



Farming Rules for Water – the devil is in the detail

John Williams, Anne Bhogal, Steve Anthony and Richard Gooday

Water pollution is a big deal



The screenshot shows a BBC News article titled "'Chemical cocktail' polluting English rivers - MPs warn". The article is by Georgina Rannard, dated 13 January 2022. A yellow banner indicates the article is more than 4 months old. The article's main text reads: "Pollution is damaging UK rivers more than public thinks, report says". The article is categorized under "Rivers" and "Pollution".

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Science & Environment

'Chemical cocktail' polluting English rivers - MPs warn

By Georgina Rannard
BBC News

13 January | Comments

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Rivers

● This article is more than 4 months old

Pollution is damaging UK rivers more than public thinks, report says

... runoff, sewage pipes and

What's killing the River Wye?
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Pollutants from agriculture



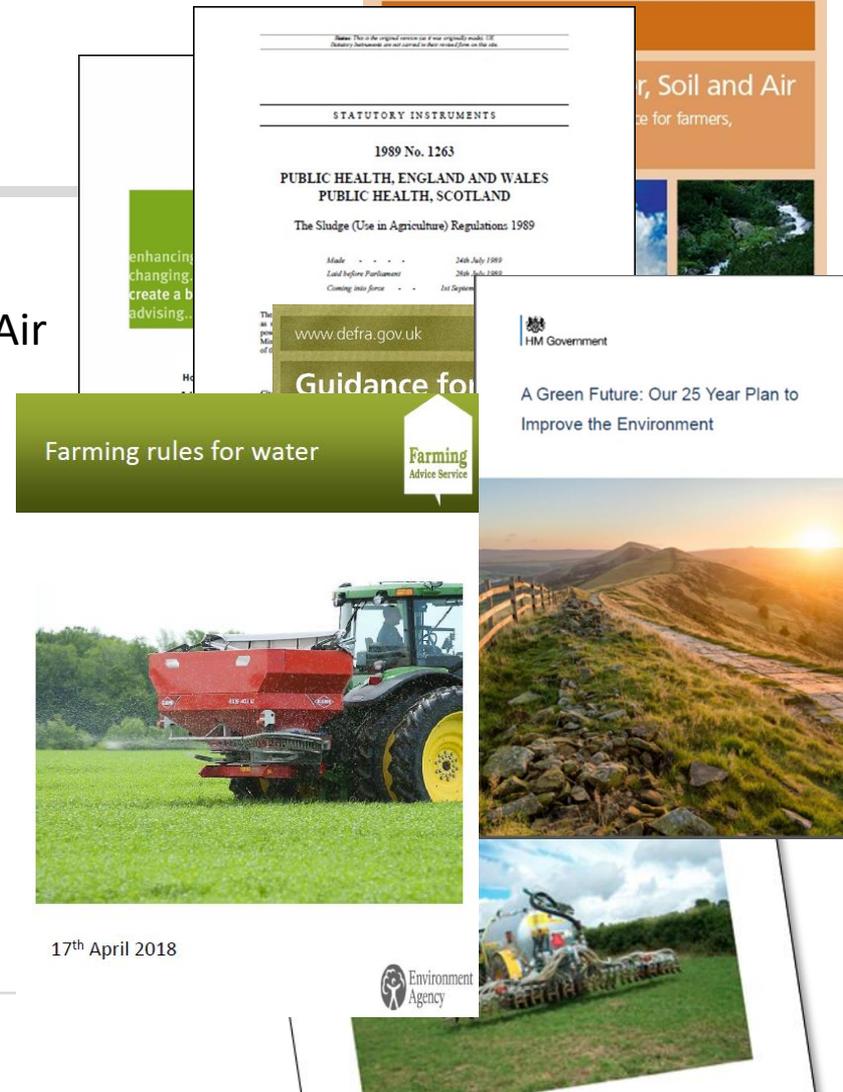
- Nitrate (algal blooms; human health)
- Ammonium (toxic to fish)
- Phosphorus (algal blooms)
- Sediment (damages water habitats)
- Microbial pathogens (human health)
- Pesticides



Agriculture estimated to contribute 60% of nitrate, 30% of phosphorus, 75% of sediment and 75% of pesticides in England's rivers

Guidance, rules and regulations

- Environmental Protection
- Code of Practice for Protection of Water, Soil and Air
- Sludge Use in Agriculture
- Nitrate Vulnerable Zone Action Programme
- AHDB's Nutrient Management Guide (RB209)
- 25 Year Environment Plan
- **Farming Rules for Water**



17th April 2018



Farming Rules for Water - 2018

- Organic manures must not be stored on land:
 - a) within 10m of a water course or 50m of a borehole
 - b) where there is significant risk of pollution
- Organic manures or manufactured fertilisers must not be applied if the soil is waterlogged, frozen, flooded, or snow covered
- Organic manures must not be applied:
 - a) within 10 m of a water course (6m if using bandspreaders)
 - b) within 50 m of a spring, well or borehole

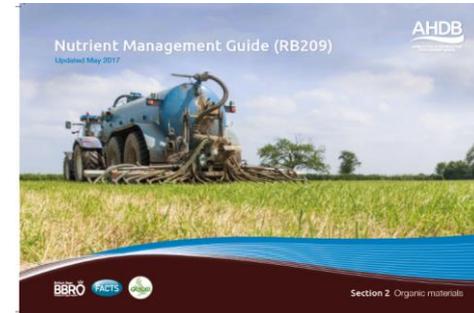


Farming Rules for Water

- “Application of organic manures and manufactured fertilisers to cultivated land must be planned in advance to meet soil and crop nutrient needs and not exceed these levels”
- “Planning must take into account where there is a significant risk of pollution and the results of testing for Phosphorus, Potassium, Magnesium and pH...at least every 5 years. You may determine soil nitrogen levels by assessing the soil nitrogen supply instead of testing the soil”

Key steps to nutrient management planning

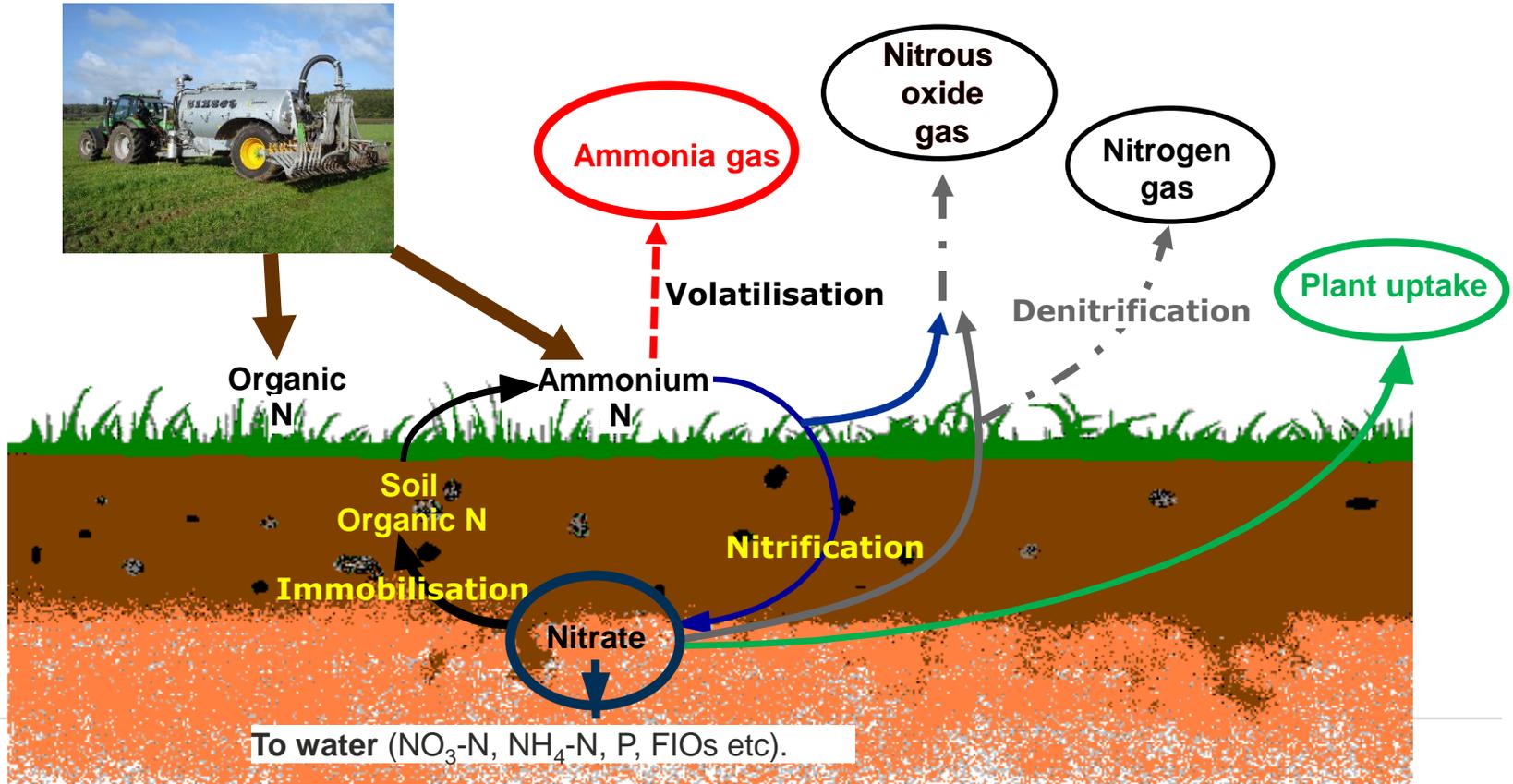
1. What does the crop need?
2. What's in the soil?
3. Account for manure nutrient supply
4. Top up with bag fertiliser



Rule 1: *‘The application of organic manures or manufactured fertiliser must be planned in advance to meet **soil and crop nutrient needs** and not exceed these levels or give rise to a significant risk of agricultural diffuse pollution’*

- **Application in autumn/winter of an organic material containing readily available N only permissible if there is an autumn crop N fertiliser requirement**
- RB209: Recommended nitrogen timings for individual crops are given in the recommendation tables.
 - No seedbed fertiliser N requirement for winter cereals
 - N fertiliser should be applied in spring or early summer to grass, although August applications are suggested if autumn grass is required for grazing

Minimising diffuse pollution from manure management - find the balance



What impact would the EA's interpretation have on:

- Farm practice
- Losses to air and water

Draft a matrix on the responsible use of organic materials



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Impact Assessment – Farming Rules for Water

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Task 1: Current practice (baseline)

Estimated quantities of organic materials applied to agricultural soils in England



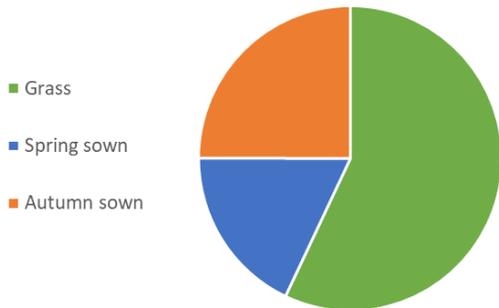
Organic Material	Total applied (MT, fresh weight)
Livestock manures:	48.2
Cattle FYM	14.2
Cattle Slurry	24.9
Pig FYM	2.1
Pig Slurry	2.9
Poultry Manures	1.9
Farm-based Digestates	2.2
Compost	1.9
Digestate*	4.3
Biosolids	3.5

*from commercial plants; WRAP, 2020



Destination of livestock manure applications

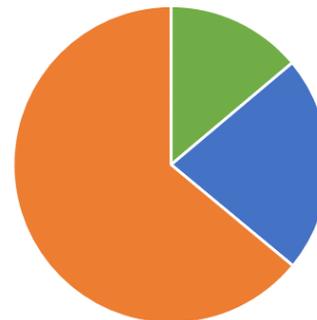
Cattle FYM



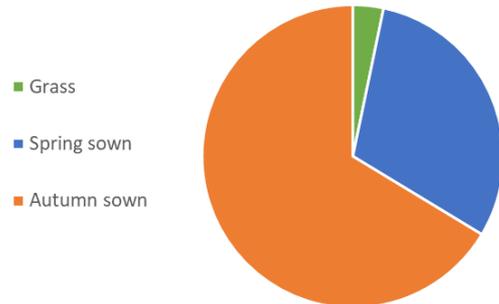
Cattle Slurry



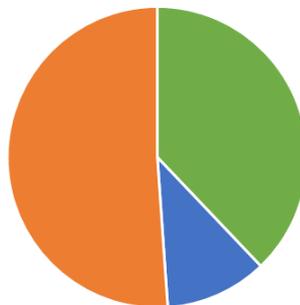
Poultry manure



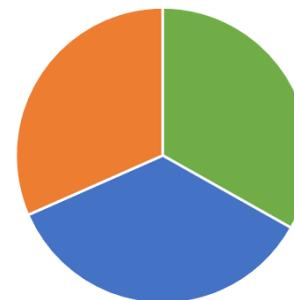
Pig FYM



Pig Slurry



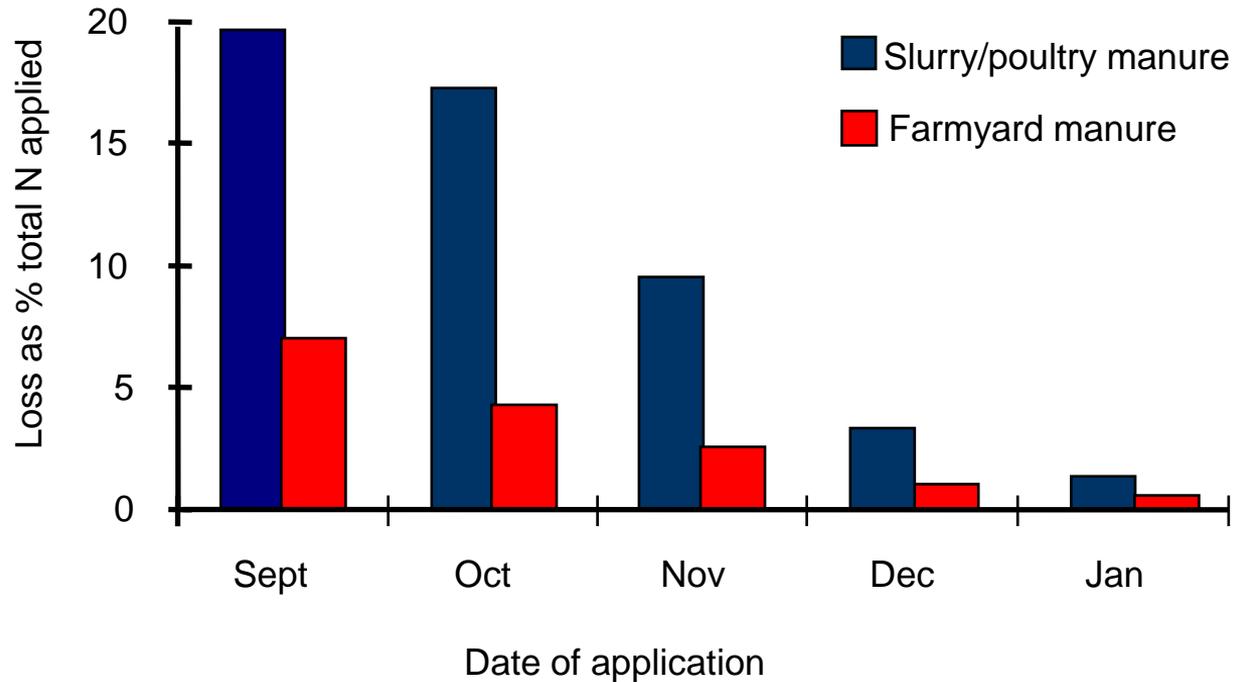
Manure-based digestate



Amount of manure moved to spring - and requiring storage over winter

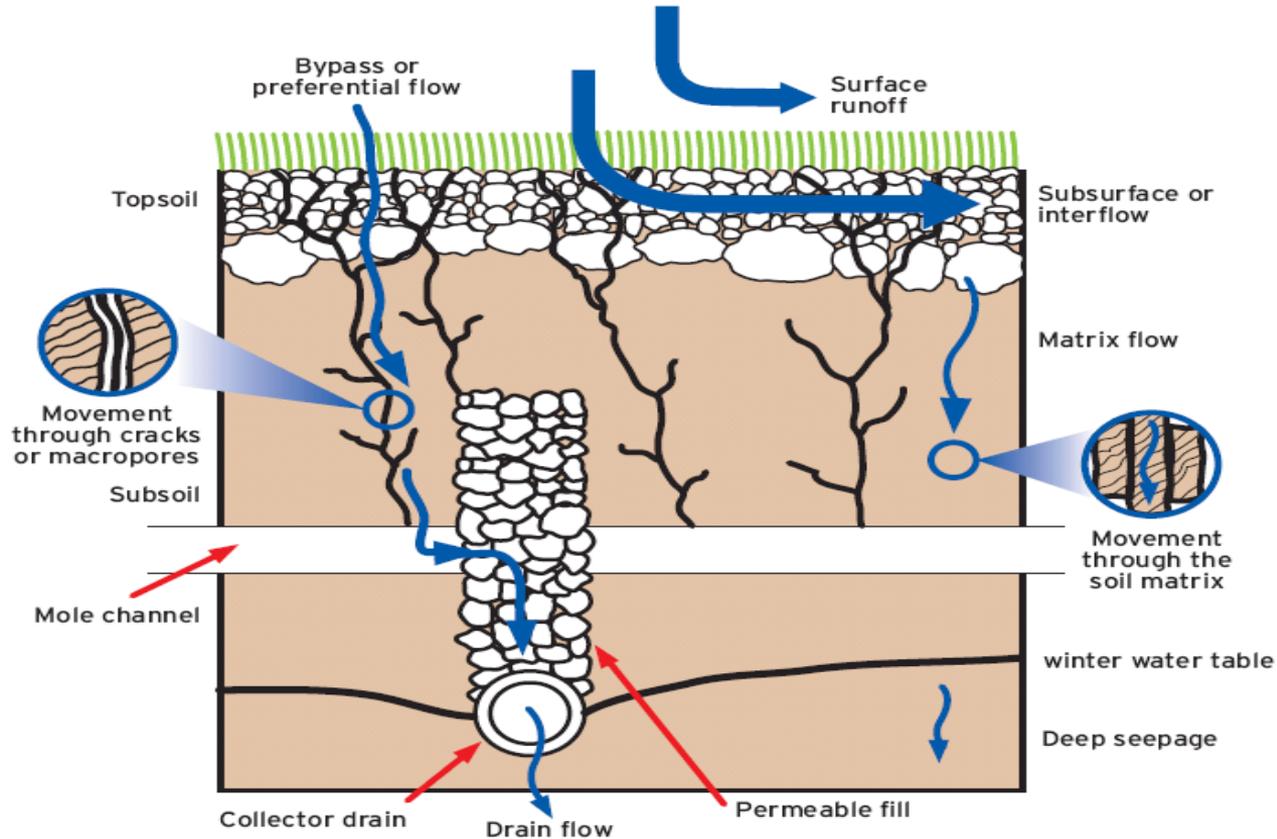
Manure type	Total applied (MT)	% Applied Aug-Dec		Quantity moved to spring	
		Baseline	Scenario	MT	%
Cattle FYM	14.2	43.6	8.2	5.1	35.5
Cattle Slurry	24.9	11.4	2.0	2.3	9.4
Pig FYM	2.1	71.9	9.2	1.3	62.8
Pig Slurry	2.9	33.6	13.0	0.6	20.6
Poultry Manures	1.9	67.8	25.5	0.8	42.2
Farm-based Digestates	2.2	18.6	7.9	0.2	10.7
Total	48.2	27.5	6.0	10.3	21.5

Spring application timings minimise nitrate leaching losses

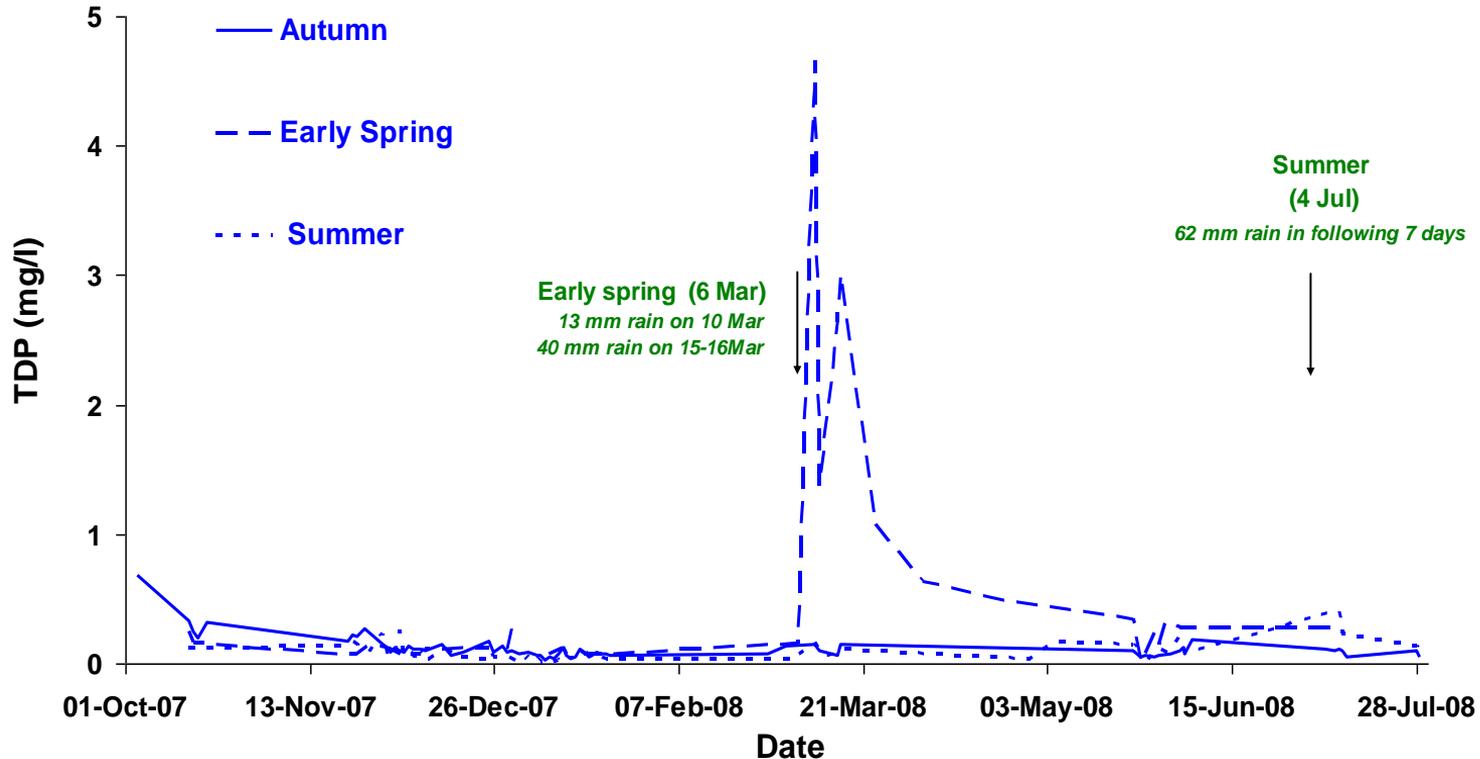


Source: Chambers *et al* (2000)

Applications on drained soils



Dissolved P concentrations in drainage water following *cattle slurry* applications to grassland



0.1mg/l indicative eutrophication limit value (EA)

Drainage water samples 10 days after slurry was applied to grassland on 6 March



Practical implications

Additional storage required:

- Temporary field heaps – increased risk of point source pollution
- Increase slurry storage capacity (current SSAFO 4 months; NVZ rules: 5-6 months) - £££
 - *New Slurry investment scheme from autumn 2022*



Practical implications

Challenges of spring spreading:

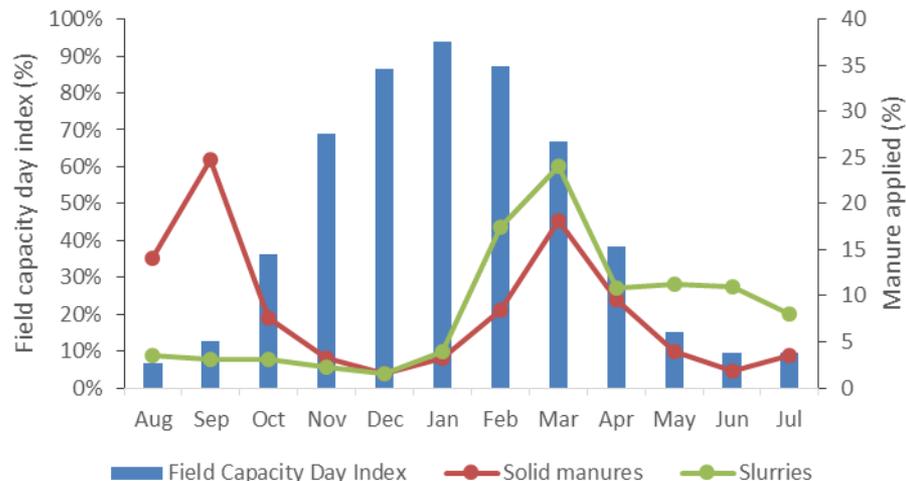
- Heavy equipment
- Risk of crop damage from top-dressing onto growing crops
- Wet soils – limited number of spreading days & risk of soil damage



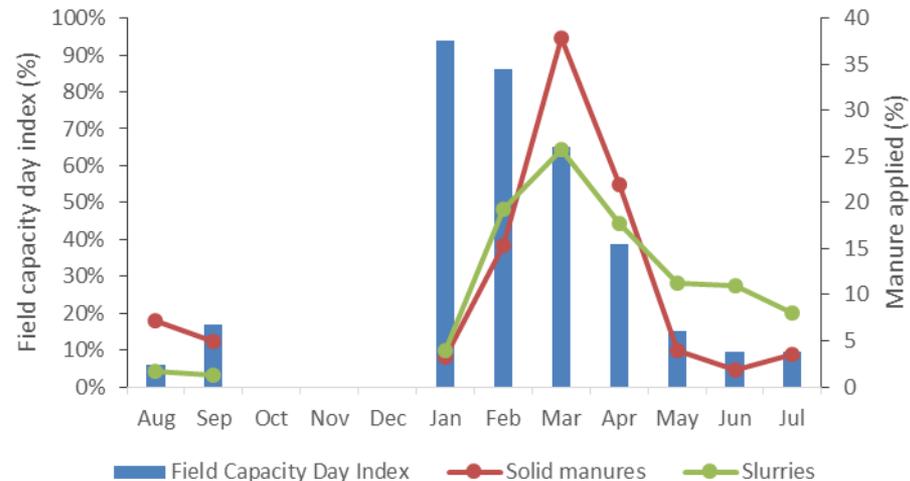
Proportion of days in a month when soils too wet to travel

Volume weighted fraction of days at field capacity in relation to the distribution of manure applications

a) Baseline (current practice)



b) Scenario



Baseline losses following livestock manure additions in England (current practice)

Loss pathway	Baseline (kt)	Total agricultural emission	
		(kt)*	%
NH ₃ -N	30.6	132	23
NO ₃ -N	9.1	331	3
N ₂ O-N	1.3	18	7
Total P	0.7	4	15

*Total agricultural emission as reported in the 2019 Agricultural Ammonia and Greenhouse Gas Inventory (AAGHI) and the PSYCHIC model (2004).

Implications of a move to spring applications on the balance of N and P losses

Totals for all soil types and English regions

Loss pathway	Baseline	Optimised scenario*	
	kt	kt	% change
NH ₃ -N	30.6	33.6	10
NO ₃ -N	9.10	3.80	-58
N ₂ O-N	1.30	1.29	-1.0
Total P	0.68	0.89	31

Effective change: 1.5% decrease, but 2 – 2.5% and 5% increase in the total agricultural emission of NO₃-N, NH₃N and P, respectively

Suggested matrix for the responsible use of organic materials



Soil type	Light						Medium/heavy					
	Low			High			Low			high		
Organic material (RAN content)												
Application timing	Autumn	Winter	spring	Autumn	Winter	spring	Autumn	Winter	spring	Autumn	Winter	spring
Spreading days	high	low	high	high	low	high	high	low	low	high	low	low
Storage requirements	low	medium	high	low	medium	high	low	medium	high	low	medium	high
Water:												
Nitrate-N	**	*	*	***	**	*	*	*	*	**	**	*
Phosphorus	*	**	**	*	**	**	*	***	***	*	***	***
Air:												
Ammonia - grass	**	**	**	***	***	***	**	**	**	***	***	***
Ammonia - arable	*	**	**	*	***	***	*	**	**	*	***	***
Nitrous oxide	*	*	*	*	*	*	*	*	*	*	*	*
Soils:												
Compaction risk	*	**	**	*	**	**	*	***	***	*	***	***

Autumn: Aug. Sept. Oct.

Winter: Nov. Dec. Jan

Spring: Feb. Mar. Apr.

Risk of losses/compaction

* low

** Medium

*** High

Summary

- Minimising diffuse pollution from agriculture is a challenge
- Nutrient management planning - optimises nutrient use efficiency
- Manure management challenges:
 - Spring applications of manures will reduce nitrate leaching losses but....
 - Incorporation into the soil reduces ammonia and odour losses to air and P losses in surface runoff
 - Topdressing solid manures – challenging!
 - Spring timings increase risk of soil damage and P loss
 - Greater slurry storage capacity needed on many farms
- Alternatives to land application are very limited



Questions?

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