

Reducing pesticide pollution by agriculture

Comparing literature with experiences in eight case studies across Europe

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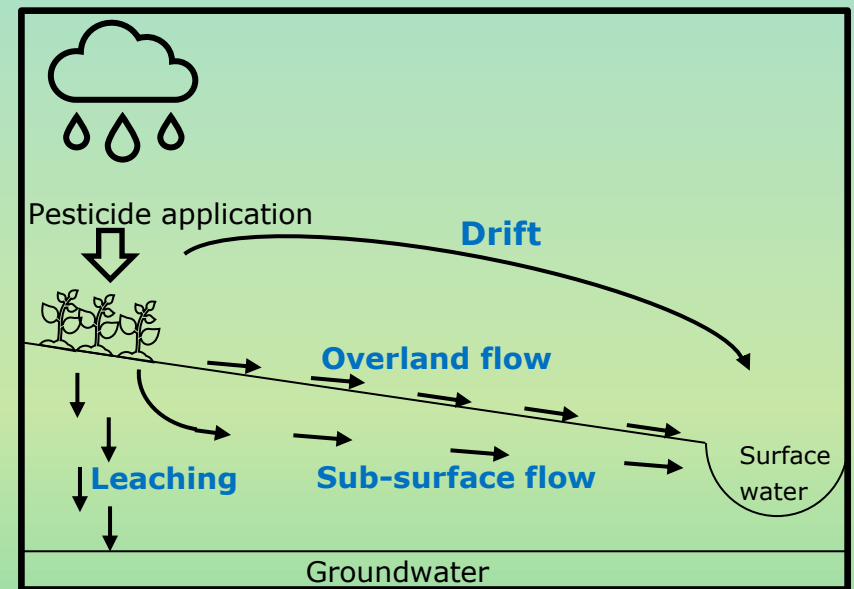
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Introduction

- Pesticides widely used in agriculture
 - found in surface water and groundwater
- EU: precautionary boundary of 0.1 $\mu\text{g/L}$ for any single pesticide
- Monitoring program + admittance through EFSA
- Current regulations: not effective enough
- Transport to off-site locations:
 - Leaching to groundwater
 - Subsurface flow
 - Overland runoff
 - Drift



Objectives

- Measures & good agricultural practices to reduce transport of pesticides from agricultural fields
 - Several reviews in literature
 - FAIRWAY: 8 case studies across Europe

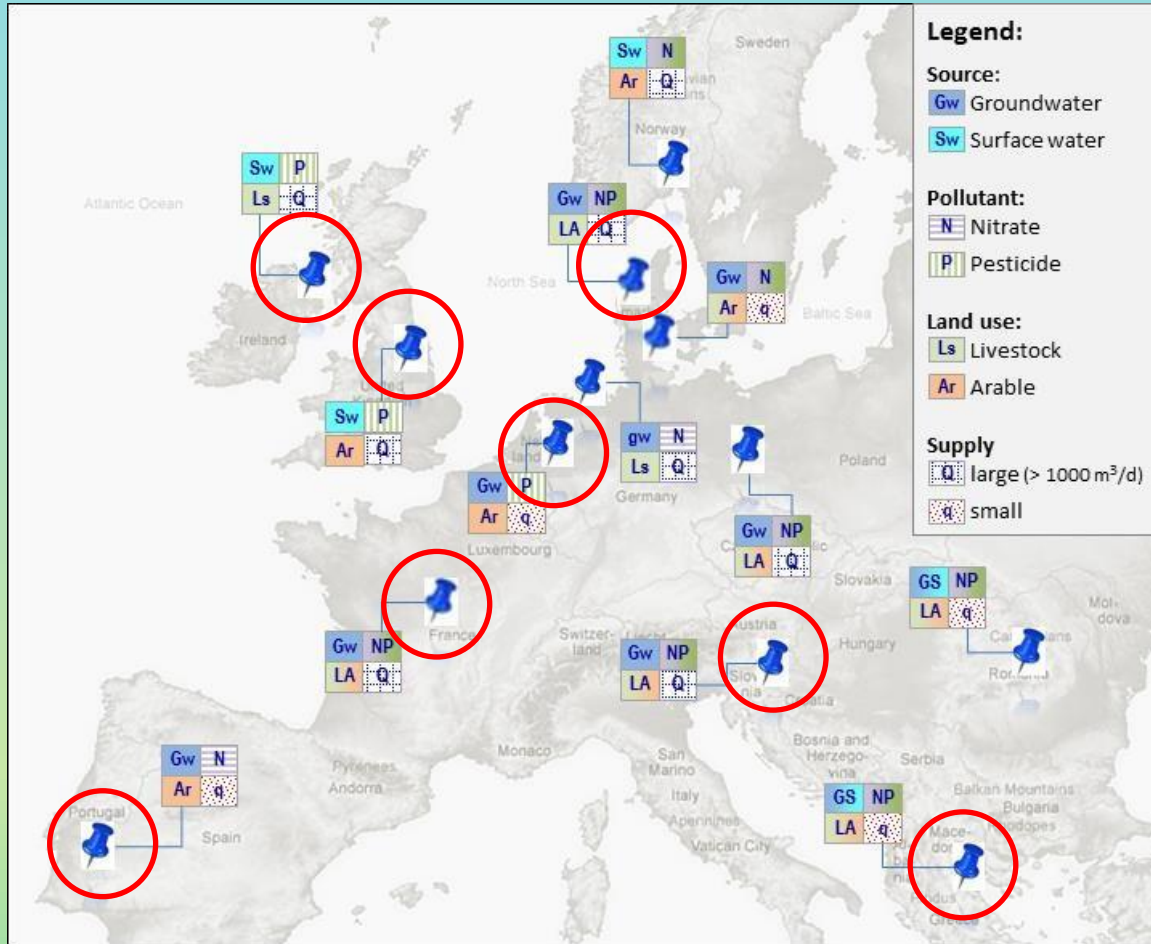
> Compare local practices and experiences (case studies) with the most promising measures identified in literature (reviews & meta-analysis)



La Voulzie case study (picture: FAIRWAY website)

Methods

Eight FAIRWAY case study areas – widely varying activities & pedo-climatic zones



- Aalborg (Denmark)
- Anglian Region (UK)
- La Voulzie (France)
- North Greece (Greece)
- Derg Catchment (Ireland)
- Noord Brabant (NL)
- Baixo Mondego (Portugal)
- Dracsko Polje (Slovenia)

Methods

- Case studies:
 - Questionnaire to local experts / case study managers: indication of:
 - (implementation) costs
 - Effectiveness
 - Adoptability
 - Applicability
- Literature:
 - Systematic search in online databases
 - 4 existing meta-analysis & 17 reviews: synthesized
 - 31 papers: meta-analysis for two specific measures

Synthesis of literature review

Table 3: Synthesis of literature results: effectiveness and costs of key measures.

Measure [source]	Effectiveness ^a		Costs ^b	Notes [source]
	Groundwater	Surface water		
1. Vegetated filter strips	+	+++	€€	Effectiveness depends on design, added ecological value [17,25,28,29]
2. Constructed wetlands	+	+++	€€€	Effectiveness depends on local design. [30–33]
3. Erosion reduction	-	+/-	?	[34,35]
4. Tillage practises	+/-	+/-	€	Effectiveness depends on local design [15,27,36]
5. Drainage optimization	?	+	€	[12]
6. Residue management/ Mulching	?	+	€	[27]
7. Drift reduction	na*	++	€€	High ecological value [26,37–40]
8. Crop rotations	++	++	€€	[16,41]
9. Application rate reduction	+	+	€	[24]
10. Alternative pesticide	?	?	?	Depends on choice [24]
11. Integrated Pest management	++	++	€€€	[24,42]

Results – FAIRWAY case studies

Table 4: Measures applied in the case study areas and their effectiveness, costs, applicability and adoptability as perceived by the questionnaire respondents (mostly case study leaders).

Measure	Involved Countries	Effectiveness		Costs	Applicability	Adoptability
		Groundwater	Surface water			
Safe pesticide cleaning and storage facilities	NL, IR	+/-	+	?	++	-
Safe storage unit for pesticides	IR	?	+	?	?	?
Vegetated buffer strips	FR, SL	?	++	€€	+	-
Crop rotation improvement	FR	++	?	€€€	+	-
Input reduction	FR, UK	++	++	€€€	+	-
Network engagement ¹	UK	?	+			
Alternative (pesticide or mechanical)	UK, IR	?	+	?	+	++
Integrated Pest Management ²	UK, DK	+++	+	€€	+	+
Obligatory reduced input	POR, DK, SL	+++	+++	€	+++	++
Bio filters/beds	IR	?	++	?	?	?
Economic/Tax management ³	DK	+++	?	€€	+++	++

Comparison literature vs case studies

Major difference:

- Literature analysis: measures to reduce transport (field scale)
- Case studies: focus on reduction of input sources (farm system)

Similarities:

- Crop rotation seems a good option, but with high costs (case studies)
- IPM favourable, but costly
- Reduced inputs: promising in case studies (effectiveness, applicability and adoptability), but slightly favourable in literature studies; but with low costs
- Leaching to groundwater: reduced input (case studies) and no effective on-site measures (literature review)
- On-site measures: similar, but with high costs and unfavourable adoptability (case studies)

Discussion

Limitations:

- Difference in focus in case studies and literature analysis
 - Literature: on-field measurable results (e.g. experiments)
 - Difficult to quantify applicability and adoptability from literature measures
 - Case studies: broader view, including estimations of adoptability and applicability, but hard to quantify and much variation

Complementarity:

- Literature review looks back in time
- Case studies: current practices and perceived effectiveness

Conclusions

Main findings:

- Farming system changes (IPM, crop rotations) most effective, but costly
- (Obligatory) reduced inputs evaluated positively in case studies regarding effectiveness, applicability and adoptability
- On-field measures rated positively include VFS, constructed wetlands, drift reduction, crop rotation and IPM; but adoptability was rated negatively for buffer strips in the case studies

Proper management on the field contributes to reduced pesticide pollution risk, but on-site measures alone are not enough – farm system changes focused on reduced input and regional / national approaches are needed as well.

Thank you for listening!

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