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Using a soil-water flume on pesticide ecological risk assessment under Mediterranean exposure scenarios.

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Introduction & objectives

The need to study pesticide effects on aquatic and terrestrial organisms under realistic environmental conditions is of great importance due to the differences in soil characteristics, climatic conditions and biota communities among EU countries. In order to homogenize and improve the Environmental Risk Assessment (ERA) of pesticides in the EU, three regions, North, Centre and South, where created under the recent Regulation concerning the placing of PPP on the market (EC No. 1107/2009). A Member State (MS) can adopt pesticides that have been accepted by other MS of the same region as long as comply with the sustainable use of pesticides established by the Directive 128/EC/2009. However, the ERA of pesticides approach is mainly based on scenarios developed for northern and central European conditions with substantially different characteristics from the Mediterranean region.

This study aims to:

- Fulfil the need for integrated studies (water and soil compartments), especially mimicking more realistic exposure scenarios under Mediterranean conditions;
- Evaluate the relevance of different pathways of pesticide transfer between these two compartment and its effects on the biota;
- Refine methodologies to assess quality standards that will contribute to decision-making aiming at a sustainable use of pesticides towards water, soil and biodiversity protection to reduce soil degradation and water contamination.

Materials & Methods

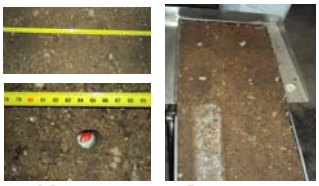
Worst case scenarios taking into consideration: three major crops; three model pesticides; maximum application rate; mode of application; irrigation regime; and field slope.

agricultural area reference soil

2 applications of 2x recommended dosage (RD) in Portugal

Onion crop

Potato crop



Maize crop Potato crop

azoxystrobin CAS 131860-33-8;

- strobilurin fungicide; inhibits mitochondrial respiration; effective against downy mildew (*Peronospora destructor)* and onion leaf blight (*Stemphylium vesicarium*); f.p. ORTIVA® (SC)
- RD – 0,8L f.p./ha (200g a.i./ha)

chlorothalonil CAS 1897-45-6;

- chloronitrile fungicide; organochlorine; broad-spectrum, against diseases Potato Late Blight Agent and Fungus (*Phytophthora infestans, Alternaria solani*); f.p. BRAVO500® (SC)
- RD – 3L f.p./ha (1500g a.i./ha)

ethoprophos CAS 13194-48-4;

- broad spectrum organophosphate soil insecticide (**M**aize) and nematicide (**P**otato);
- Acetilcolinesterase inhibitor; f.p. MOCAP 10G® (MG); RD – **M** -12,5kg f.p./ha (1,25kg a.i./ha), **P** – 100kg f.p./ha (10kg a.i./ha)

Effects assessment

&

Leachates – groundwater exposure **Runoff** – superficial water exposure

OECD 211 & Daphtoxkit F™ Magna.

ALGALTOXKIT F™ *P. subcapitata*

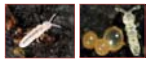
Refined effect assessment based on refined exposure

Work under development

Maize crop

Potato crop

ISO 11267 collembolan



line and between line soil exposure

ISO 11268 earthworms

Results and Discussion

Azoxystrobin and chlorothalonil scenarios:

Sub-lethal effects on *Daphnia magna*

	azoxystrobin Onion		chlorothalonil Potato	
21d reproduction	RD	2x RD	RD	2x RD
Leachate	X	✓	X	X
Runoff	X	?	X	?
Eluate	X	X	X	✓

X – but 60% mortality
X – but 80% mortality
? – not possible to evaluate due to 100% mortality in 100% runoff control

X – No effects
✓ – Effects

Ethoprophos scenarios:

lethal effects on *Daphnia magna*

ethoprophos

	Maize				Potato			
72h Mortality (%)	RD		2x RD		RD		2x RD	
Leachate	X		X		✓		✓	
Runoff	X		X		X		X	
	L	bL	L	bL	L	bL	L	bL
Eluate	X	X	✓	X	✓	X	✓	X

L - line
bL – between line

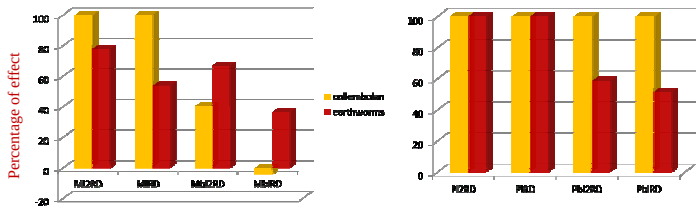
✓ – Effects X – No effects

Aquatic organisms:

- Azoxistrobin leachate was more toxic than chlorothalonil leachate, but only at 2xRD;
- Chlorothalonil proved to be more toxic than Azoxistrobin through both runoff and eluates at RD, though only lethal effects were detected;
- Ethoprophos eluates were more toxic at the RD than leachates for both crop scenarios;
- Effects were observed on eluates from crop line areas after after10d of ethoprophos application (microgranules);
- Ethoprofos higher dosages are more toxic in potato than in maize.

Ethoprophos scenarios:

Maize crop *Potato crop*



Terrestrial organisms:

- Clear differences in effects between species and crop recommended dosage;
- Ethoprophos proved to be more toxic to collembolans;
- Soil from crop **l**ine (application of pesticide) more toxic than soil from between crop line (**bl**) for both organisms;
- 2x recommended dosage (**2RD**) more toxic for both crops (**P**otato and **M**aize scenarios);

Conclusions

- As expected due to the doses applied, the insecticide was more toxic for aquatic and terrestrial organisms under potato crop than under maize;
- The studied fungicides were less toxic for aquatic organisms than the insecticide;
- Contaminated runoff waters resulting from rain events after chlorothalonil application can cause effects on aquatic microcrustaceans;
- Leachates after azoxystrobin and ethoprophos (potato crop) application can pose a risk for groundwater;
- In Ethoprophos (granular application) different toxicity was found under crop line and between crop line.

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