SPRINT Conference

Brussels – 25 June 2025

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SUSTAINABLE PLANT PROTECTION TRANSITION

WP4.1 ECOTOXICOLOGICAL ASSESSMENT

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Main objective:

Assess the effects of **plant protection product (PPP) mixtures** on aquatic and terrestrial ecosystems

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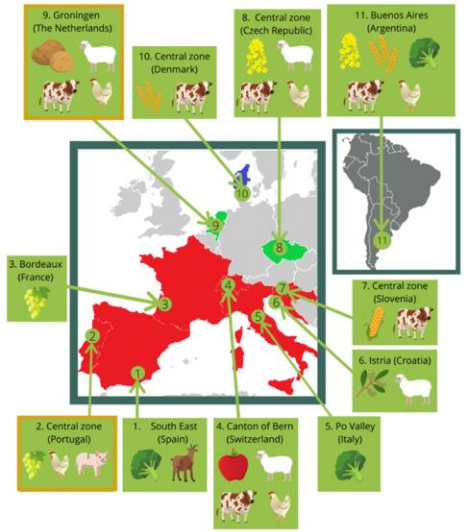
Ecotoxicity testing strategy



11 pesticide mixtures (in 11 case study sites)

combination of **5 pesticides**

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AQUATIC ECOSYSTEM

Selection of the TOP **5** **PPPs**

For each pestcide:

RQ
(risk quotient)

X

Frequency of occurrence

$$RQ = \frac{PEC_{sw}}{PNEC}$$

Predicted Environmental Concentration

FOCUS steps1-2

Predicted Non-effect Concentration

Science of the Total Environment 956 (2024) 177322

Contents lists available at ScienceDirect

Science of the Total Environment

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

Towards a comprehensive methodology for ecotoxicological assessment: Prioritizing plant protection products for mixture testing in edge-of-field surface waterbodies

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TERRESTRIAL ECOSYSTEM

Selection of the TOP 5 PPPs

For each pestcide:

Soil invertebrates and microbes

RQ (risk quotient)

$$RQ = \frac{PEC_{soil}}{PNEC}$$

Bees and benefitial insects

RQ (risk quotient)

$$RQ = \frac{Applic.rate}{LD50/LR50}$$

X

Frequency of occurrence

Journal of Hazardous Materials
Volume 495, 5 September 2025, 138942

Prioritization of currently used pesticides in soils of main European cropping systems and an Argentinian cropping system for assessment of mixture toxicity and risk on terrestrial biota

Olukayode Jegede [a 1], Paula S. Tourinho [b], Violette Geissen [a], Jakub Hofman [b]

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MIXTURE COMPOSITION

Herbicides
Fungicides
Insecticides
Metabolites

CSS	AQUATIC SPECIES
ES	Chlorantraniliprole
	Fludioxonil
	Azoxystrobin
	Fluopicolide
	Acetamiprid
PT	Terbuthylazine
	Dimethomorph
	Ethofumesate
	Tebuconazole
	Glyphosate
FR	Chlorantraniliprole
	Zoxamide
	Fluopicolide
	Trifloxystrobin
	Fluopyram
CH	Terbuthylazine
	Ethofumesate
	Tebuconazole
	Iprovalicarb
	Glyphosate
IT	Terbuthylazine
	Azoxystrobin
	Glyphosate
	Spinetoram
	Acetamiprid
HR	Terbuthylazine
	Glyphosate
	Trifloxystrobin metabolite CGA 321113
	AMPA
SL	Terbuthylazine
	Azoxystrobin
	Fludioxonil
	Mecoprop (P)
	Glyphosate
CZ	Terbuthylazine
	Fluopicolide
	Fludioxonil
	Fenhexamid
	Tebuconazole
NL	Terbuthylazine
	Azoxystrobin
	Tebuconazole
	Dimethenamid (P)
	Metobromuron
DK	Glyphosate
	Fluopyram
	Metalaxyl Metabolite CGA
AR	Cyproconazole
	Metribuzin
	2,4-D
	MCPA
	Glyphosate

CSS	Soil invertebrates	Plants	Microbes	Bees and insects
SP	Oxyfluorfen	AMPA	Metrafenone	lambda Cyhalothrin
	Chlorantraniliprole	Glyphosate	Propamocarb (hydrochloride)	Acetamiprid
	Difenoconazole	Metazachlor	Pendimethalin	Chlorantraniliprole
	Boscalid	Propyzamide	Boscalid	Glyphosate
	Propyzamide	Difenoconazole	Difenoconazole	Propamocarb (hydrochloride)
PT	Chlorantraniliprole	Glyphosate	Metrafenone	Spirotetramat
	Boscalid	AMPA	Boscalid	Glyphosate
	Difenoconazole	Iprovalicarb	Penconazole	Spiroxamine
	AMPA	Penconazole	Fludioxonil	Tebuconazole
	Azoxystrobin	Metolachlor oxanilic	Tebuconazole	Cyprodinil
FR	Chlorantraniliprole	Glyphosate	Metrafenone	lambda Cyhalothrin
	Boscalid	AMPA	Boscalid	Trifloxystrobin
	Difenoconazole	Fenbuconazole	Dimethomorph	Glyphosate
	AMPA	Metrafenone	Glyphosate	Spiroxamine
	Cyflufenamid	Difenoconazole	AMPA	Metrafenone
SW	Difenoconazole	AMPA	Methoxyfenozide	Emamectin
	Methoxyfenozide	Difenoconazole	Tebuconazole	Pirimicarb
	Myclobutanil	Myclobutanil	AMPA	Myclobutanil
	AMPA	Emamectin	Difenoconazole	Tebuconazole
	Pirimicarb	Tebuconazole		Difenoconazole
IT	Chlorantraniliprole	Propyzamide	Metrafenone	lambda Cyhalothrin
	Oxyfluorfen	Pendimethalin	Boscalid	Pendimethalin
	Boscalid	lambda Cyhalothrin	Pendimethalin	Chlorantraniliprole
	Propyzamide	Oxyfluorfen	Propamocarb (hydrochloride)	Tebuconazole
	Difenoconazole	Difenoconazole	Tebuconazole	Boscalid
CR	Boscalid	Glyphosate	Boscalid	Phosmet
	AMPA	AMPA	Tebuconazole	Acetamiprid
	Dimethomorph	Deltamethrin	AMPA	Trifloxystrobin
	Tebuconazole	Trifloxystrobin	Dimethomorph	Glyphosate
	Glyphosate	Tebuconazole	Glyphosate	Tebuconazole
SL	Bixafen	Metolachlor (S)	Terbuthylazine	CAPTAN
	AMPA	Terbuythylazine	Tebuconazole	Terbuthylazine
	Tebuconazole	Thiencarbazone-methyl	Thiencarbazone-methyl	Bixafen
	Terbuthylazine	AMPA	AMPA	Tebuconazole
	Metolachlor (S)	Terbuythylazine desethyl		Thiencarbazone-methyl
CZ	Boscalid	AMPA	Metrafenone	lambda Cyhalothrin
	Prochloraz	Diflufenican	Boscalid	tau-Fluvalinate
	AMPA	Mecoprop P	Flupyradifurone	Acetamiprid
	Dimoxystrobin	Dimethenamid (P)	Dimoxystrobin	Flupyradifurone
	Azoxystrobin	Deltamethrin	Tebuconazole	Spiroxamine
NT	Bixafen	Metribuzin	Boscalid	lambda Cyhalothrin
	Boscalid	Metobromuron	Metobromuron	Prochloraz BTS 44595
	Azoxystrobin	AMPA	Fluoxastrobin	Esfenvalerate
	AMPA	Diflufenican	AMPA	Prosulfocarb
	Pirimicarb	Prosulfocarb	Prochloraz BTS 44595	Metobromuron
DE	Boscalid	AMPA	Boscalid	Esfenvalerate
	AMPA	Diflufenican	Pendimethalin	Glyphosate
	Diflufenican	Fluopyram	AMPA	Fluopyram
	Fluopyram	Pendimethalin		Pendimethalin
	Pendimethalin	Boscalid		Boscalid
AR	AMPA	Glyphosate	Methoxyfenozide	folpet
	methoxyfenozide	AMPA	AMPA	Glyphosate
	Azoxystrobin	Diflufenican	Glyphosate	Fluxapyroxad
	Fluxapyroxad	2,4-D (free)	Folpet	Bixafen
	Bixafen	lambda-Cyhalothrin		lambda Cyhalothrin

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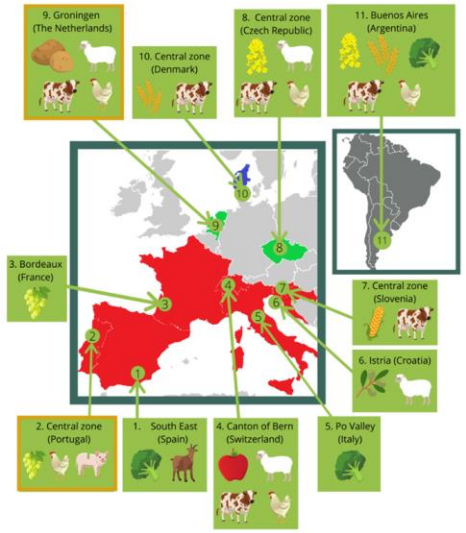
Ecotoxicity testing strategy



- Control (no treatment)
- MEC (measured environmental concentration)
- PEC (predicted environmental concentration)
- 3x PEC
- 5x PEC

11 pesticide mixtures (in 11 case study sites)

combination of **5 pesticides**

5 concentrations

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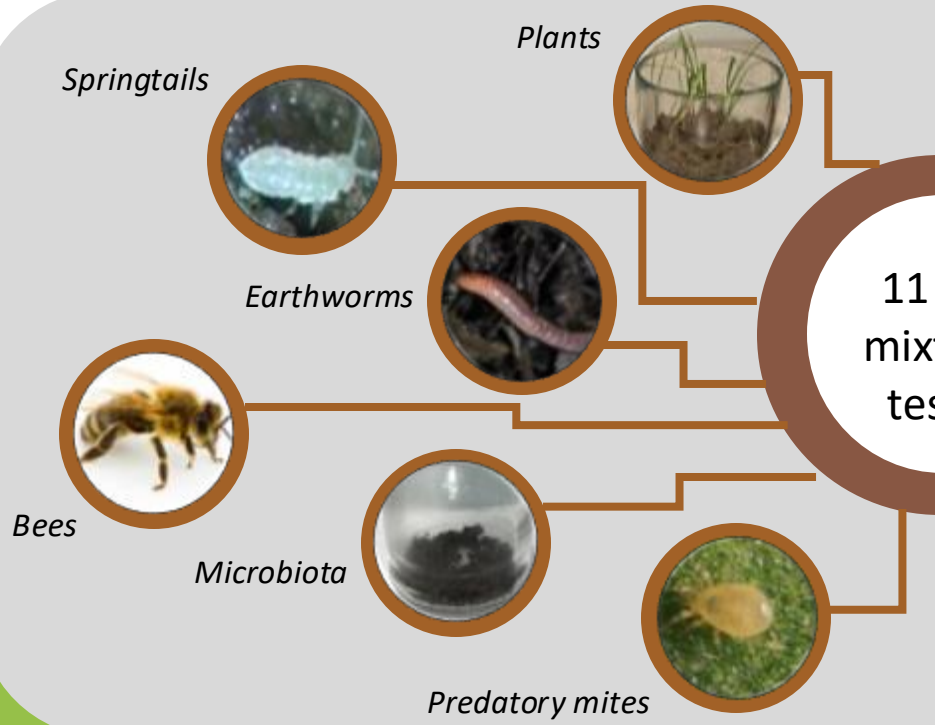
Overview of the Ecotoxicological Assessment

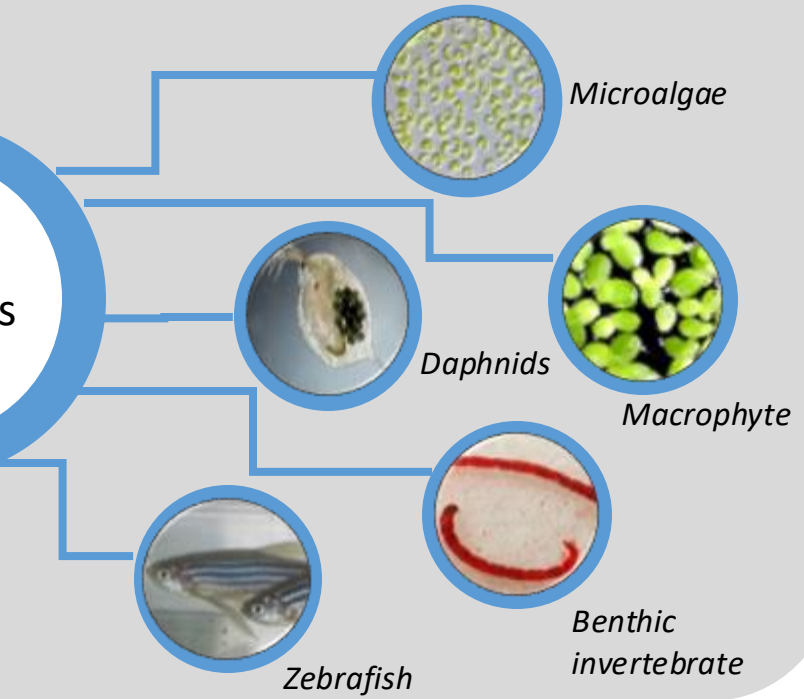
Monospecies assays:

TERRESTRIAL ECOSYSTEM



11 PPP mixtures tested

AQUATIC ECOSYSTEM

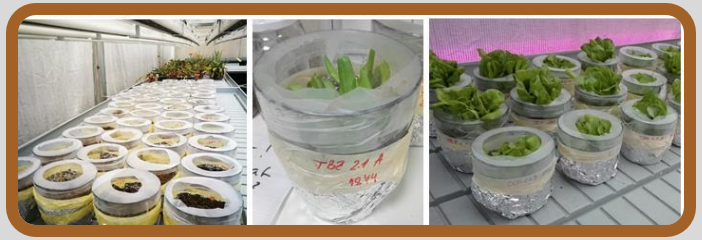


New ecotoxicological insights on 11 realistic mixtures of PPP and their impact on soil and aquatic species.

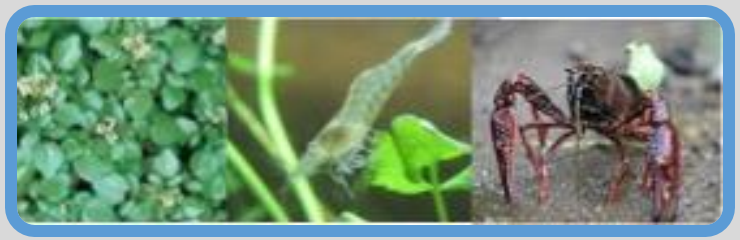
New ecotoxicological data on the **effects of PPP mixtures on native** soil and aquatic species.

News health indicators.

Multispecies:



Earthworm, lettuce, and microbiota



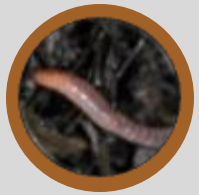
Watercress, freshwater shrimp, crayfish

New information on the potential for PPP bioaccumulation and trophic transfer.

11 PPP mixtures tested

Springtails

Earthworms



Microbiota

Plants

Bees

Predatory mites

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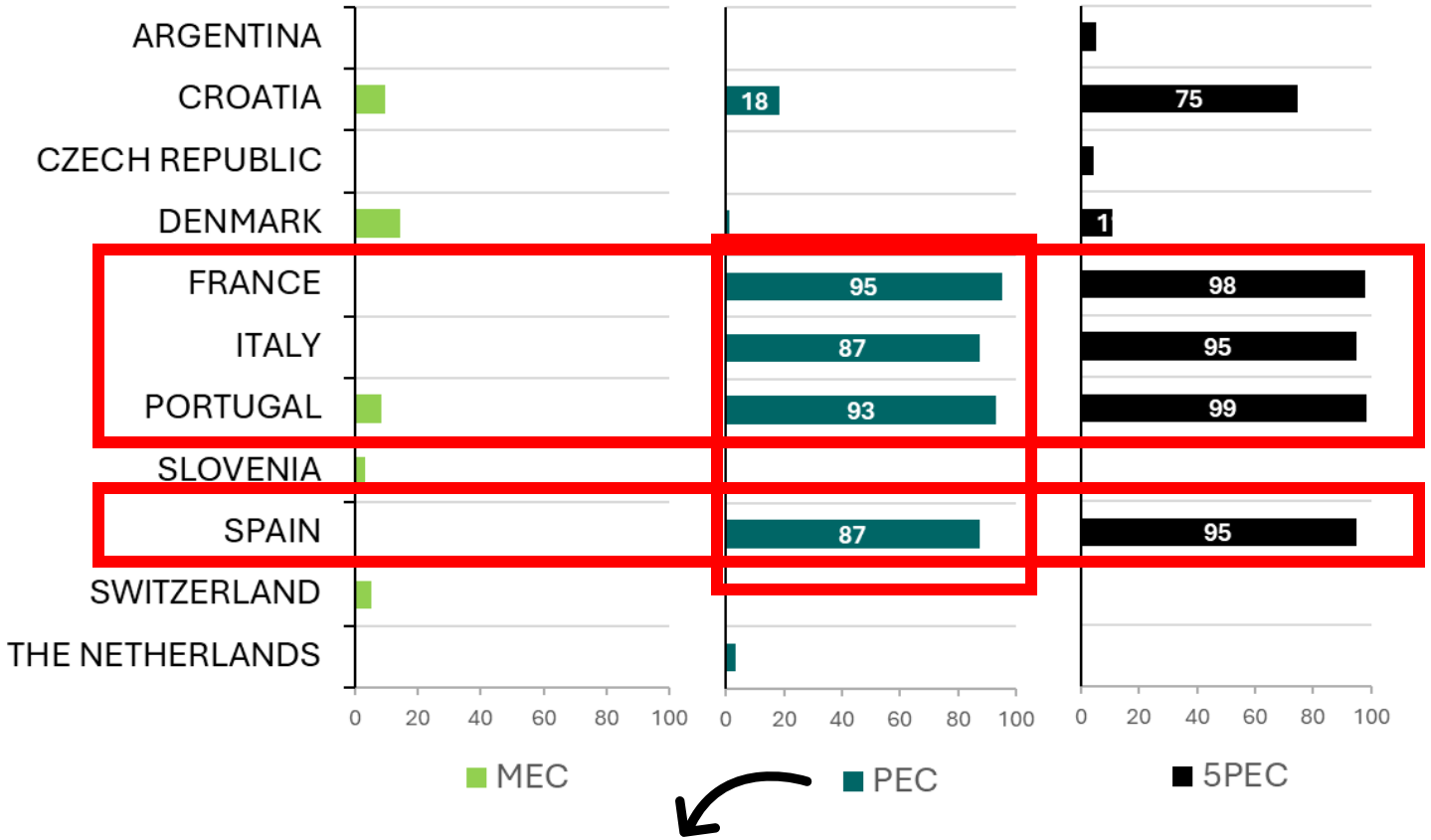
Springtails

Folsomia candida

Reproduction (28 d)

% of effect in each concentration



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Earthworms

Eisenia fetida

Reproduction (56 d)

% of effect in each concentration

Concentrations ≤ 'Safe levels'

High toxicity

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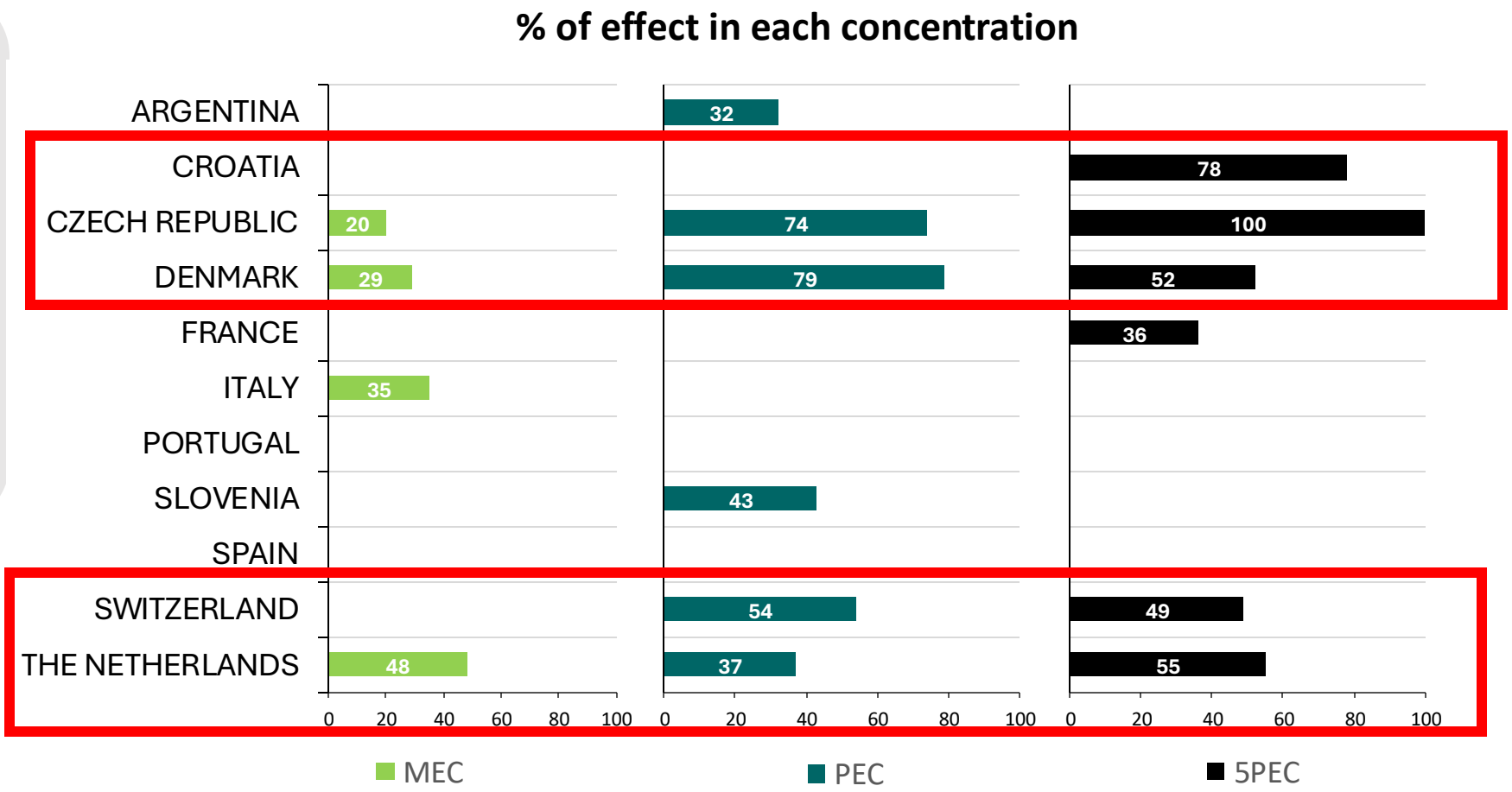
Earthworms

Lumbricus rubellus

Reproduction (56 d)



⚠ No data on 'Safe levels'

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Significant effects:

F. Candida → ES, FR, HR, IT, PT

E. fetida → AR, CZ, HR, PT, SI

L. rubellus → CH, CZ, DK, NL

11 mixtures

Different mixtures

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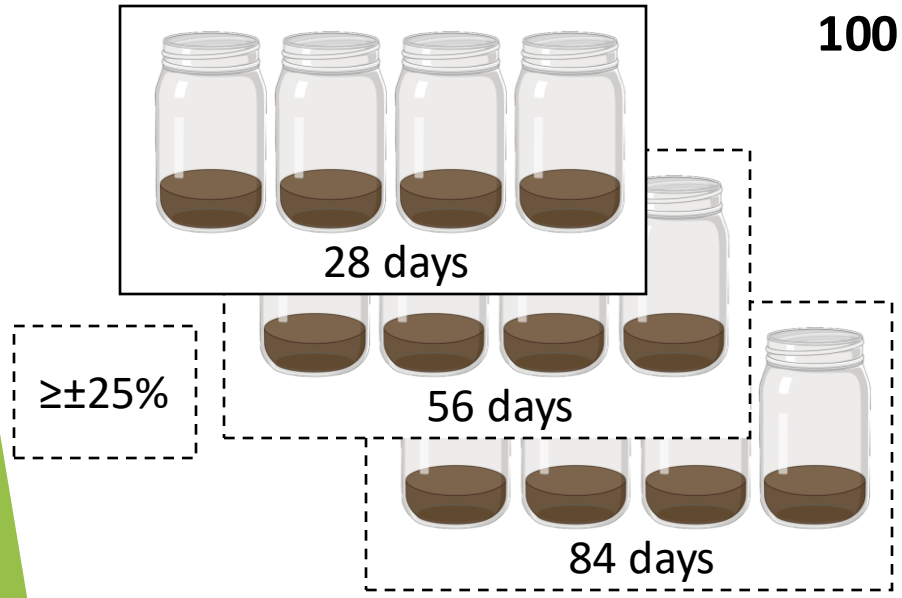
Soil microbes

OECD guidelines 216 and 217

- **Carbon transformation**
- **Nitrogen transformation**

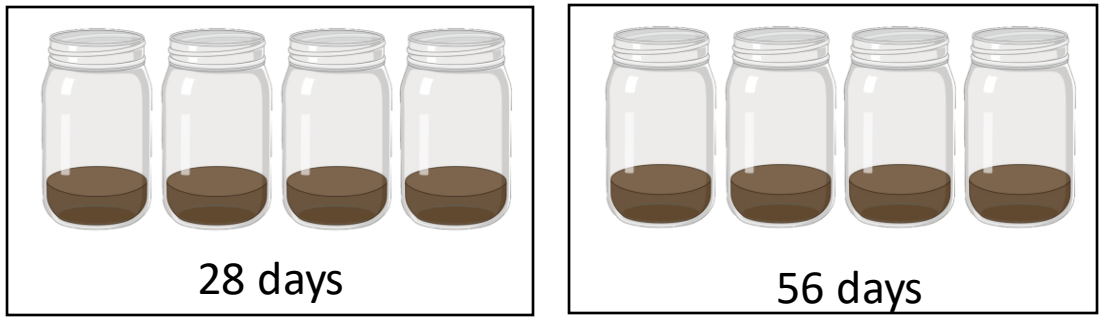
Threshold < 25% up to 100 days



Novel soil indicator

Microbial function and structure

- Enzyme activities
- Functional genes
- 16S rRNA genes
- fungal ITS fragment
- DNA extraction
- 16S archaea



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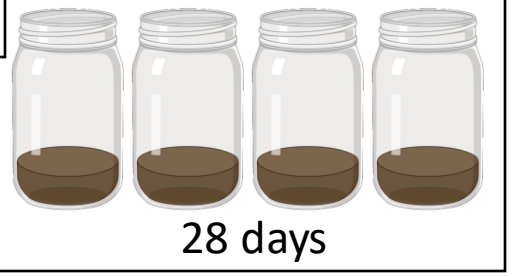
OECD tests

5 mixtures

≥±25%



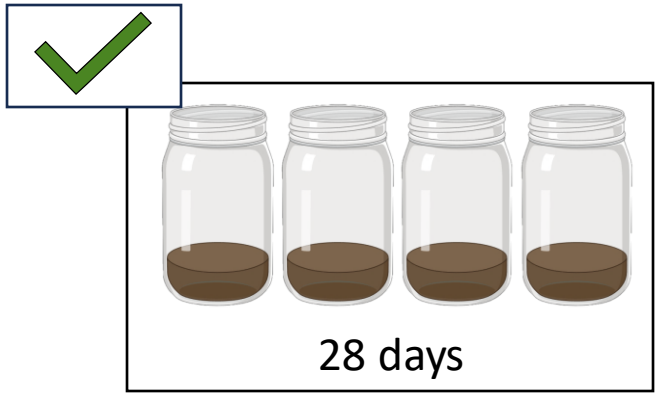
28 days

56 or 84 days

Risk assessment

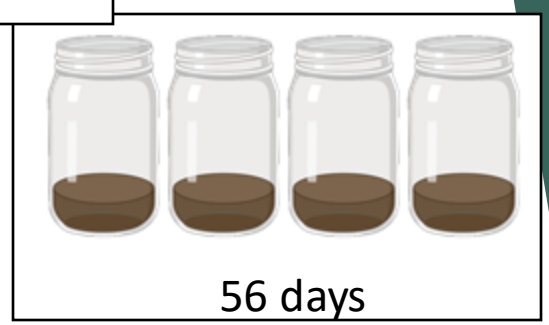
Novel soil indicator

- All mixtures → endpoints
- Effects observed only at 56 days



28 days

≥±25%



56 days

Risk assessment

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Conclusions

- Effects observed at lowest concentrations tested

 Bees

 Terrestrial plants

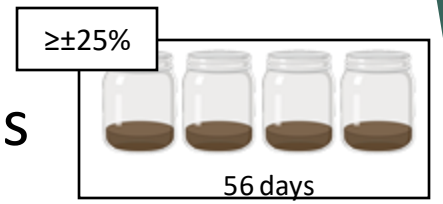
 Predatory mites

☒ Toxicity was higher than expected → synergistic effects

New SPRINT indicators (non-standard tests)

Sensitivity →native species vs standard species

Prolongation of exposure period→ “late” effects on microorganisms



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