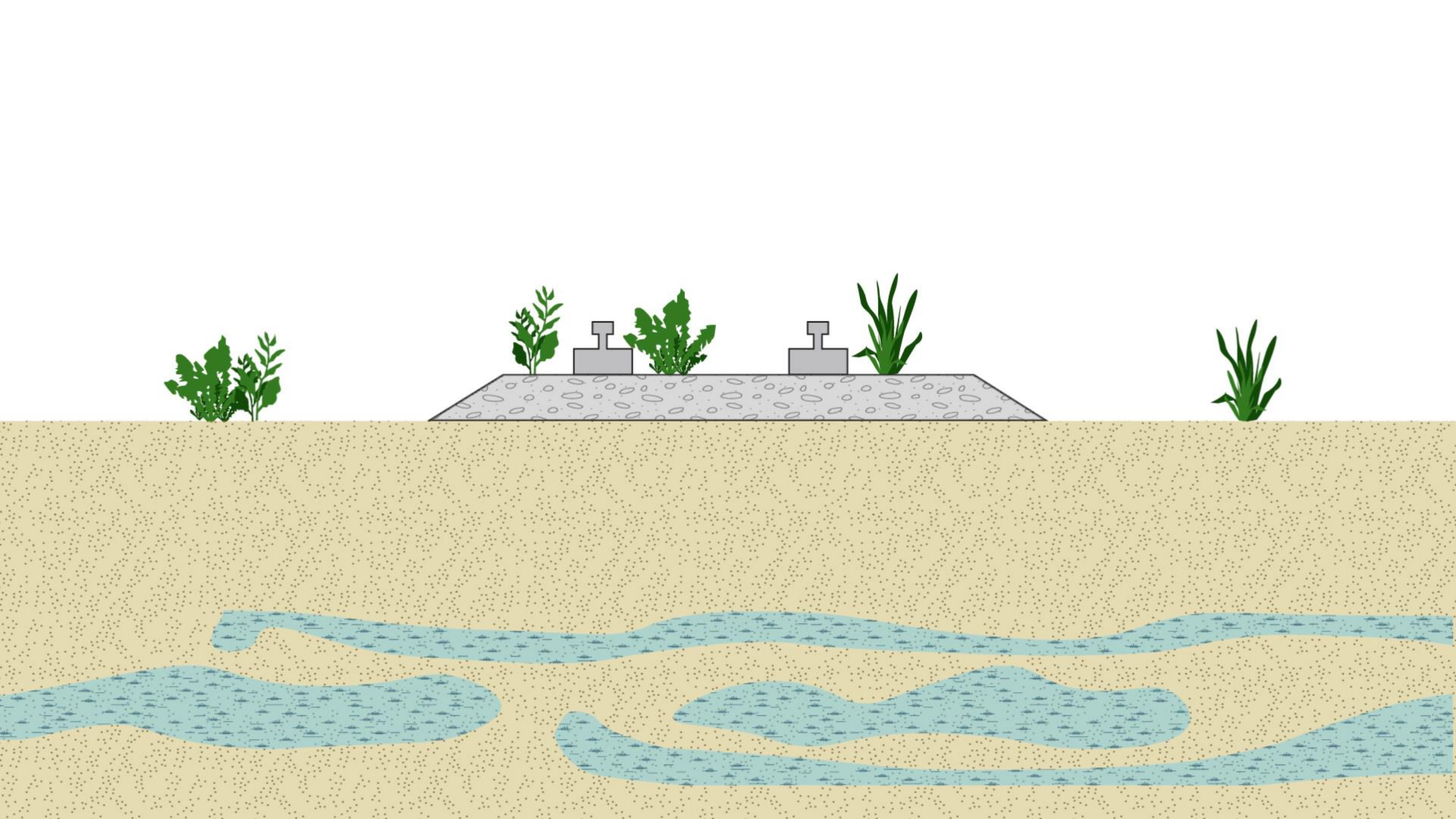


Experimental setup



There are 3 replicates per soil-type







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Applied herbicides



Applied herbicides

● Auxins

2,4-D
MCPA
Dichlorprop-P
Mecoprop-P
Fluroxypyr
Triclopyr

● Sulfonylureas

Iodosulfuron-methyl
Foramsulfuron
Thiencarbazone-methyl

● Pigment synthesis inhibitors

Mesotrione
Diflufenican
Flumioxazin

+ Glyphosate



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Results



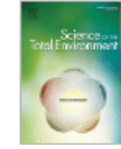
Previous studies

- Quizalofop-P
- Pelargonic-acid



Science of The Total Environment

Volume 909, 20 January 2024, 168396



Leaching of herbicides and their metabolites in lysimeters filled with soils from railway tracks

[Ignaz J. Buerge](#) , [Roy Kasteel](#), [Thomas Poiger](#)

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Degradation and sorption of the herbicide pelargonic acid in subsoils below railway tracks compared to a range of topsoils

Research | [Open access](#) | Published: 05 January 2024

Volume 36, article number 4, (2024) [Cite this article](#)

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[Thomas Poiger](#) , [Joanna Müller](#), [Roy Kasteel](#) & [Ignaz J. Buerge](#)

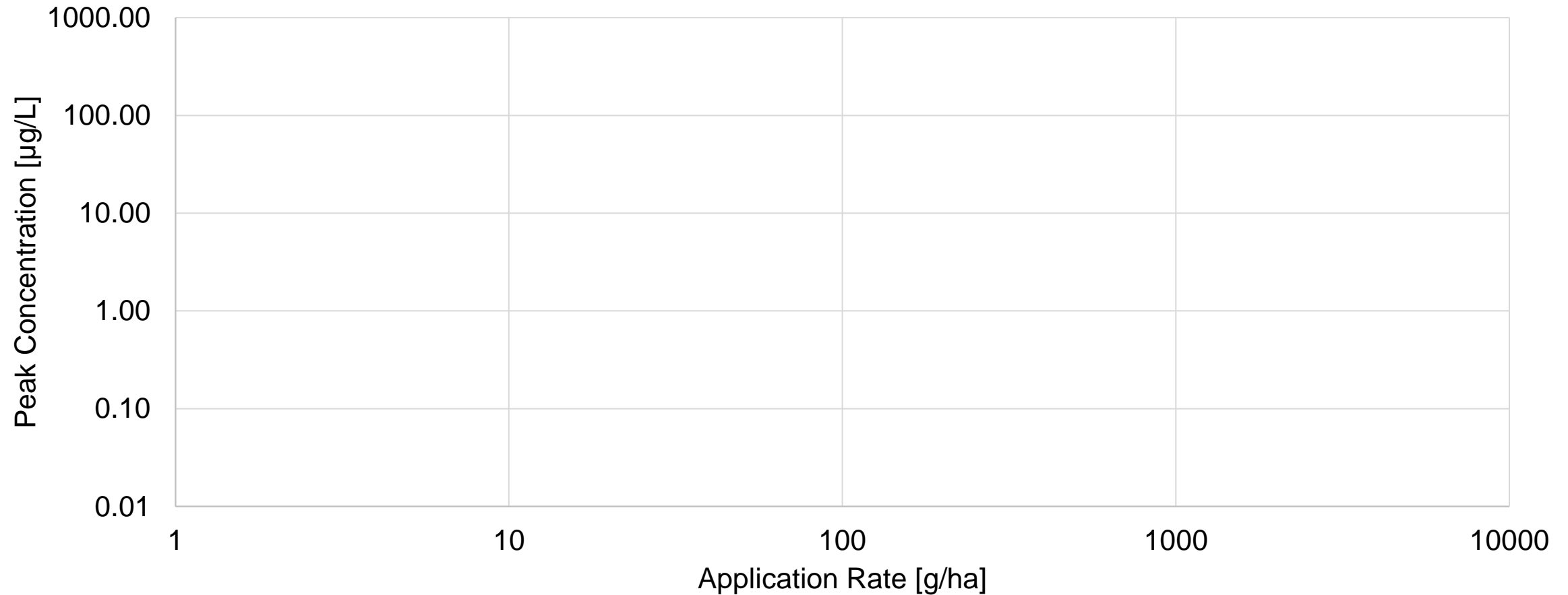


Peak concentrations

● Auxins

● Sulfonylureas

● Pigment synthesis inhibitors



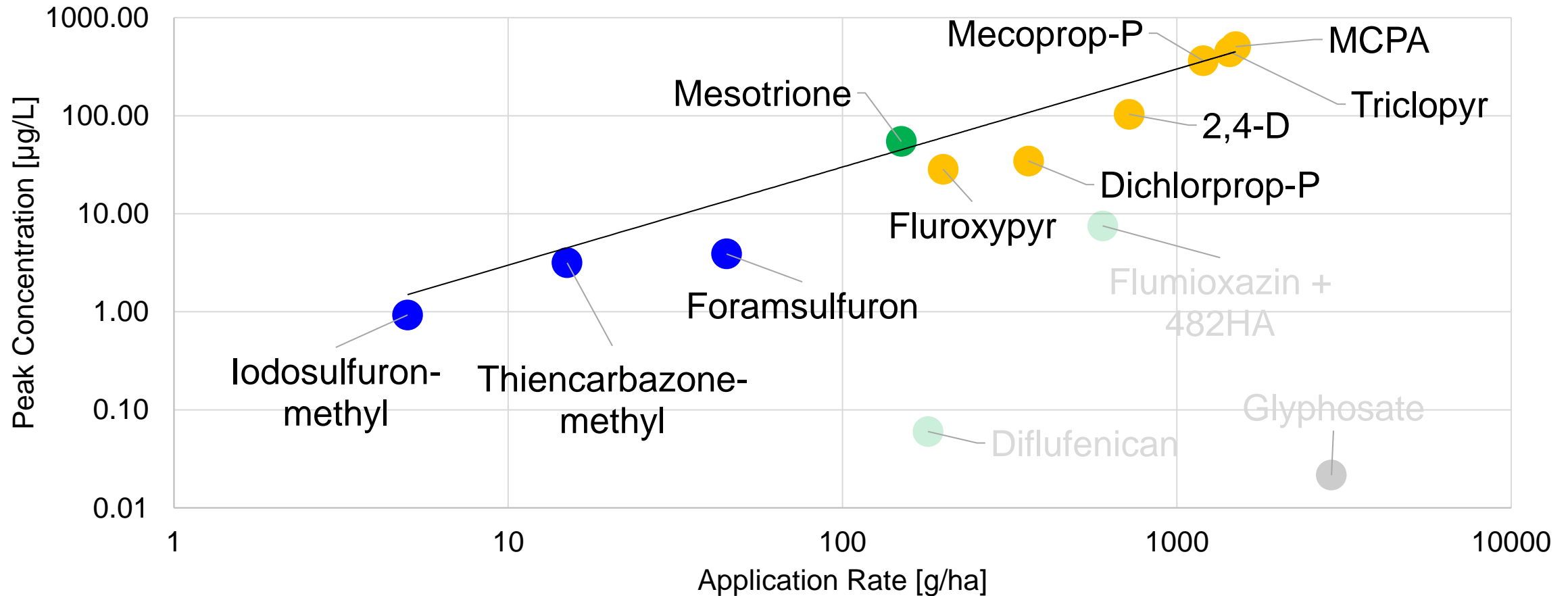


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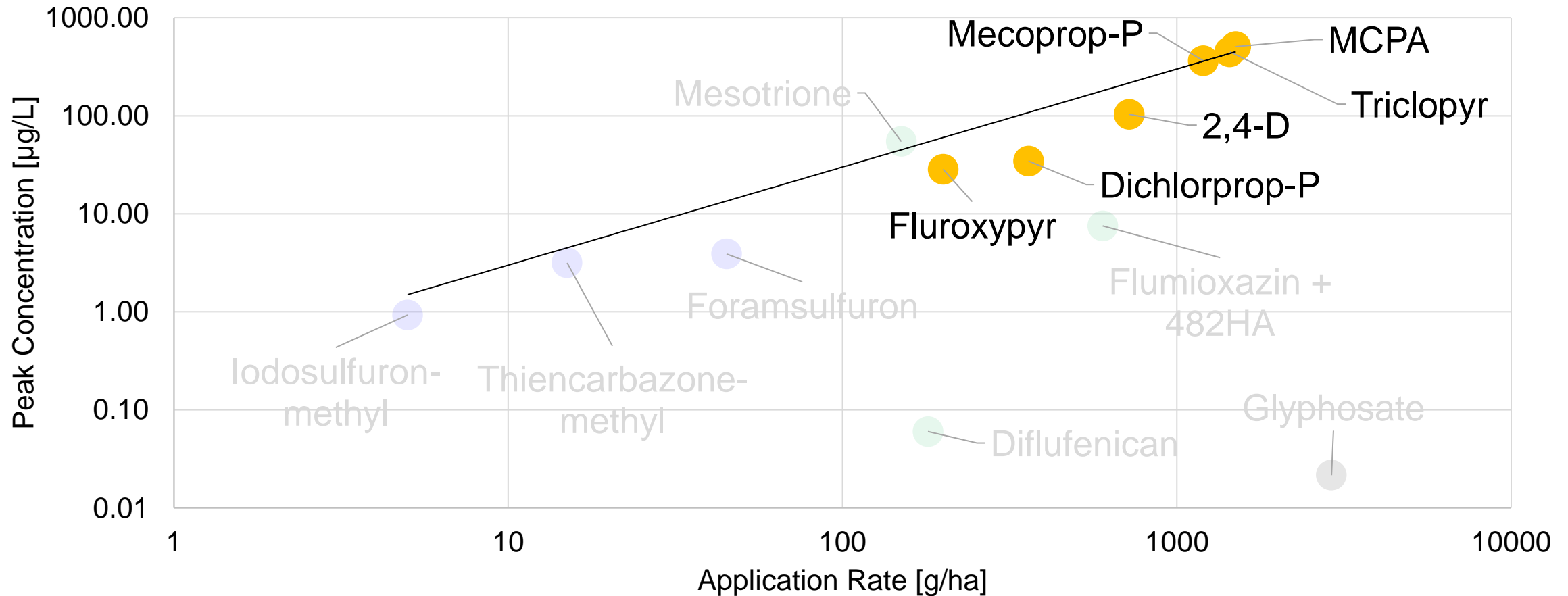


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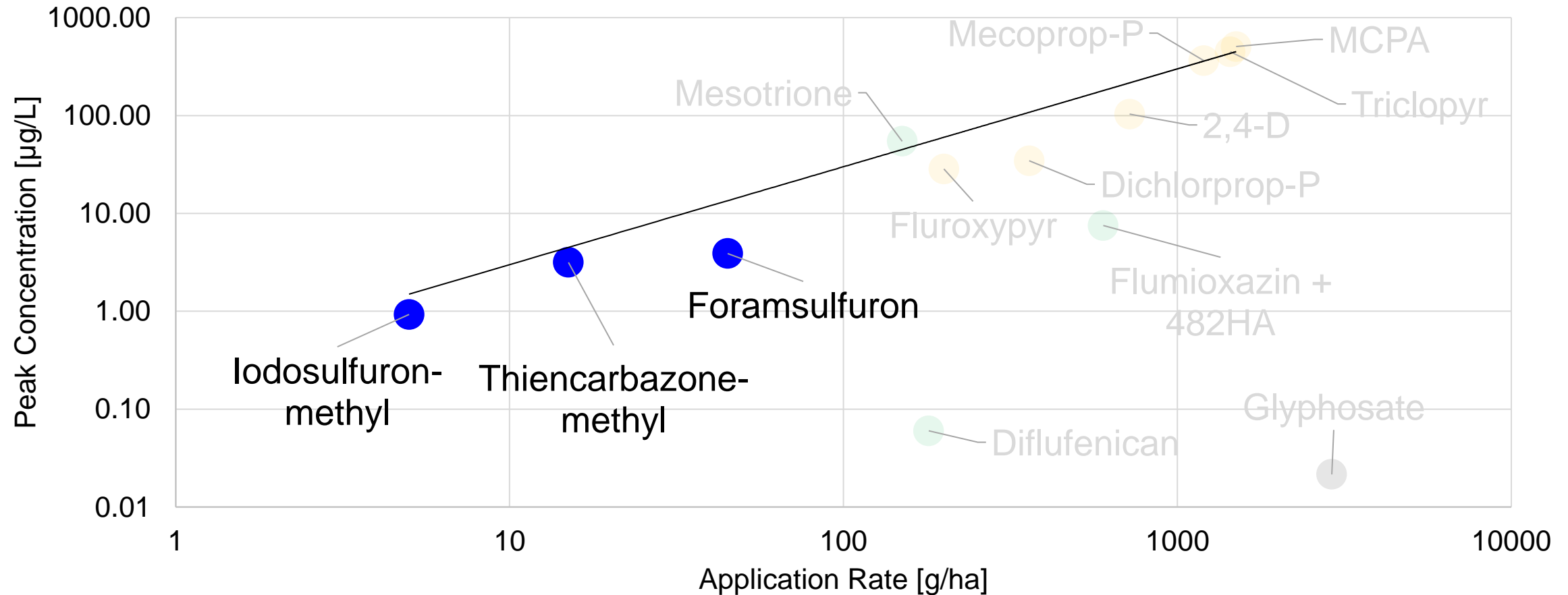


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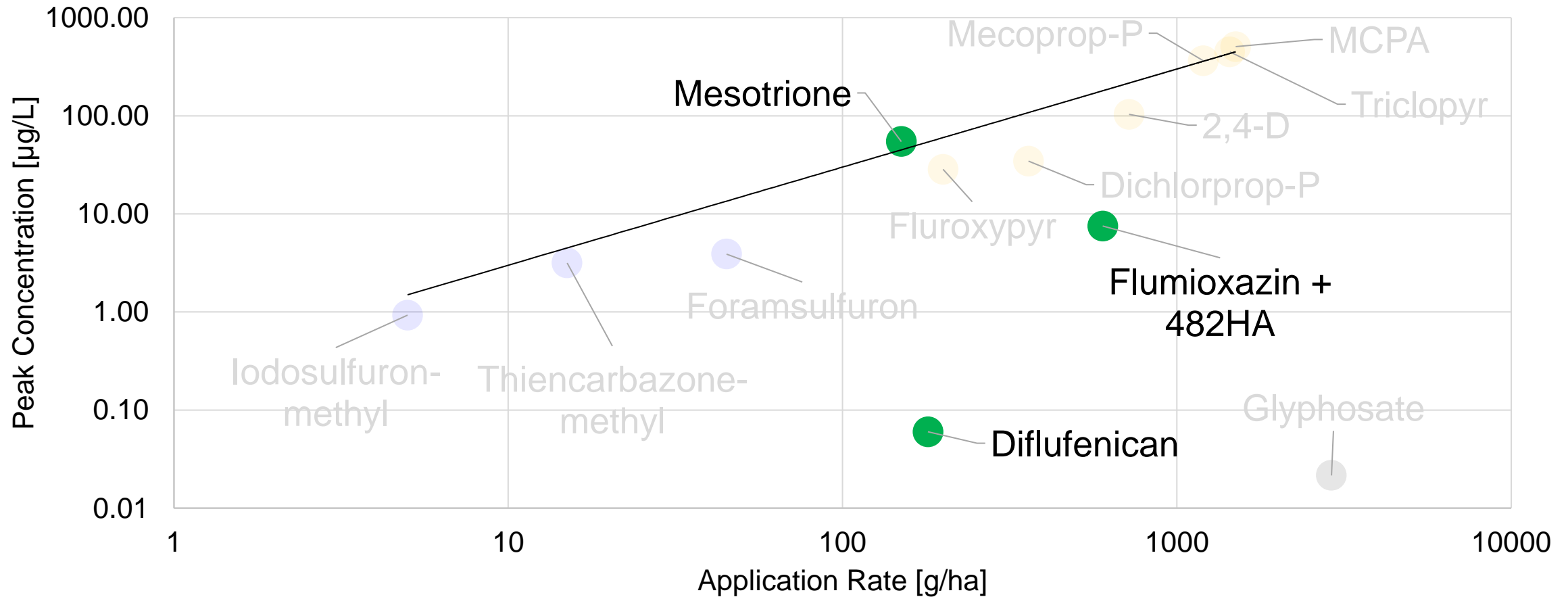


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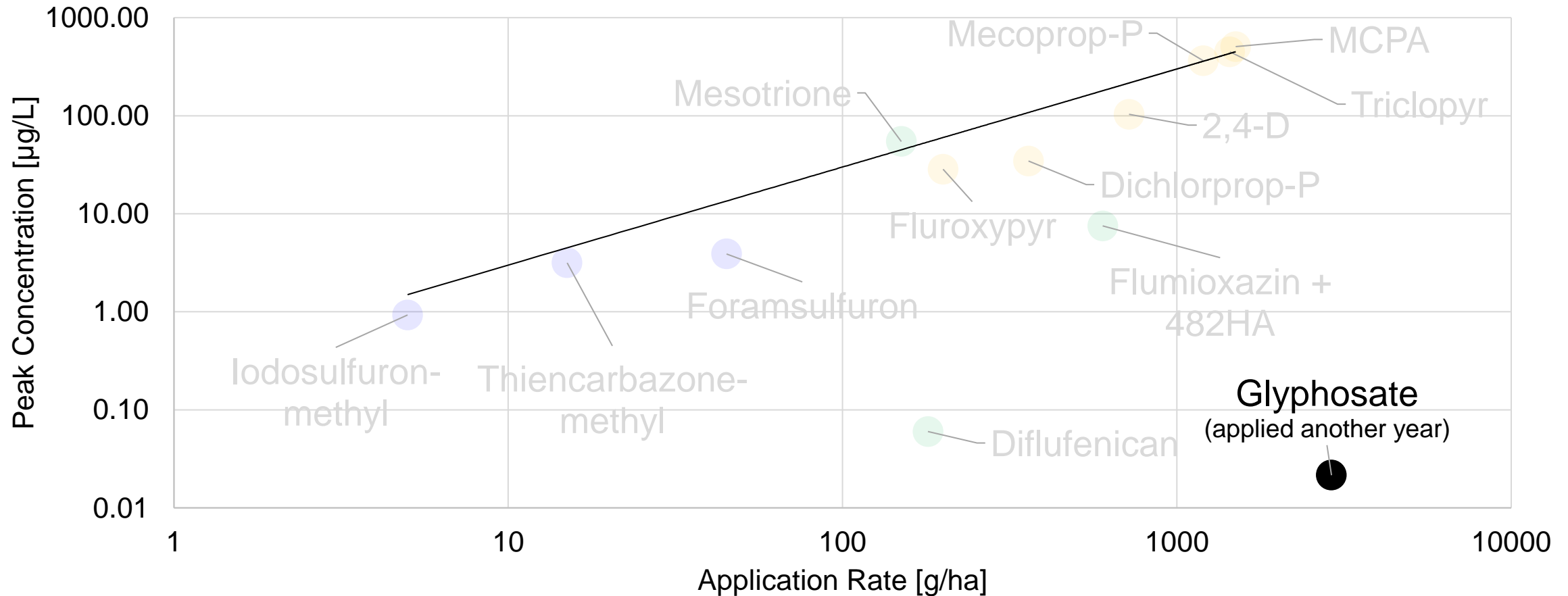


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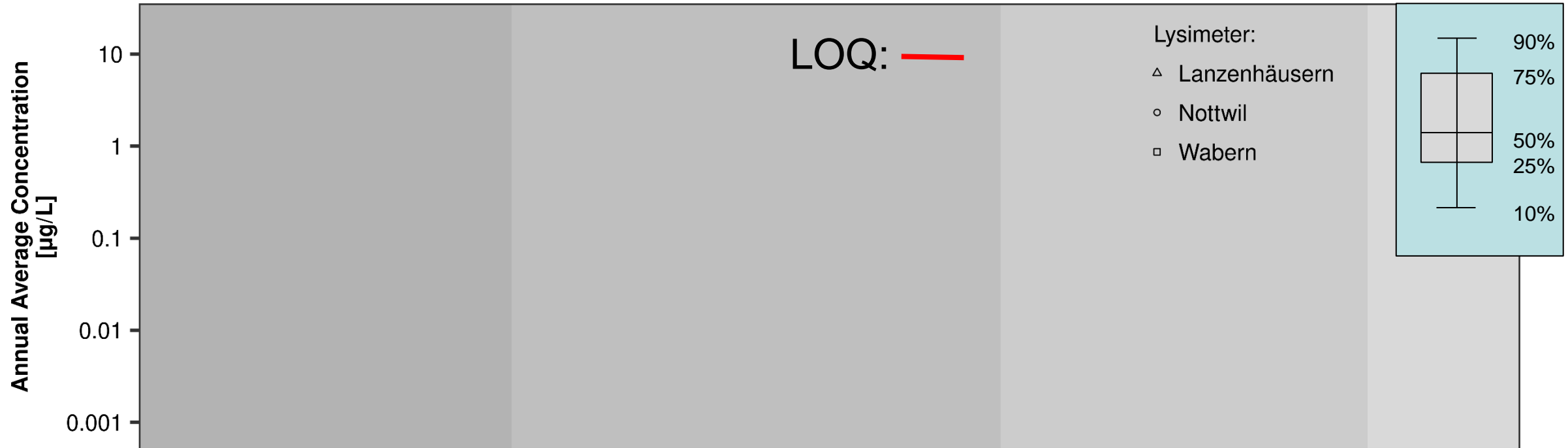
Annual average concentration

● Auxins

● Sulfonylureas

● Pigment synthesis inhibitors

Glyphosate





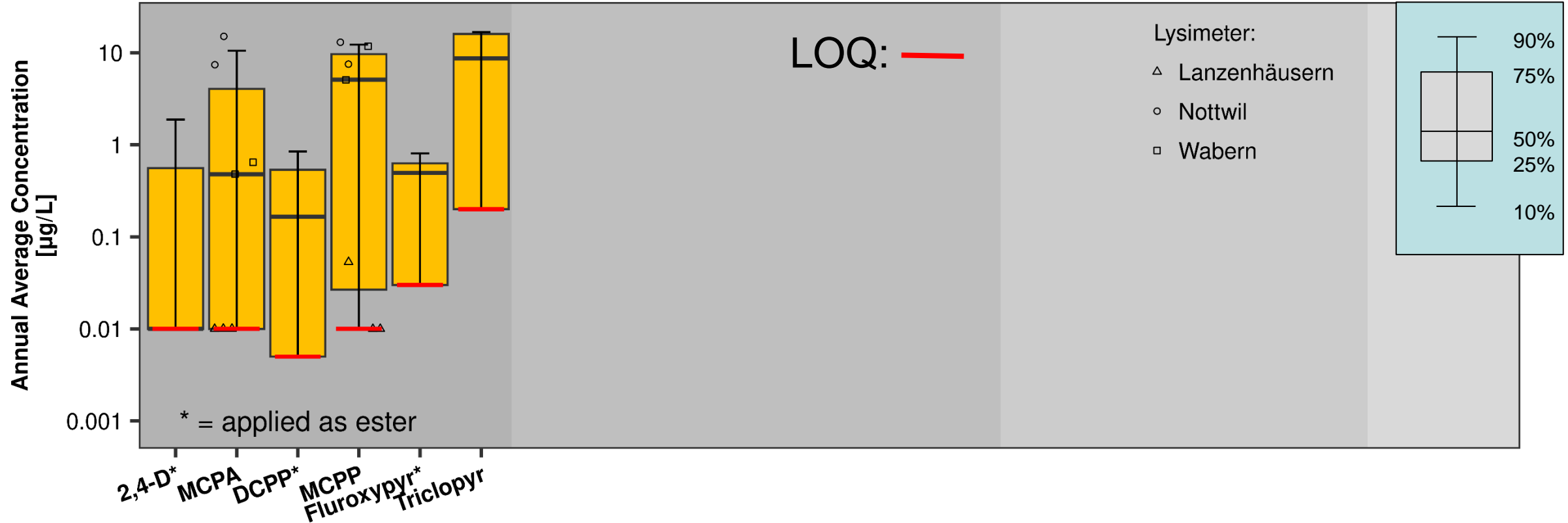
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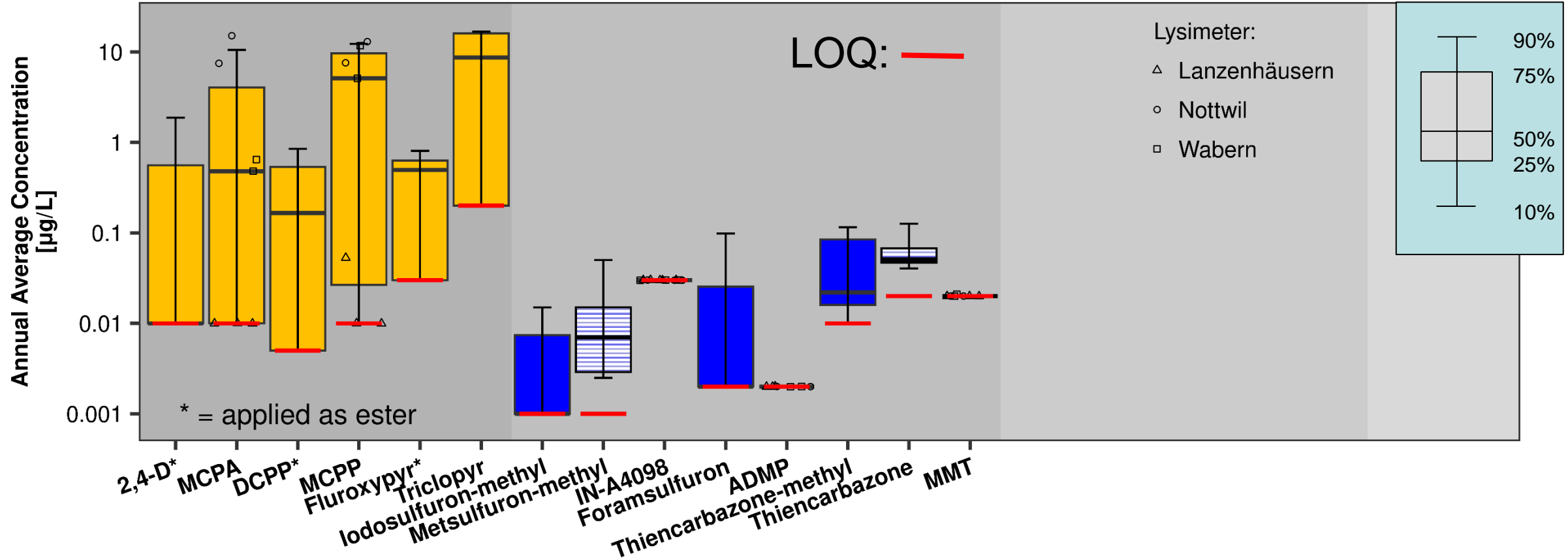
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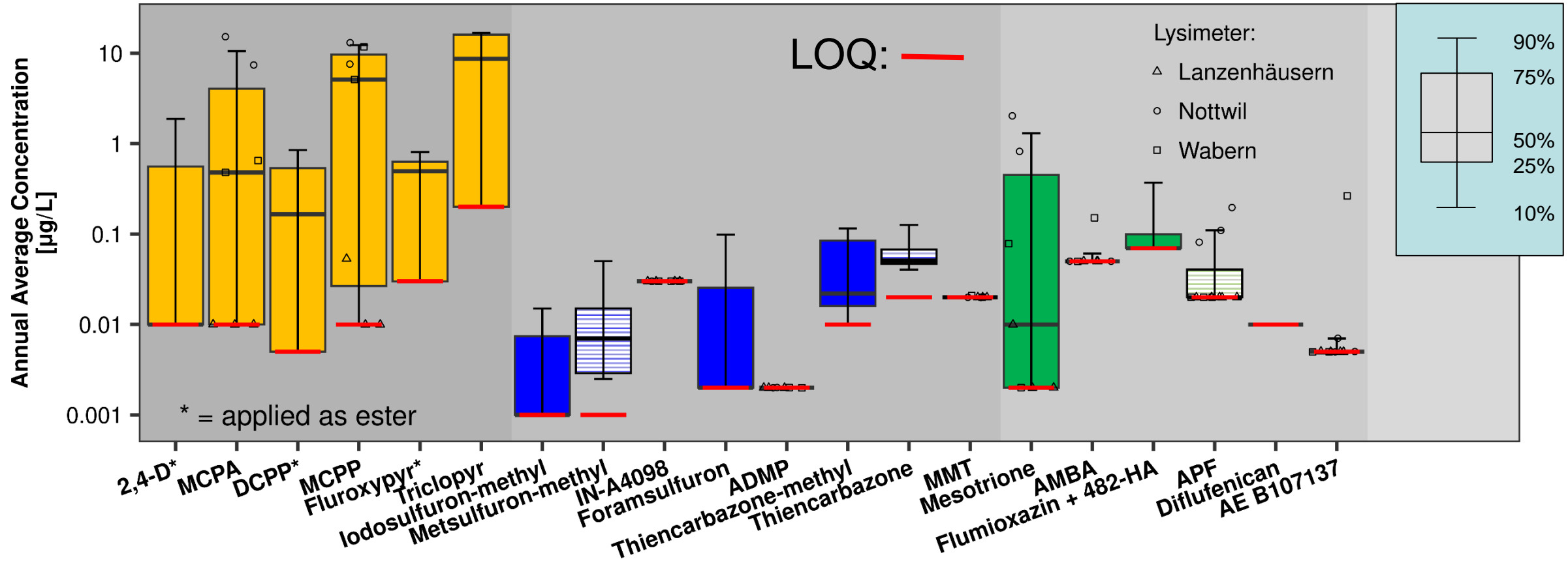
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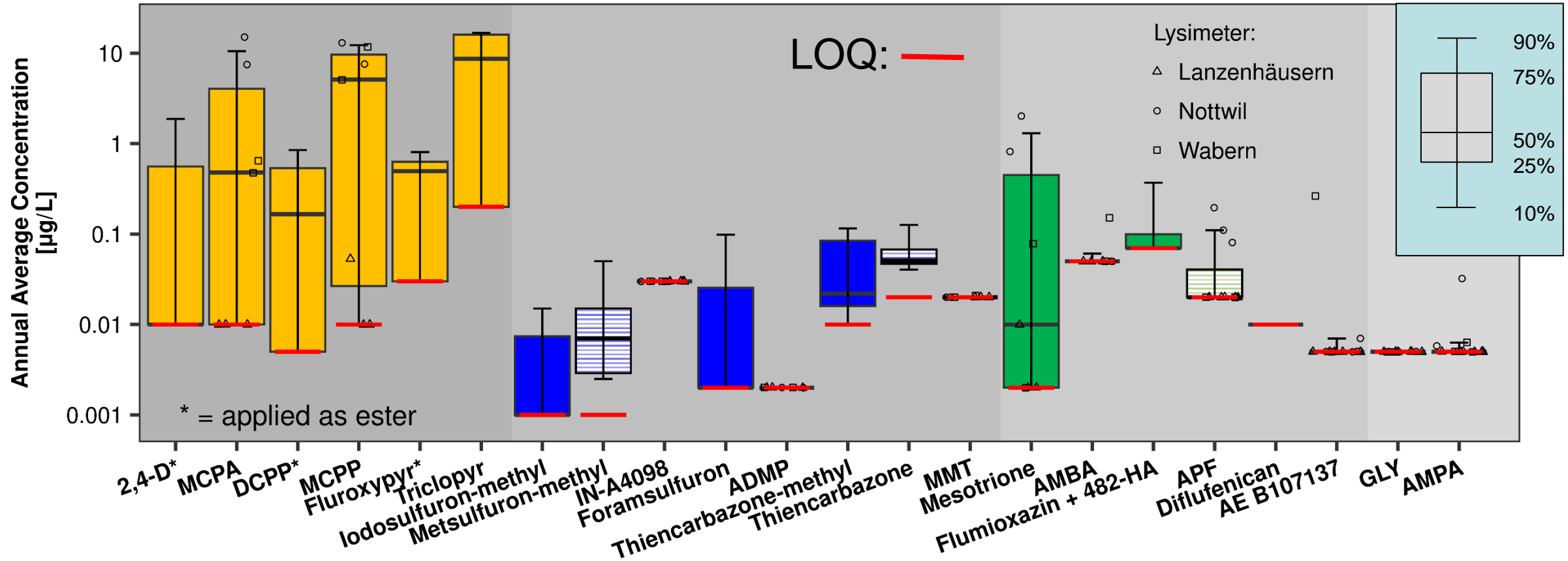
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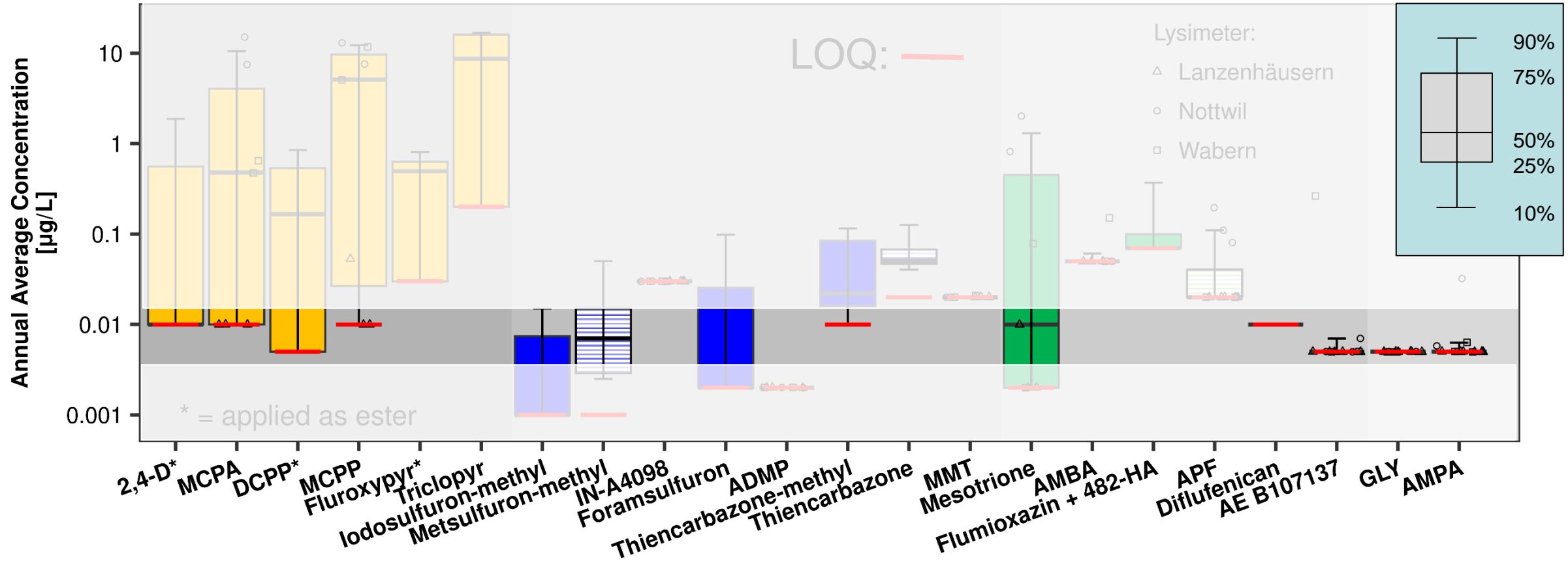
Annual average concentration

Auxins

Sulfonylureas

Pigment synthesis inhibitors

Glyphosate





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Conclusions

Summary



● Auxins

● Sulfonylureas

● Pigment synthesis inhibitors



2,4-D MCPA Dichlorprop-P Mecoprop-P Fluroxypyr Triclopyr
Mesotrione



Iodosulfuron-methyl Foramsulfuron Thiencarbazone-methyl
Flumioxazin



Diflufenican (previous study) Quizalofop-P (previous study) Pelargonic-acid
Glyphosate



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Take-home message



Take-home message

- Choosing the right herbicide is a complex process:
 - Efficacy
 - Herbicide resistance in plants
 - Ecotoxicology
 - Operator protection



Take-home message

- Choosing the right herbicide is a complex process:

- Efficacy

...but is fairly persistent in the soil

Effective against monocotyledons but requires **auxins** for broader control

Limited efficiency, often needs to be used in combination with **sulfonylureas**,

Diflufenican (previous study) **Quizalofop-P** (previous study) **Pelargonic-acid**
Glyphosate





Take-home message

- Choosing the right herbicide is a complex process:

- Efficacy

...but is fairly persistent in

In the context of railway soil, from a groundwater protection standpoint, glyphosate remains the best option.

e in

Effective against monocotyledons but requires **auxins** for broader control

Limited efficiency, often needs to be used in combination with **sulfonylureas**,



Diflufenican (previous study) **Quizalofop-P** (previous study) **Pelargonic-acid**
Glyphosate



Acknowledgement



SBB CFF FFS



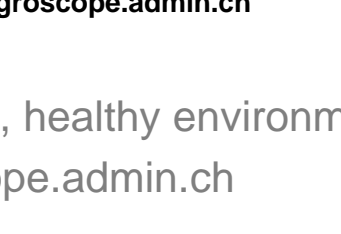
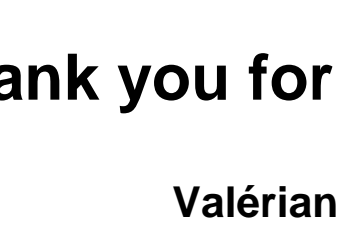
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Union des transports publics
Unione dei trasporti pubblici



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Thank you for your attention

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Leaching profiles

