BioGreenhouse

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IN SCIENCE AND TECHNOLOGY

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3rd INTERNATIONAL SYMPOSIUM ON ORGANIC GREENHOUSE HORTICULTURE

11-14 APRIL 2016 IZMIR, TURKEY

Is copper fungicide that bad?

Nancy Peña
Assumpció Antón

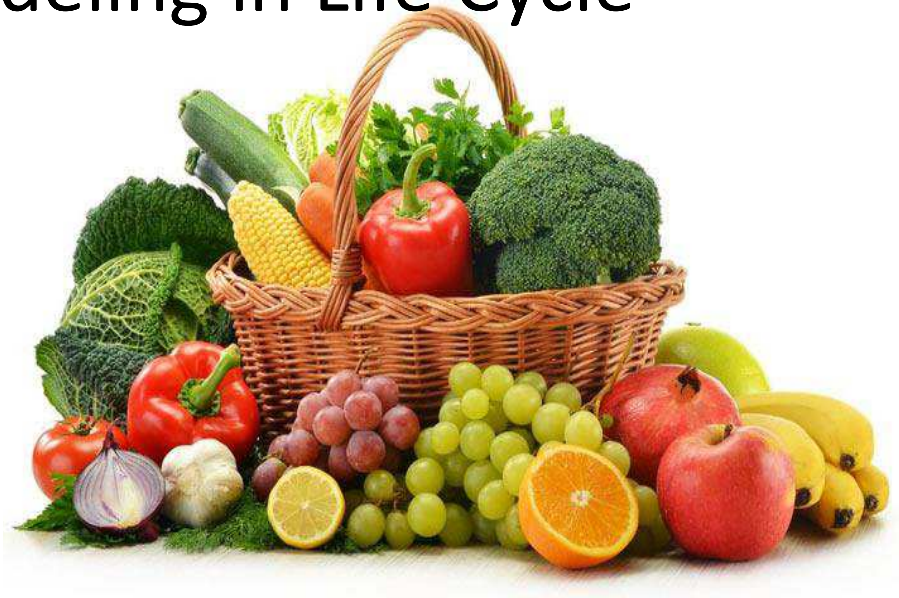
icta Institut de Ciència i Tecnologia Ambientals · UAB

IRTA RECERCA I TECNOLOGIA AGROALIMENTÀRIES

nancy.pena@irta.cat

Outline

- ✓ Introduction
- ✓ Context – Pesticide modeling in Life Cycle Assessment
- ✓ Scenarios
- ✓ Ecotoxicity impact assessment
- ✓ Conclusions



Introduction

Downy mildew is one of the most serious and devastating diseases for greenhouse horticultural products like vegetables, berries, green beans and cucurbitaceous worldwide.

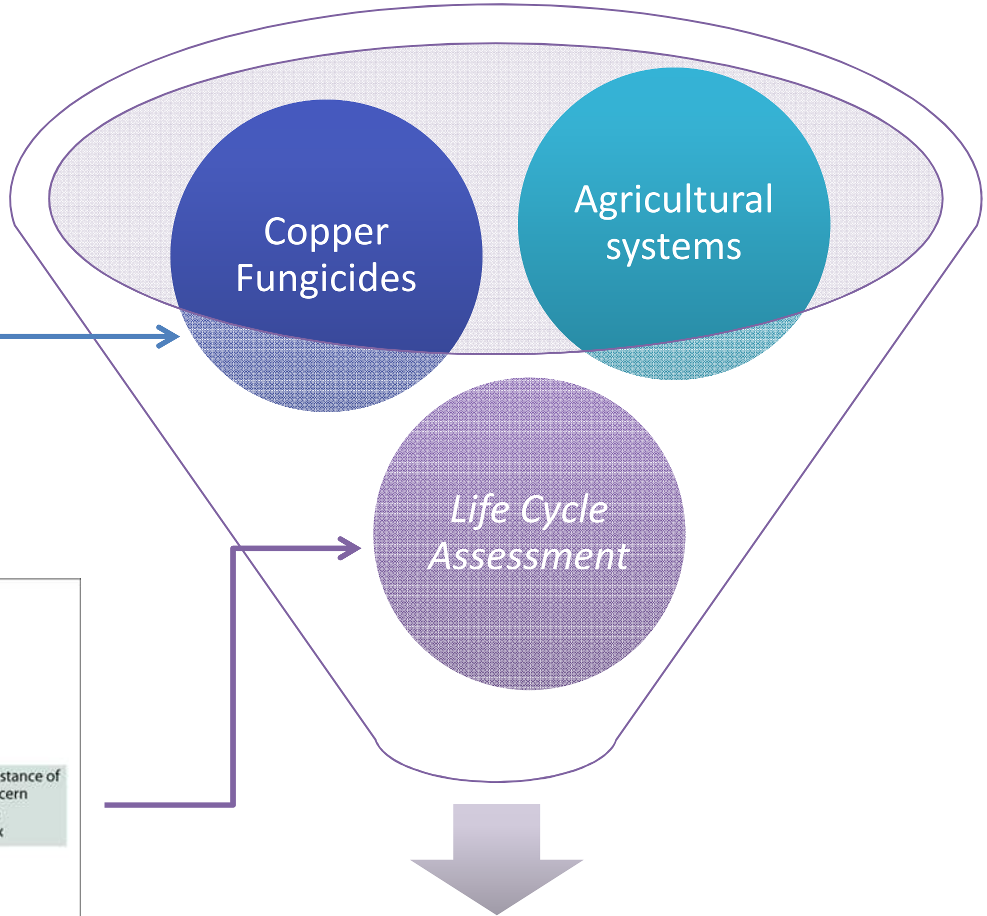
For disease control **Copper-based fungicides** are the most effective and used active ingredients in both conventional and organic pest management.

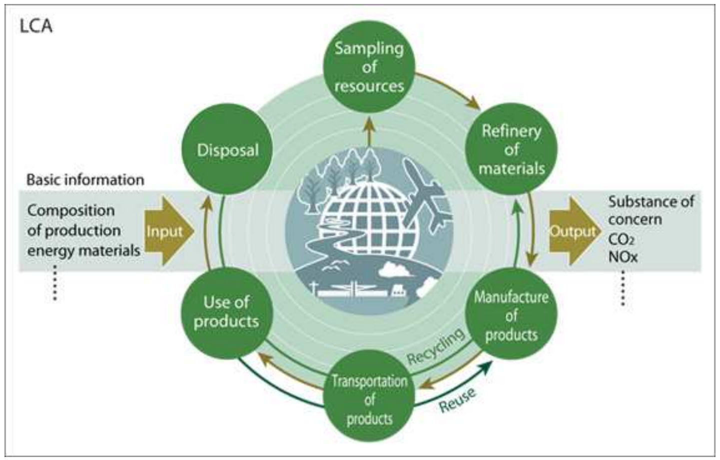
About **80% of the copper contribution to the environment** from agricultural systems is from fungicides. Therefore, its use is being **limited** and its reduction is one of the main principles of **organic production.**

A comprehensive **environmental impact** assessment of the organic and conventional systems is needed to enable more **reliable** conclusions.

Pesticide modeling in LCA perspective

Copper toxicity depends mainly on its capacity to interact with the **surrounding environment** (pH, T, humidity, etc).





Characterize and evaluate the potential environmental impact

Life Cycle Assessment LCA

The potential environmental impacts and resources used throughout a product's life cycle

ISO 14040

Life Cycle Assessment LCA

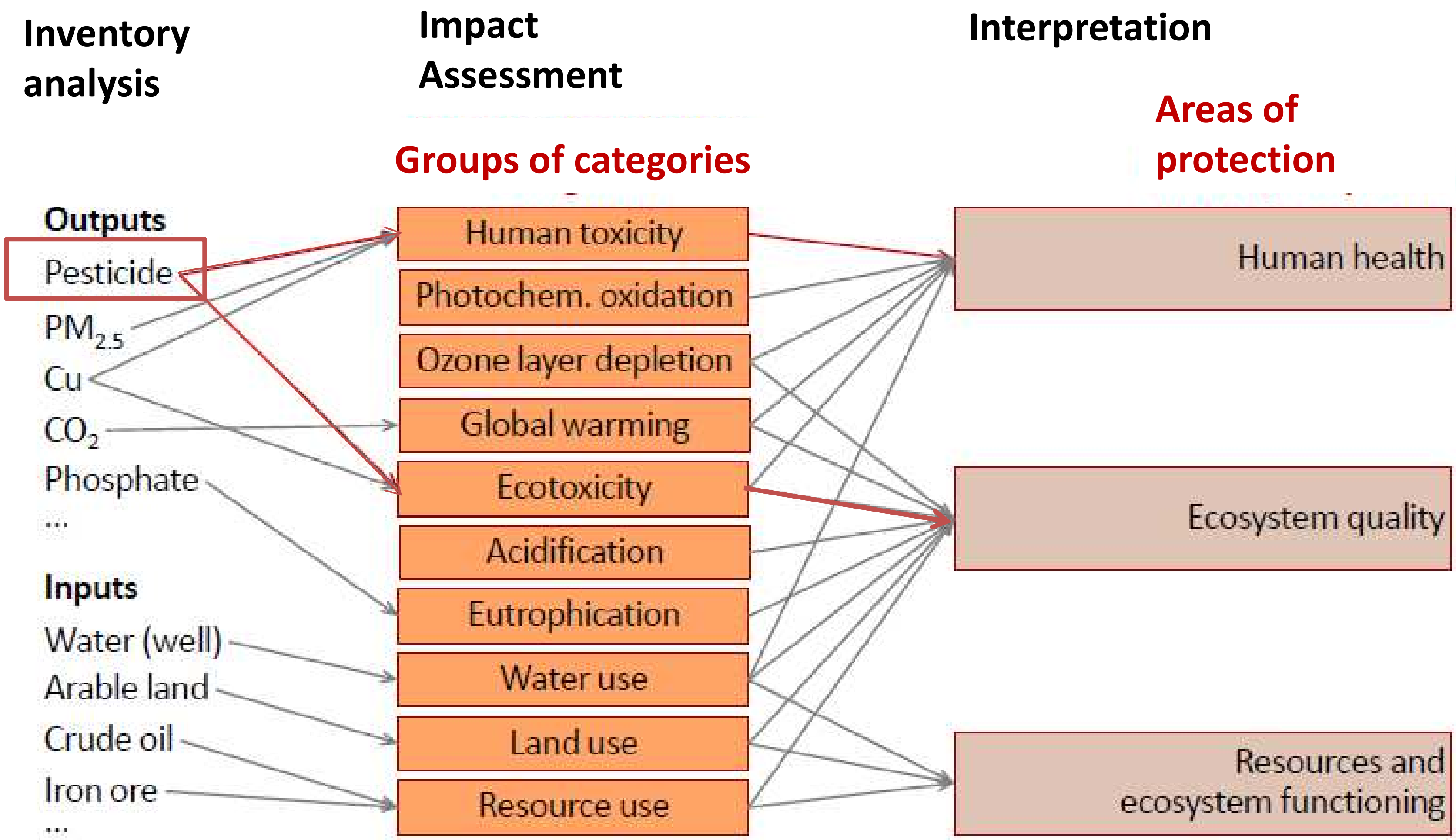
Goal and scope definition

Life Cycle Inventory Analysis

Life Cycle Impact Assessment

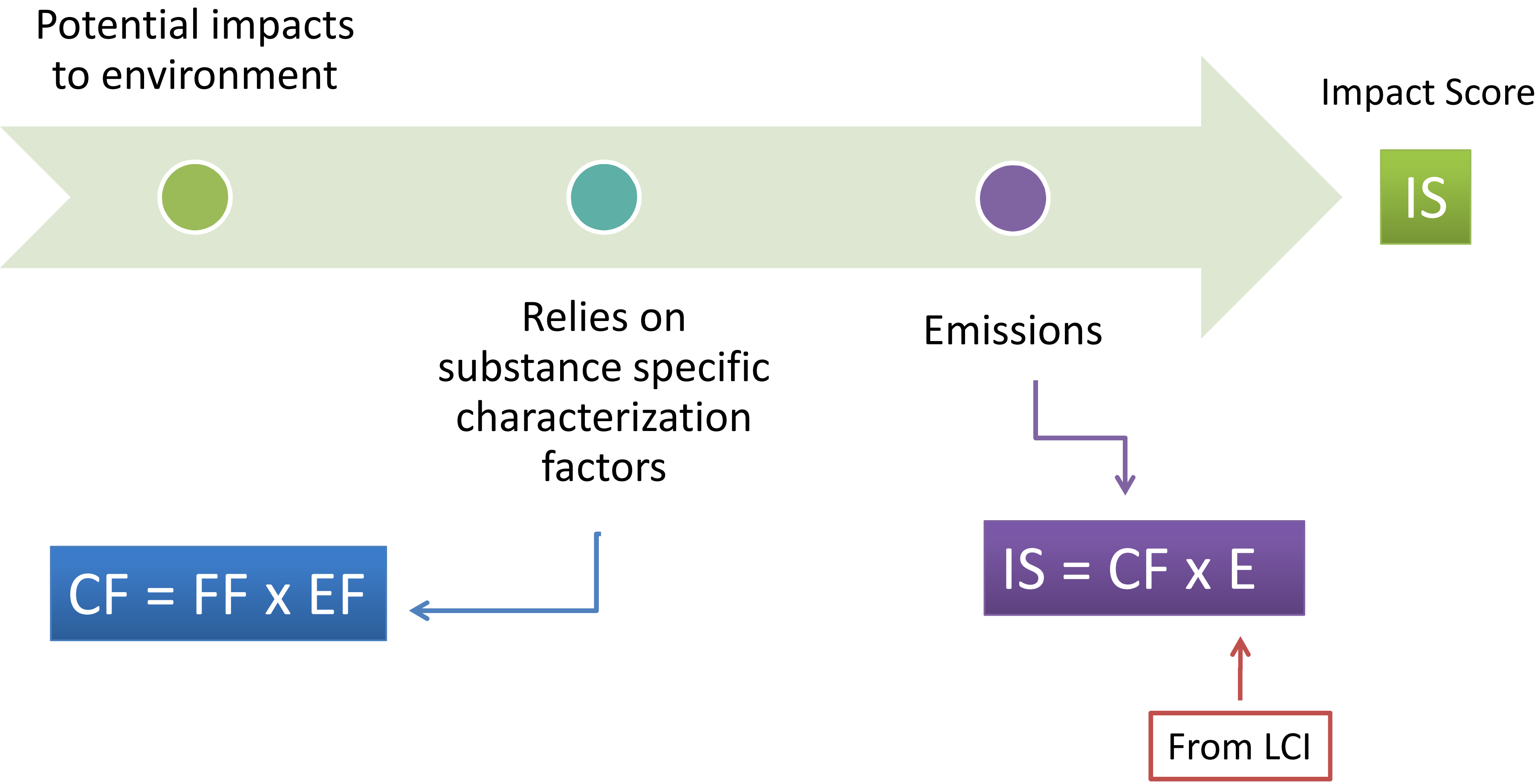
Results and interpretation

Life Cycle Impact Assessment



Fantke 2015

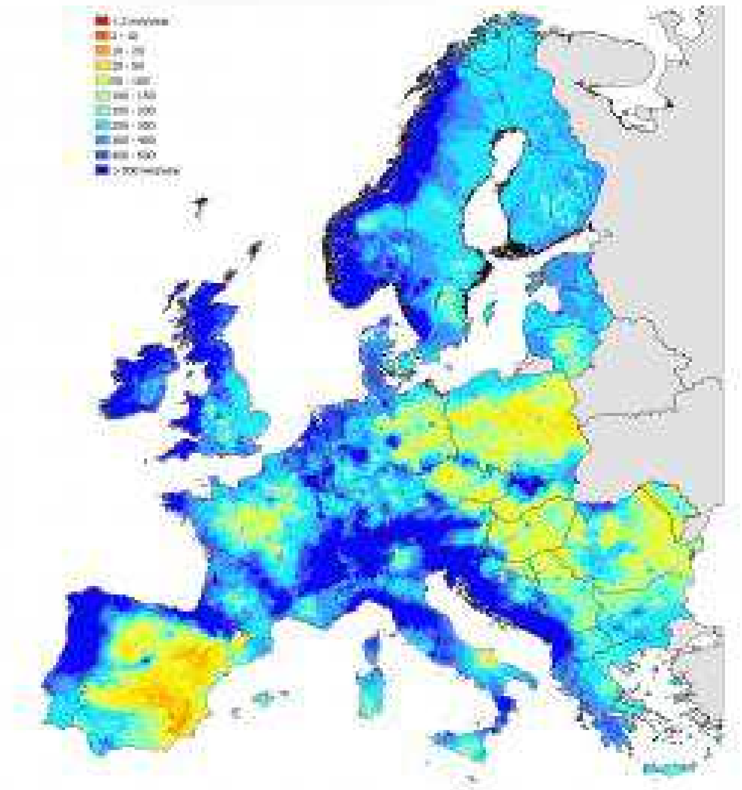
Ecotoxicity Impact Assessment



Application scenarios

Evaluated active ingredients, main crops and recommended dose in kg/ha

Active ingredients	Crop	Rec. dose (Kg/ha)
Azoxystrobin		
Captan		
Cymoxanil		
Chlorothalonil		
Folpet		
Mancozeb		
Maneb		
Copper (II)		



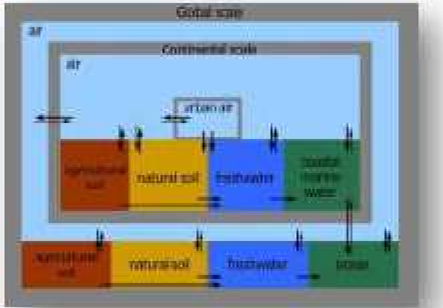
Inventory

Toxicity Characterization in LCA

- USEtox model

Emission

Emission flow
$[kg_{emitted}/d]$



Fate

Mass in environment
$[kg]$

Exposure

Available (dissolv.) fraction
$[kg_{available}]$

Effects

Potentially Affected Fraction
CTU_e=[PAF(m^3*d)]

$$\overline{FF}\ [d] \quad * \quad \overline{XF}\ [-] \quad * \quad \overline{EF}\ \text{PAF}\ [m^3*d/kg_{available}] \quad = \quad \overline{CTU_e}\ \text{PAF}\ [m^3*d/kg_{emitted}]$$

Rosenbaum et al. 2007 Env. Int. 33: 624-634

Potential Freshwater ecotoxicity impacts

Global CTPs expressed as PAF·day·m³/kg

Name	***CTP*** (PAF.day.m3/kg)
Cymoxanil	1,09E+04
Mancozeb	5,22E+04
Cu(II)	5,52E+04
Maneb	6,84E+04
Azoxystrobin	7,31E+04
Captan	8,51E+04
Folpet	1,13E+06
Chlorothalonil	1,15E+06

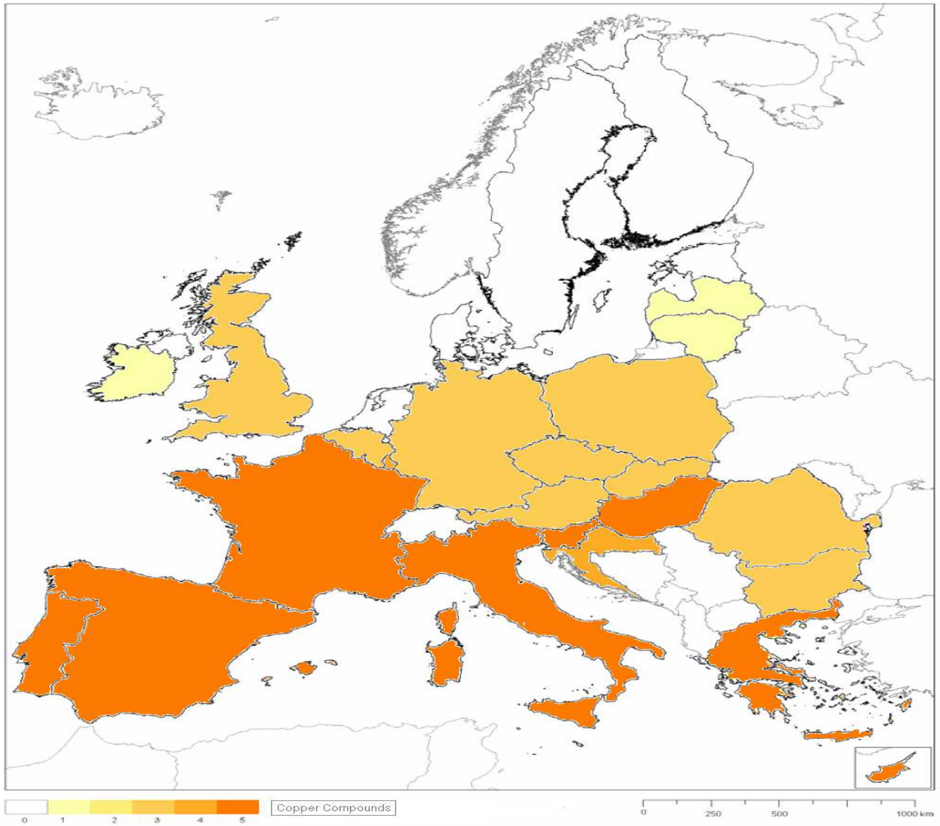
Spatial differentiation do matter!

European CTPs expressed as PAF·day·m³/kg

Name	***CTP*** (PAF.day.m3/kg)
Cymoxanil	1,38E+04
Mancozeb	6,66E+04
Maneb	8,72E+04
Azoxystrobin	1,07E+05
Captan	1,20E+05
Cu(II)	7,50E+05
Folpet	1,59E+06
Chlorothalonil	2,60E+06

Potential Freshwater ecotoxicity impacts

Water type	IS		
	min	med	max
EU1	4,59E+02	6,12E+02	9,18E+02
EU2	1,91E+03	2,55E+03	3,83E+03
EU3	4,59E+03	6,12E+03	9,18E+03
EU4	1,10E+03	1,46E+03	2,19E+03
EU5	5,10E+04	6,80E+04	1,02E+05
EU6	1,22E+05	1,63E+05	2,45E+05
EU7	4,08E+04	5,44E+04	8,16E+04



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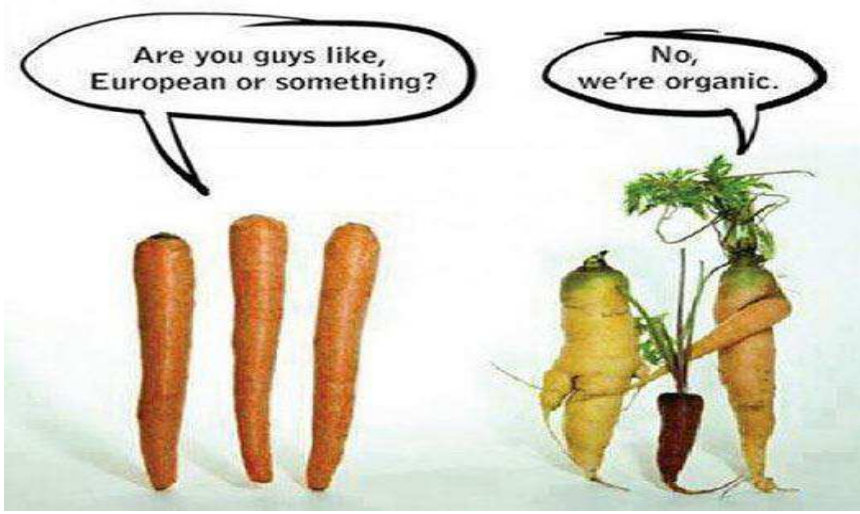
Take home message

✓ Cu toxicity depends mainly on its capacity to interact with the surrounding environment (pH, T, humidity), and the dynamics of this interaction (speciation).

✓ Copper base fungicides are toxic products and an we need to define its use in a proper way.

Take home message

- There is still work to do!
  - Substance specific impact of the copper active ingredients.
  - More research required to analyze **influence of all contributing processes**



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