



New BMPs on Drainage and Leaching



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Outline



- Context for Developing & Using the New BMPs
- Factors Affecting Pesticide Movement & Its Diagnosis
- The BMP Measures
 - Pesticide Use Practices
 - Agronomic Practices
 - Drainage & Irrigation Practices
- Conclusion & Next Steps



Context for Developing & Using the New BMPs

- Key to completing the 'TOPPS umbrella' for water protection
- The aim is to meet society's expectations for clean water by reducing pesticide movement down soil profiles where unacceptable
- BMPs cover two kinds of pesticide movement with water in soil profiles:
 - **Drainage:** via artificial drains to surface water
 - **Leaching:** down to groundwater
- Water protection mostly achieved by strict EU regulatory procedures
- Unacceptable movement sometimes occurs at the extremes
 - Product use patterns & pesticide movement potential
 - Local soil & climate characteristics + field management practices



Context for Developing & Using the New BMPs

When should the Drainage and Leaching BMPs be implemented?

Reactively

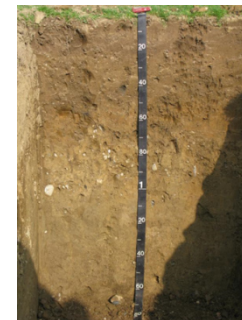
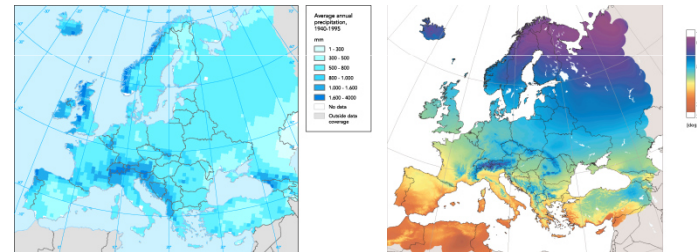
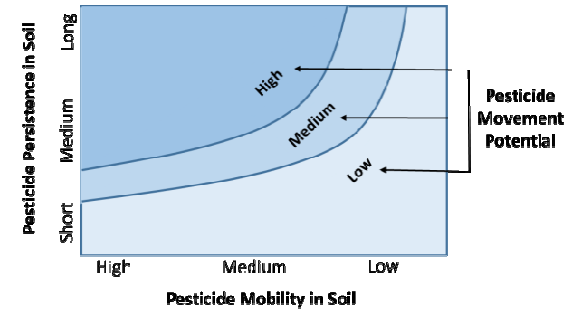
- When unacceptable movement occurs
- Focus on pesticide use BMPs
- Improve conventional agriculture
- Product stewardship

Pro-Actively

- Before unacceptable movement occurs
- Focus on agronomy BMPs etc.
- Support sustainable agriculture
- Land stewardship

Factors Affecting Pesticide Movement & Its Diagnosis

- **Pesticide factors** – determined partly by use rates & strongly by movement potential
- **Climate factors** – drive pesticide movement (total rainfall) & rates of degradation (temperature)
- **Soil hydrology** – different soil & water scenarios for drainage & leaching (for unacceptable findings pesticide-climate factors implicit)



Soil hydrology diagnosis needed to limit pesticide movement



Factors Affecting Pesticide Movement & Its Diagnosis

Pesticide movement vulnerability decision trees: Drainage

- Factors: drainage type, cracks, subsoiling, % clay, WHC

Drainage due to low-permeability soil	Large cracks/macropores ¹ occur	High risk		
		Subsoiling or moling done		
	Large cracks/macropores do not occur in most years	No subsoiling or moling done	Clay >35%	High risk
			Clay 25 to 35%	Medium risk
			Clay <25%	Low risk
	Drainage to control shallow groundwater	Mineral soil	Large cracks/macropores occur	High risk
Large cracks/macropores do not occur in most years			WHC ³ <150 mm	High risk
			WHC 150–230 mm	Medium risk
		WHC >230 mm	Low risk	
Peaty ² soil		Low risk		

Decision tree co-developed by academia, technical institutes & industry



Factors Affecting Pesticide Movement & Its Diagnosis

Pesticide movement vulnerability decision trees: Leaching

- Factors: GW depth, cracks, soil type, no-till, WHC

Shallow ¹ groundwater	Large cracks/macropores ² occur		High risk
	Large cracks/macropores do not occur in most years	Sowing under no-till	High risk
		WHC ³ <150 mm	High risk
		WHC of 150 to 230 mm	Medium risk
		WHC >230 mm	Low risk
Peaty soil ⁴	Low risk		
No shallow groundwater	Shallow soil ⁵ on fractured rock		High risk
	Other soil	Sowing under no-till	Medium risk
		WHC <150 mm	Medium risk
	WHC >150 mm	Low risk	

Decision tree co-developed by academia, technical institutes & industry



The BMP Measures - Pesticide Use Practices

What to do?

Types of BMP Measure	The BMP Measures
Adapt application timing	<ul style="list-style-type: none"> • Avoid applications shortly before heavy rainfall is forecast • Use split applications if possible (to spread the risk) • Avoid applications in the drainflow / GW recharge season* • Consider using alternative products*
Reduce use rates / field	<ul style="list-style-type: none"> • Reduce applied rates within label conditions • Use seed treatment instead (doses normally lower) • Use pest monitoring to refine choice of product / AI • Use variable rates across fields if justified / feasible • Use mixture products if feasible to manage pests*
Optimise overall use rate across catchment area	<ul style="list-style-type: none"> • Depends very strongly on the crop rotation • Rotate pesticides used for individual crops in the rotation* • Restrict pesticide applications in most vulnerable fields*

*Use reactively if there are unacceptable findings; others pro-actively



The BMP Measures - Pesticide Use Practices

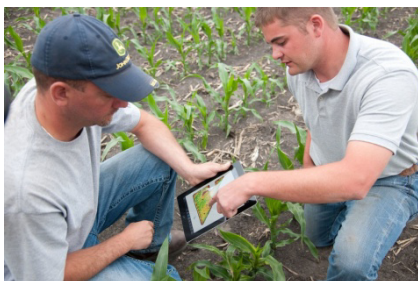
How to do it?

- Check product labels / weather forecasts
- Check with product stewardship advisors, e.g. agronomists

and

Look to the Future & Go Digital by Following Investments in:

- Mapping tools over *which fields* to apply to due to vulnerability
- Decision support tools over *when* to apply due to pest risks
- Precision technology over *which parts of fields* to apply to





The BMP Measures - Agronomic Practices

- **What to do?**

Types of BMP Measure ¹	The BMP Measures
Optimise crop rotation	Select crop rotations to include optimisation of crop health <ul style="list-style-type: none">• Alternate winter and spring crops on fields• Alternate crops with tap and fibrous root systems
Grow cover crops	Select cover crops to fit crop rotation & benefit farmers <ul style="list-style-type: none">• Brassicas (mustards, raddishes, turnips)• Legumes (vetches, clovers)• Grasses & cereals (oats, rye, ryegrass)
Adapt tillage in soils with large cracks / macropores	If drainage or leaching is an issue, then consider using <ul style="list-style-type: none">• Shallow tillage on vulnerable fields to reduce the impact*

¹All highlighted in the Sustainable Use Directive as core to IPM

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The BMP Measures - Agronomic Practices

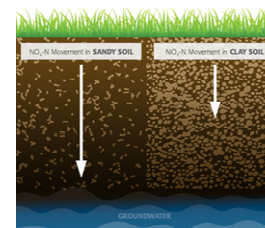
- **Why do it? To work more productively with Ecosystem Services**
Optimise Crop Rotation, Including Cover Crops & Adapt Tillage

IPM &
soil health



Explores soil
resources fully

Sustainable
cropping



Helps
recycle
nutrients

As little as possible, but
as much as necessary



Cover crops
feed soils

- **Why not do it? If costs > benefits. Too complex. Time consuming.**



The BMP Measures – Drainage & Irrigation Practices

- **What to do?**

Types of BMP Measure	The BMP Measures
Drainage	Design drainage systems to avoid over-drainage <ul style="list-style-type: none">• Get advice to install primary drainage systems (~decades)• Amend secondary drainage system practices (~5 years)
Drainage Retention	Use retention structures (ponds, wetlands) if there are issues*
Irrigation	<ul style="list-style-type: none">• Optimise scheduling - modern precision practices to meet crop water needs (real time needs vs. calendar estimation)• Amend pesticide use if there are issues (design integrated practices for product application / irrigation)*

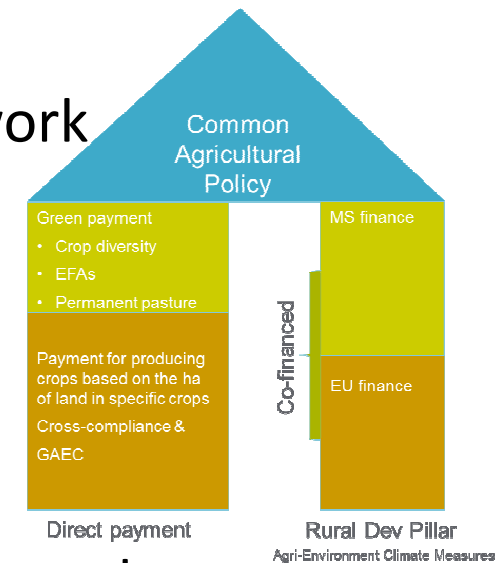
*Use reactively if there are unacceptable findings; others pro-actively

Conclusion

- New drainage & leaching BMP framework defined
- Relevant to drinking water providers to deliver clean water

Next Steps

- Raise awareness & start implementing framework
- Start changing practices as necessary
 - **Pesticide Use:** amend use pattern thinking
 - **Agronomy:** add ecosystem services thinking
 - **Drainage & Irrigation:** use it, don't lose it
- Help farmers move to Sustainable Agriculture step-by-step





Thank you for your attention!

And to the drainage & leaching project team:

- Professor Colin Brown, York University, UK
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