

Multi-criteria comparison of eco-toxicity models focused on pesticides

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23rd September 2010



🌿 Introduction

🌿 Goal and approach

🌿 Results

- Theoretical comparison
- Correlation between model results

🌿 Summary

Introduction



🌿 Why this evaluation?

- several models available to assess toxic effects
- no review of toxicity methods in the context of pesticide application
- only a few pesticides are characterised for the use in LCA

Goal and approach



Goal

Comparison of the toxicity models EDIP97, USES-LCA, IMPACT2002, EI99

Approach

a theoretical comparison based on a criteria list taking into account

- scientific soundness
- practical feasibility
- stakeholder utility

validation with a set of pesticide spray patterns

Theoretical comparison: Structure



Dimension	Criterion	Sub-Criterion	Decision rules	Value
Scientific soundness	Environmental issues	Aquatic species	not considered	1
			1 target species	2
			2 target species	3
			3 target species	4
			>3 target species	5
		Beneficial organisms		
		...		
Practical feasibility	Human health			
	...			
	...			
Stakeholder utility	Accessibility of input data	Field specific data	...	...
				
		...		

Theoretical comparison: Results



Dimension	EDIP97	EI99	Impact 2002	USES-LCA	Average
Scientific Soundness	2.6	3.2	3.1	3.2	3
Practical feasibility	2.8	N/A	2.6	2.8	2.7
Stakeholder utility	2	N/A	2	2	2
Average	2.5	N/A	2.6	2.7	

1 = low soundness, feasibility or utility, 5 = high soundness, feasibility or utility

Practical Test: Dataset



🌿 **Surveyed pesticide spray patterns**

150 patterns applied in wheat (Saxony-Anhalt)

55 different active ingredients applied

Treatment Frequency Index between 1.2 and 14

0.35 – 7.4 kg active ingredient

50 applied in apple orchards (Lake Constance)

39 different active ingredient applied

TFI between 14 and 59

7.9 – 61.6 kg active ingredient

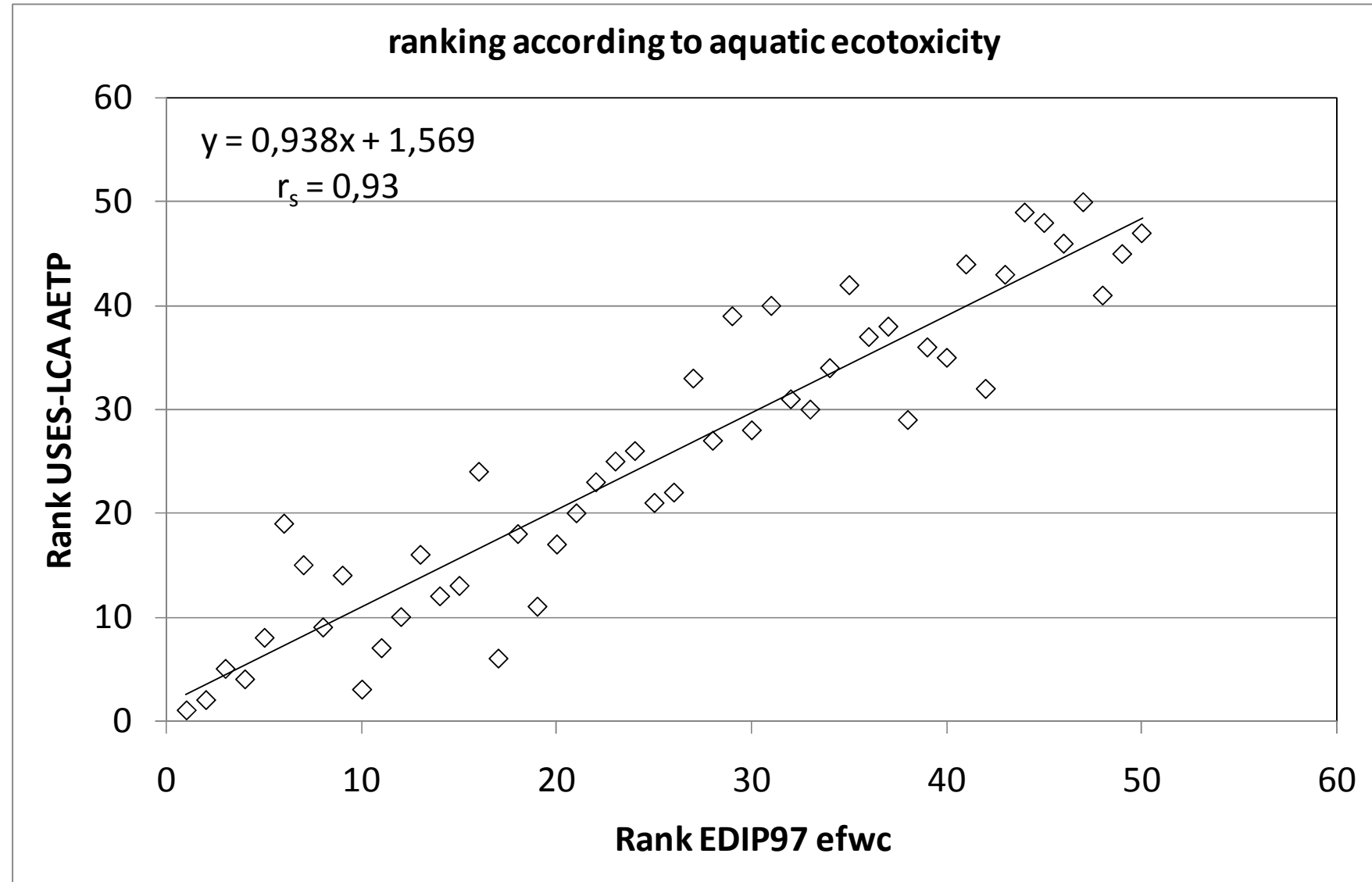
Practical Test: Characterisation



🌿 Characterisation factors

- Calculated according to the methods EDIP97, USES-LCA, IMPACT2002
- Physico-chemical -, toxicological data and data on half-life taken from 2 databases
 - SYNOPS with more than 360 active ingredients
 - Footprint with more than 800 active ingredients
- Modified calculation of $E_{f_{wc}}$ for EDIP97 compared to the original method

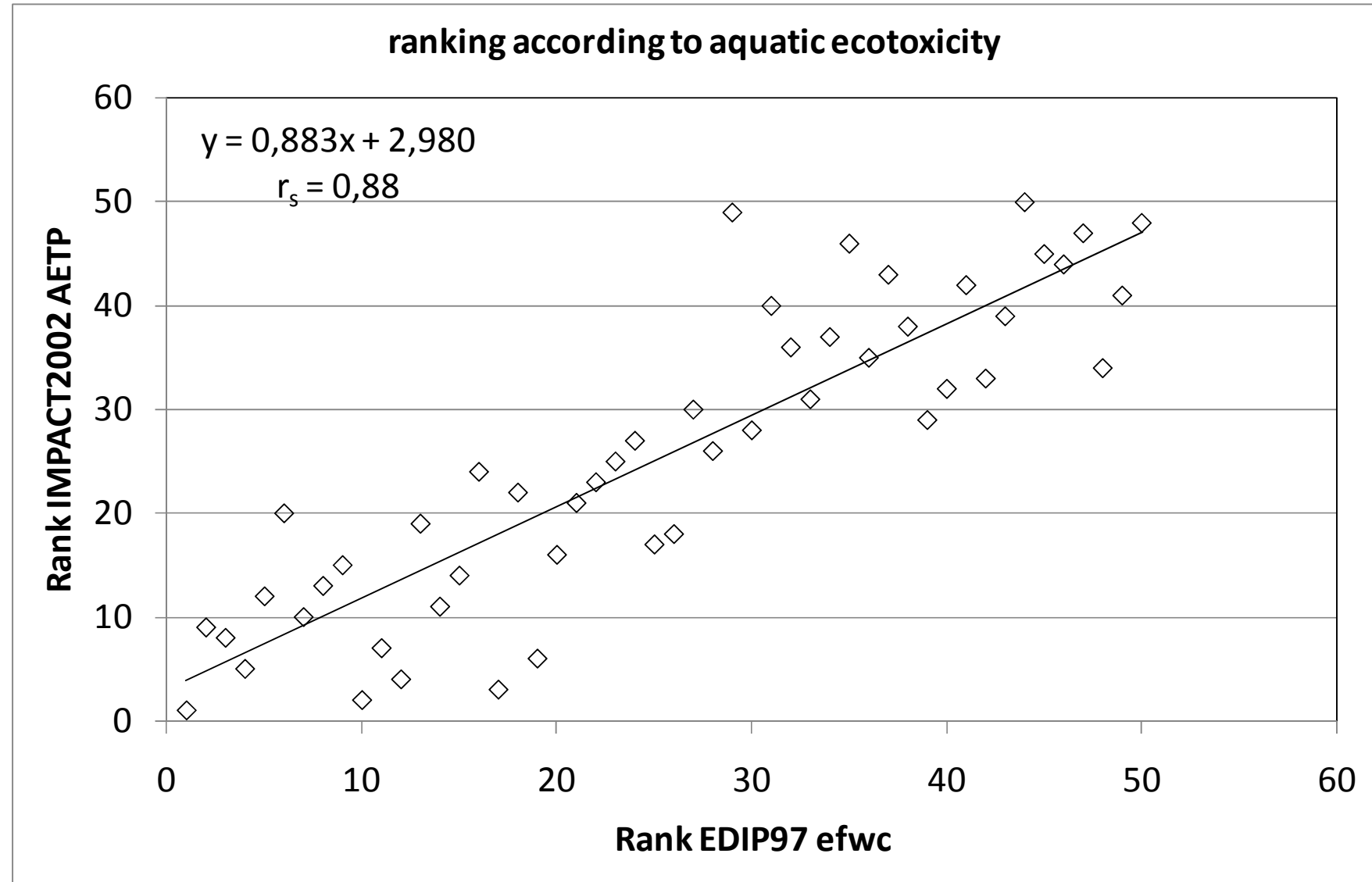
Practical Test : Case study orchard



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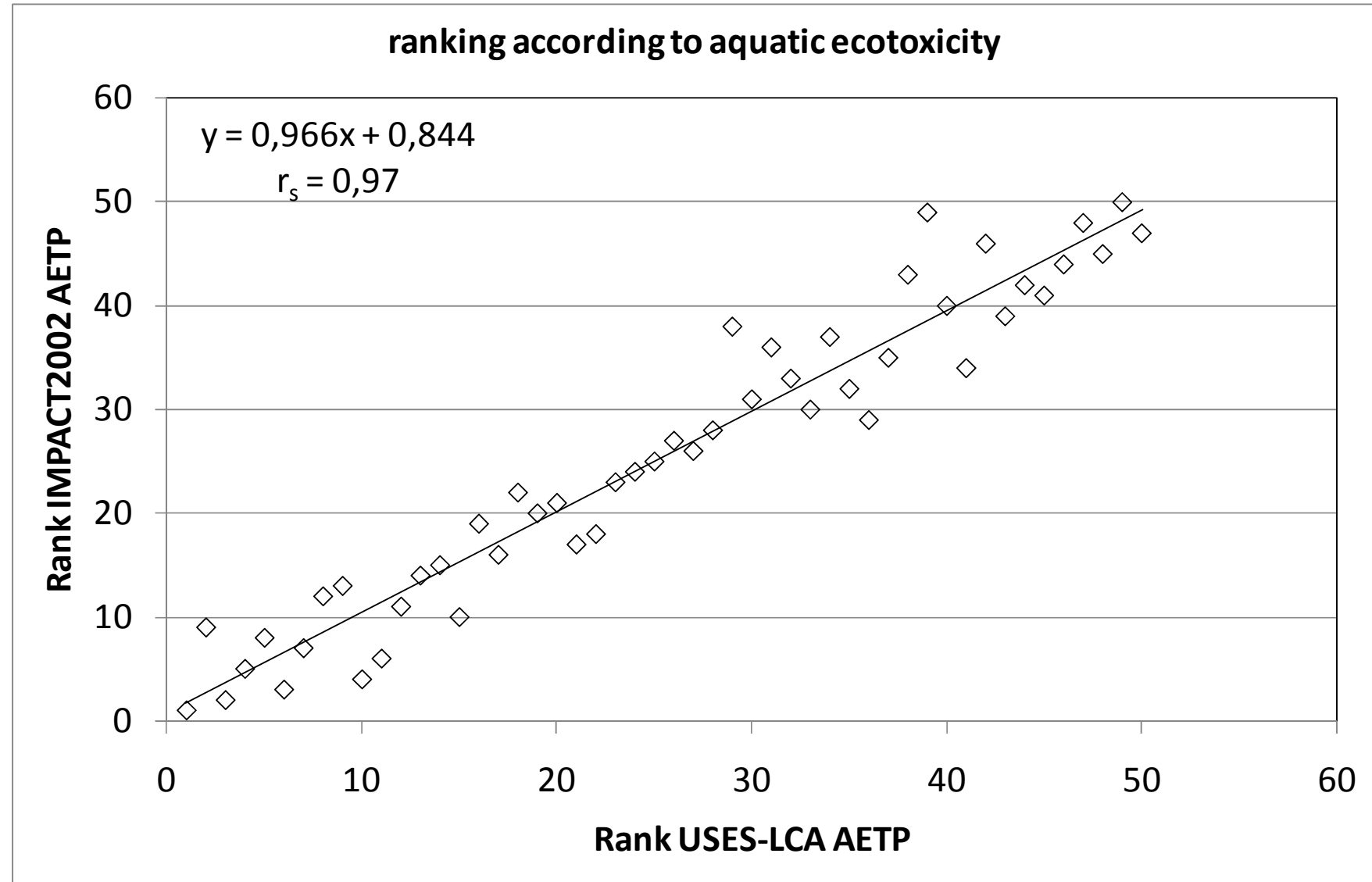
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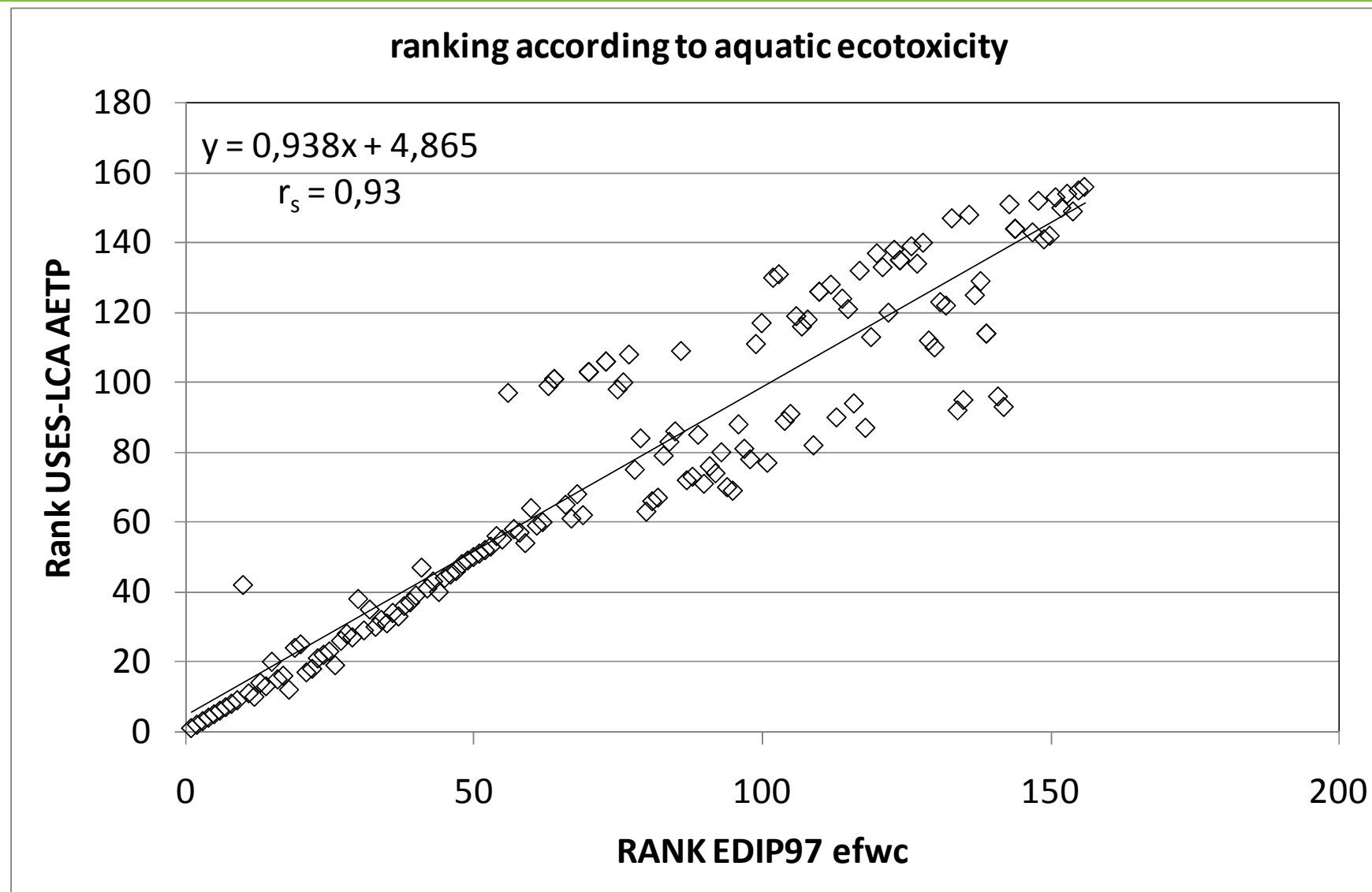
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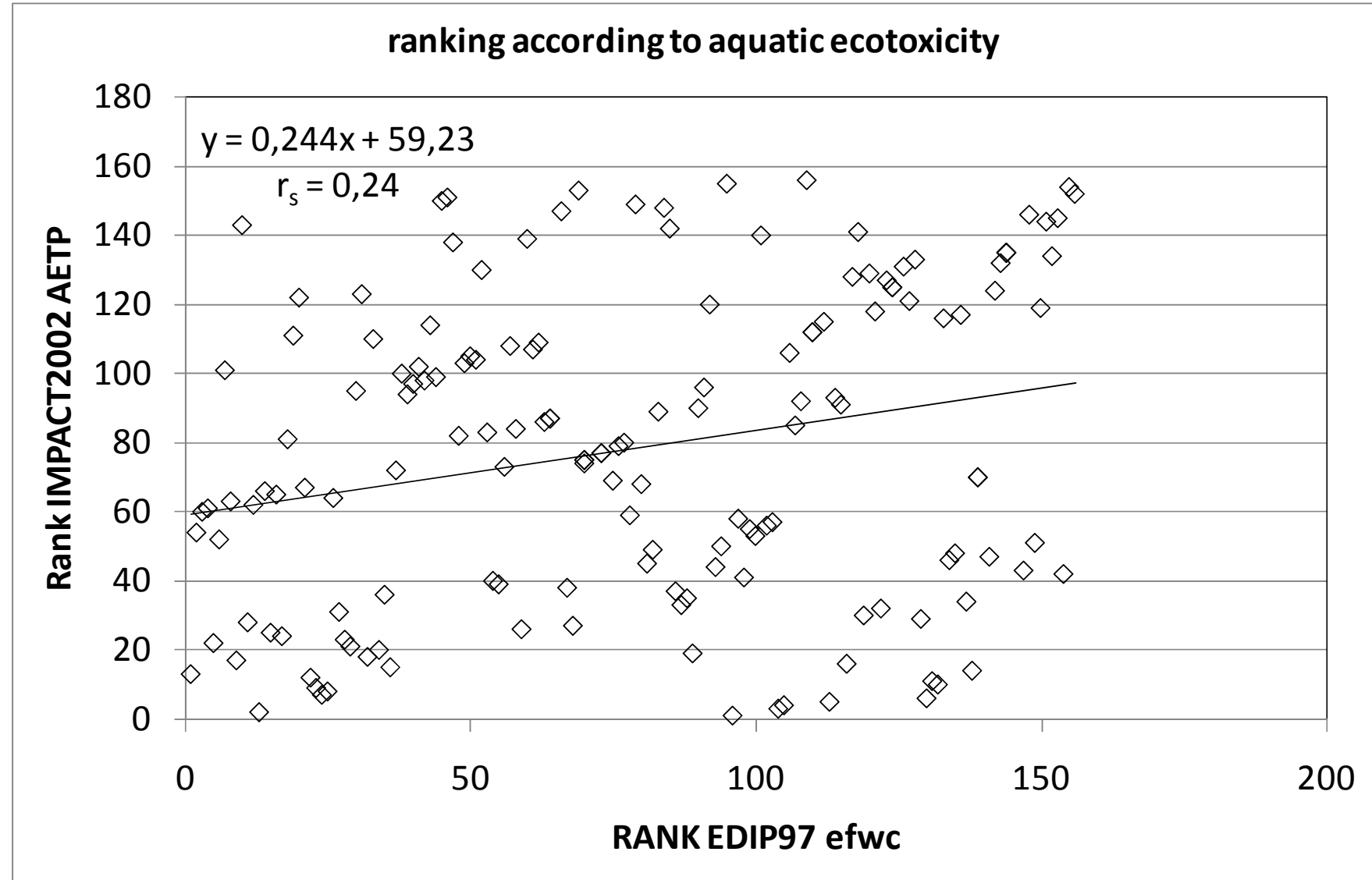
Practical Test : Case study wheat



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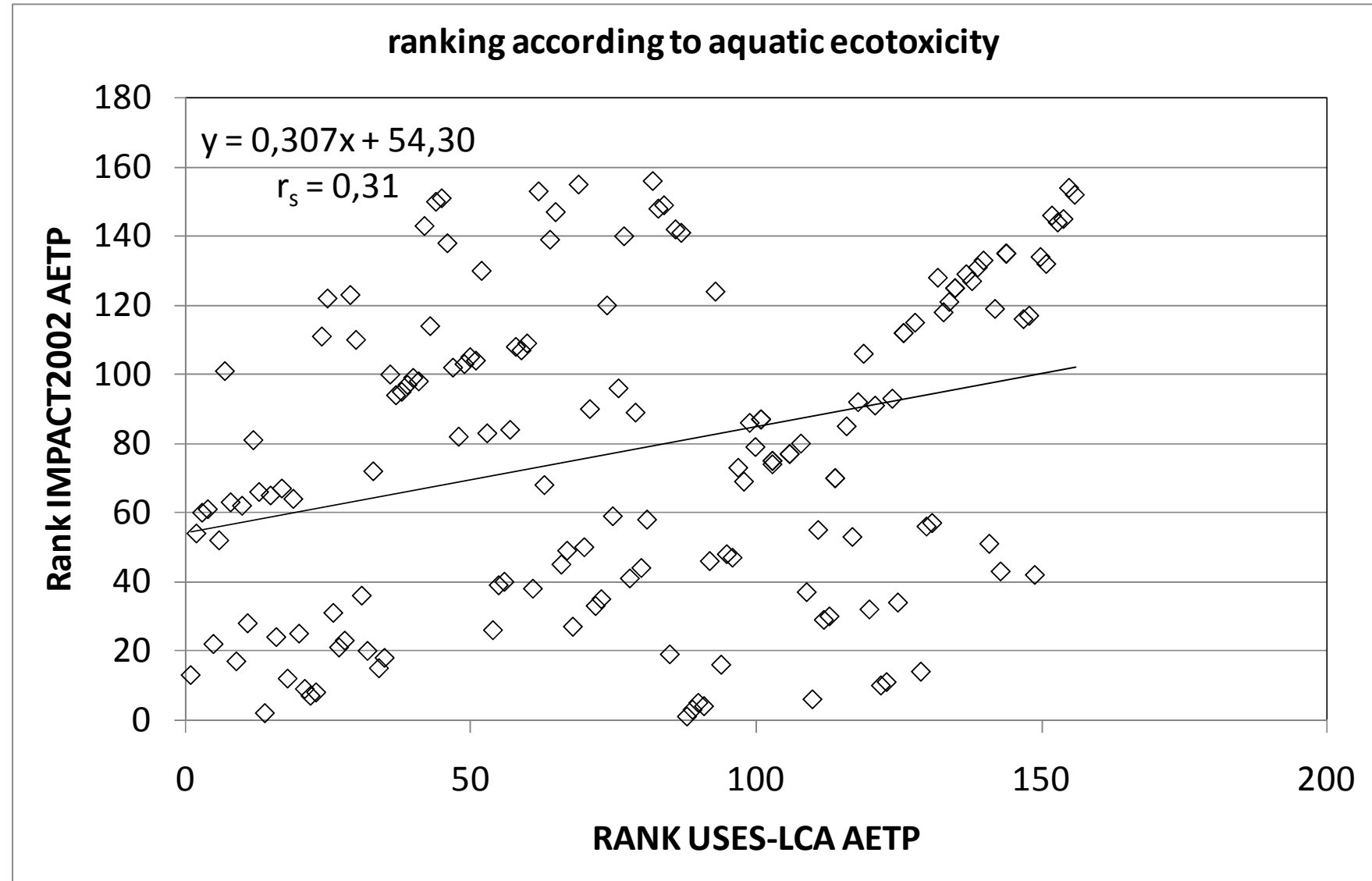
Practical Test : Case study wheat



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Summary



Scientific soundness

- EDIP97 the weakest method
- Impact2002 and USES-LCA with a comparable ranking

Practical feasibility and stakeholder utility

- Only small differences between the LCA methods

Correlation of model results

- correlation results show that a careful interpretation of toxicity results in agricultural life cycle assessments is necessary

**Thank you very much for
your attention**



Literature



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