Ulster Arable Conference
25 February 2010

Supplying the Nutrient needs of Arable Crops

- working within RB209

Brian J Chambers

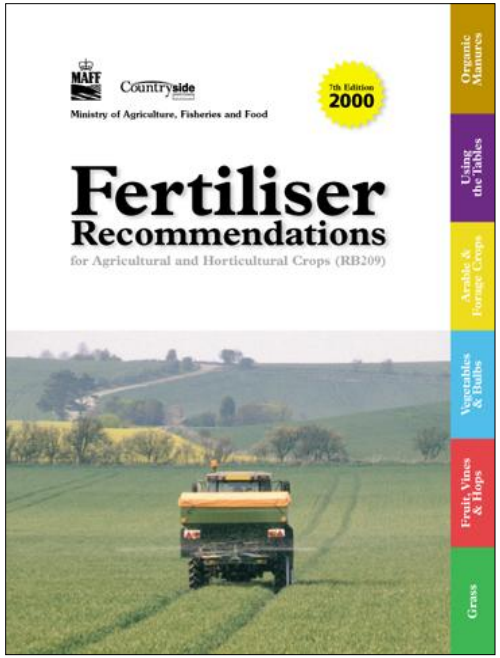
ADAS

Fertilisers

Revision of Defra's "Fertiliser Recommendations (RB209)" booklet

Led by Rothamsted Research:

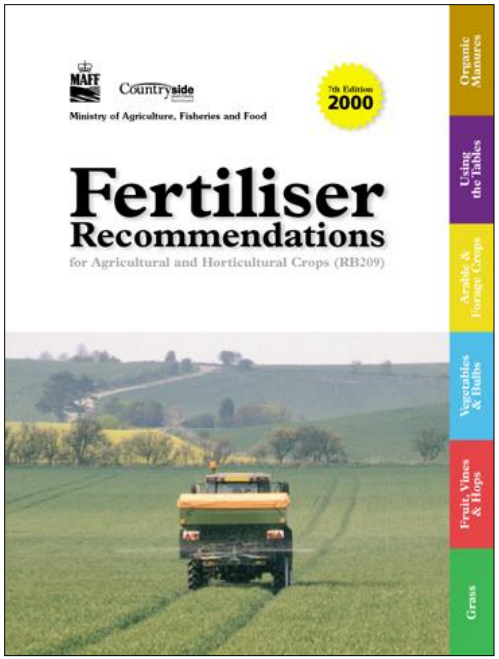
- wide consultation
- draft revisions by technical groups
- *revised edition due soon* (delay: consensus not reached on grassland)



The RB209 recommendations are not mandatory limits under the NVZ rules in England and Wales

Revision of Defra's "Fertiliser Recommendations (RB209)" booklet

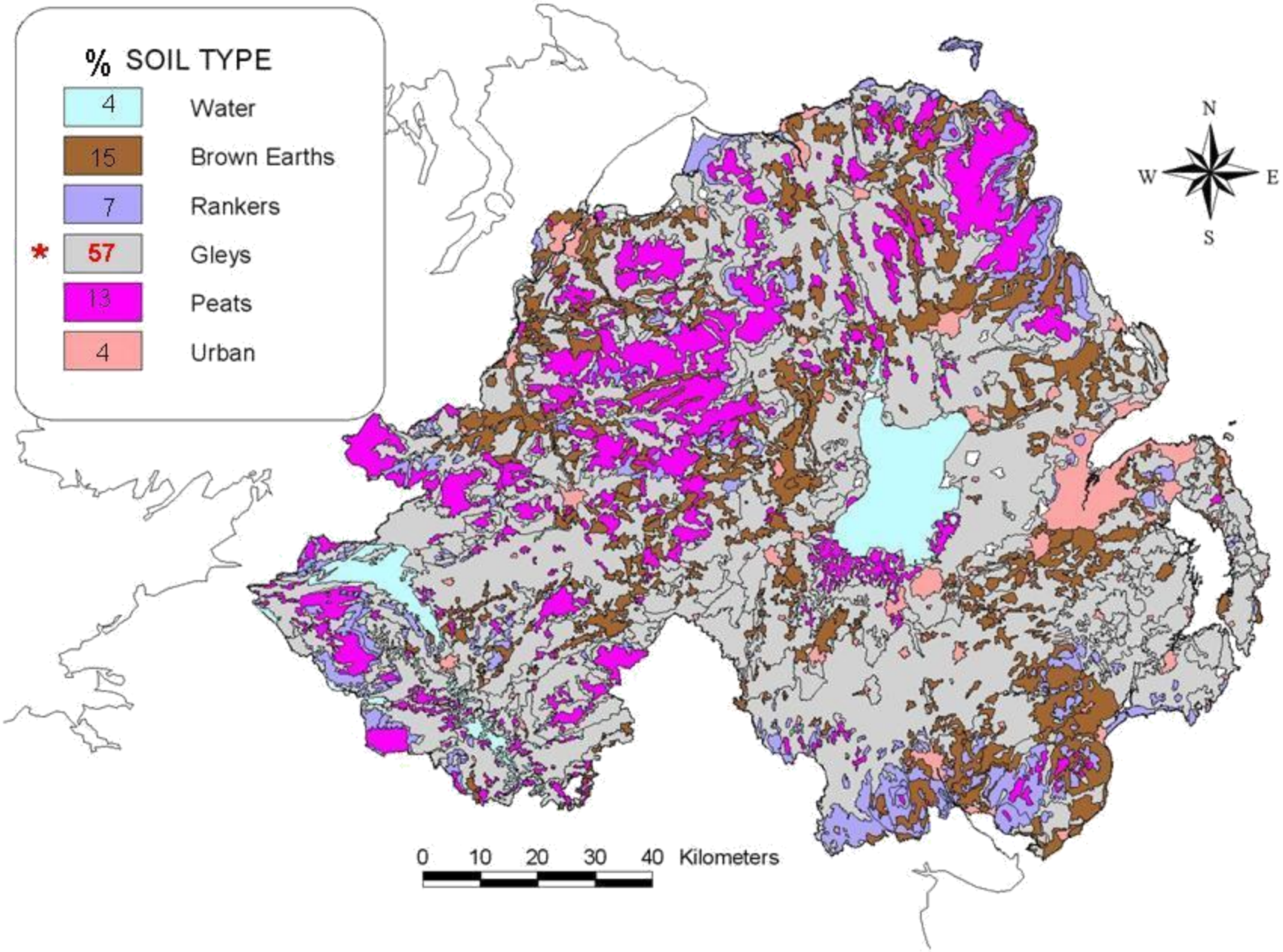
- **The "Fertiliser Manual (RB209)"…….**
  - **Arable (biomass)**
  - **Vegetables**
  - **Organic manures**
  - **PKSMg fine tuned**
  - ***Clarification on soil types***



- ***Environmental aspects strengthened (NVZs)***

- **But style remains same as 7th edition of RB209**

Major Soil Types



The N max limit - a limit on the rate of N that may be applied across the *whole area of a crop type (including manure N)*

Crop	Nitrogen limit (kg N/ha)	Standard yield (t/ha)
Winter wheat	220	8.0
Spring wheat	180	7.0
Winter barley	180	6.5
Spring barley	150	5.5
Oilseed rape, winter	250	3.5
Sugar beet	120	-
Potatoes	270	-
Forage maize	150	-
Field beans	0	-
Peas	0	-
Grass	330/300	-

The N max limits for some crops can be increased if:

- **yield is above the standard yield**
- **shallow soil type**
- **milling wheat**
- **cut grass**

There are no N max limits for other crops

Closed periods – manufactured N fertiliser

Grassland	Tillage land
15 September to 15 January	**1 September to 15 January**

- Application is allowed to *specified crops* that have a crop N requirement during the closed period. Conditions apply
  - e.g. oilseed rape (30 kg N/ha max)
- Application to other crops during the closed period is allowed with written advice from a FACTS qualified adviser
- Solution fertilisers may be applied in the closed period if there is a P or K requirement and no practical alternative

Revised RB209 – main changes (draft)

- **Soil Nitrogen Supply (SNS) Index System - revised:**
  - **lower SNS Index in some situations, e.g. crops following peas, beans, oilseed rape, potatoes, un-cropped land (set-aside)**

- **N rates increased for winter wheat:**
  - **Break-even Ratio (BER) adjustment**
  - **grain N% adjustment, but no yield adjustment**
  - **none or only minor changes to other arable crops**

- **Only minor changes to PKS recommendations**

N response x variety trials (HGCA funded)

- **Winter wheat: 39 trials**
  Spring barley: 15 trials

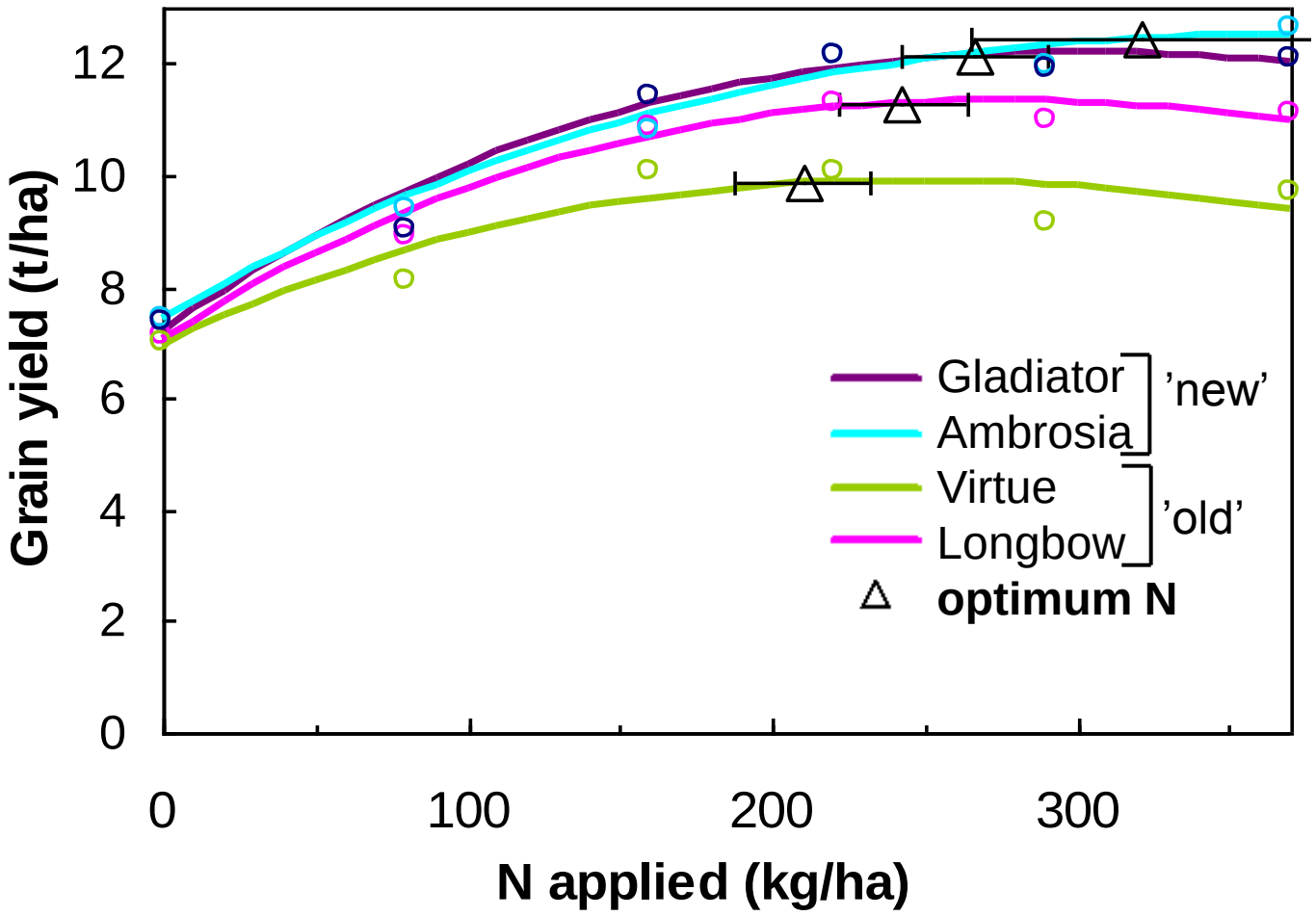
- **Harvests 2003-2007:**

  4 varieties
  - **2 ‘old’: *new in 1980s***
  - **2 or 3 ‘new’: *new in 2000s***

  6 N levels
  - **Nil to 167% recommended N**

ADAS Terrington 2006

N response x variety (Terrington 2006)



HGCA N response x variety trials - summary

Winter wheat

	Old	New	
Yield at Nopt, t/ha	8.35	+1.19	✈✈✈
Optimum N, kg/ha	146	+28	✈✈✈
Grain N at nil N, kg/ha	77	+5	✈✈
Grain N at Nopt, kg/ha	145	+21	✈✈✈
Grain protein at N_{200}, %DM	12.8	-0.47	✈✈✈

Spring barley

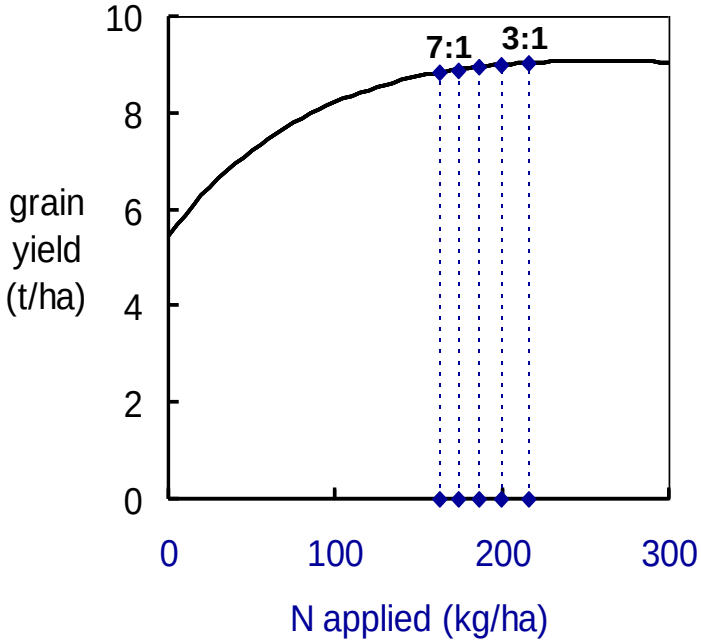
Yield at Nopt, t/ha	5.13	+0.87	✈✈✈
Optimum N, kg/ha	142	-7	NS
Grain N at nil N, kg/ha	43	+3	✈
Grain N at Nopt, kg/ha	87	+12	✈✈

Breakeven ratio (BER) = kg grain to pay for 1 kg N

CAN (£135/t) = $\frac{135 \times 100}{27 \times 10}$ = 50 pence/kg

Grain (£100/t) = 10 pence/kg

Breakeven ratio = $\frac{50}{10}$ = 5



- **Small changes around the optimum have little effect on yield**
  - **more effect on grain protein**

BER adjustments

	Fertiliser N content (%)	*Fertiliser Cost (£/tonne PRODUCT)*					
AMMONIUM NITRATE	**34.5%**	**£138**	**£207**	**£276**	**£345**	**£414**	**£483**
UREA	**46.0%**	**£184**	**£276**	**£368**	**£460**	**£552**	**£644**
UREA-AMMONIUM NITRATE LIQUID	**28.0%**	**£112**	**£168**	**£224**	**£280**	**£336**	**£392**
Cost of FERTILISER NITROGEN	***£/kg N***	**£0.40**	**£0.60**	**£0.80**	**£1.00**	**£1.20**	**£1.40**
Change to recommended N for ALL CEREALS (kg/ha)							
Grain sale price (£/tonne)	**50**	**-40**	**-80**	**-120**	**-150**	**-180**	**-210**
	75	**-0**	**-40**	**-70**	**-100**	**-120**	**-140**
	100	**10**	**-10**	**-40**	**-60**	**-80**	**-100**
	125	**30**	**0**	**-20**	**-40**	**-60**	**-70**
Decrease	**150**	**30**	**10**	**-0**	**-20**	**-40**	**-50**
Increase	**175**	**40**	**20**	**10**	**-10**	**-20**	**-40**
	200	**40**	**30**	**10**	**0**	**-10**	**-30**
	225	**50**	**30**	**20**	**10**	**-0**	**-20**
	250	**50**	**40**	**30**	**10**	**0**	**-10**
	275	**50**	**40**	**30**	**20**	**10**	**-0**

Note: Comparisons do not take into account probable ammonia losses (urea)

Revised N recommendations – winter wheat

Based on BER of 5:1 (e.g. CAN @ £135, grain @ £100/t) – current RB209 is based on BER of 3:1

Soil type	SNS Index						
	0	1	2	3	4	5	6
	kg/ha						
Light sand soils	160	130	100	70	40	0-40	0-40
Shallow soils	280	240	210	180	140	80	0-40
Medium soils	250	220	190	160	120	60	0-40
Deep clay soils	250	220	190	160	120	60	0-40
Deep silty soils	220	190	160	130	100	40	0-40
Organic soils				120	80	40-80	0-40
Peat						0-60	

Consider *targeted* SMN analysis

- **High residue fields and 'nitrate retentive' soils:**
  - previous organic manures
  - previous grass
  - previous lodging
  - NOT peaty soils or 1st year after grass

- **Recognise variability and 'snapshot' factor**
  - ***avoid spurious precision***

New HGCA Guidelines – winter wheat

Aims:

- *Explain & enhance rationale underpinning* current N recommendations
  - RB209 (Scotland)
- Enable most profitable use of N
  - compliant with NVZ regulations

Approach:

- Allows calculation
  - N balance equation
- Explains uncertainty
- Recommends regular crop monitoring.

Monitor & Review *… vital for good management*

N errors are inevitable:

- They are usually unseen
- Small errors seldom matter
- Beware of big errors
- Errors can accumulate:
  - if not corrected
  - except light or shallow soils

Checklist provided:

- Key check is grain protein

Action:

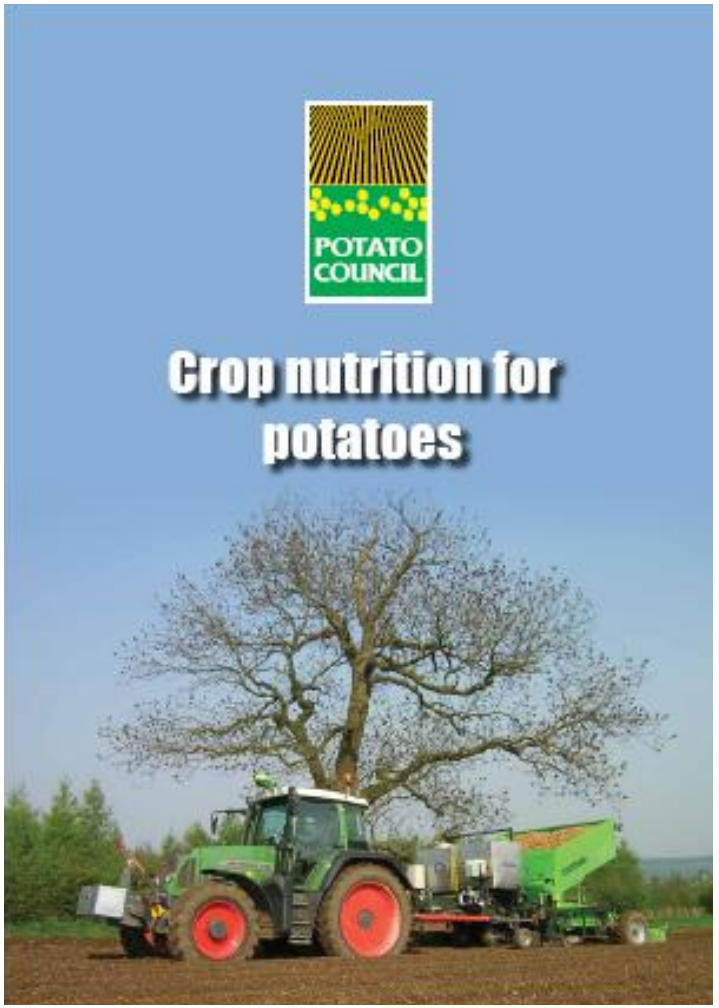
- Double-check any odd fields
- Adjust strategy gradually.

Table 16. Check-list for an example field

Check	Result		
Did you use more or less N than intended?	✓ less	same	more
How did N use compare with Table 12?	less	✓ same	more
How do grain prices compare to those budgeted?	more	same	✓ less
How did N prices compare to those budgeted?	✓ less	same	more
Colour of crop in late May?	pale	✓ normal	dark
Estimated weed infestation in May?		✓ little	lots
Crop height and lodging, ignoring overlaps?	short	✓ none	some
Was grain yield more, or less, than expected?	✓ more	same	less
Was grain protein of feed varieties?	✓ ✓ under 10%	11%	over 12%
What about other grain analyses?	✓ low	normal	high
Summary position of ticks		✓	
Likely difference from optimum N use	**too little**	**on target**	**too much**

New Potato Council Guidelines

- **Expand on Defra's "Fertiliser Manual (RB209)"**
- **Six step process to calculate crop nutrient requirements**



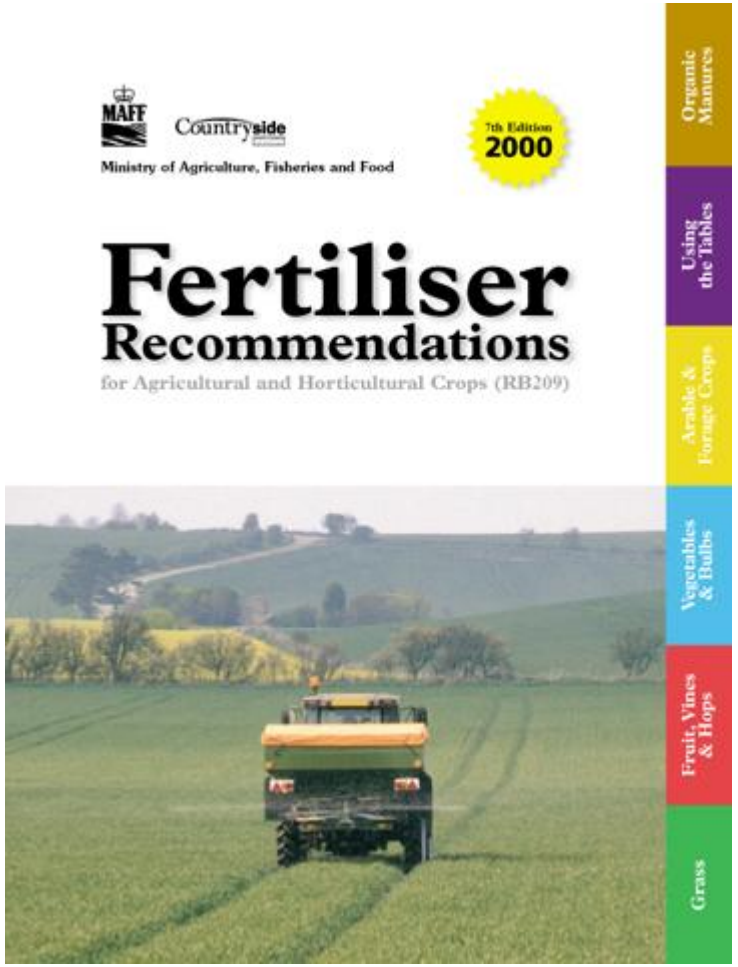
Organic manures

Livestock manures are potentially worth

Seventh edition “RB209” (2000)

Organic manures section:

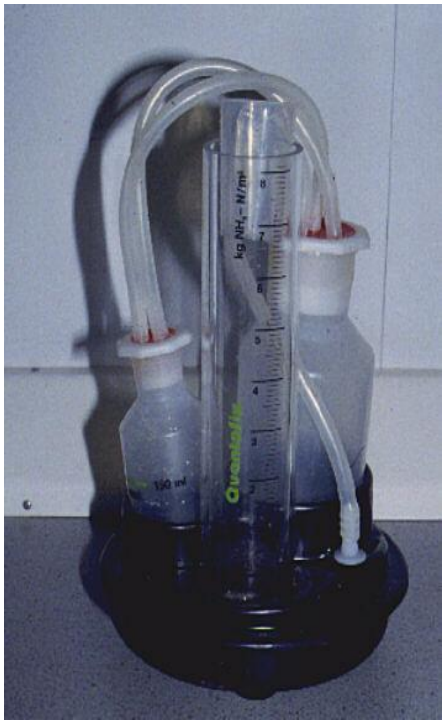
- Typical manure nutrient contents - type.
- Manure analysis (on-farm or laboratory methods).
- Crop N availability to next crop grown (manure type, soil type, application timing etc).
- Integrating manure and fertiliser nutrients.



Evolution rather than revolution……

“Fertiliser Manual (RB209)”

- **‘Typical’ figures (N, P_2O_5, K_2O, SO_3, MgO) for a wider range of:**
  - **livestock manure types**
  - **biosolids, compost, paper crumble types**
- **Revised ‘typical’ readily available N contents (NVZ compliance) in Britain**
- **Enhanced sampling and analysis guidance:**
  - **laboratory analysis**
  - **on-farm slurry analysis methods**
  - **N meters (Agros, Quantofix)**
  - **hydrometer (dry matter)**




HY-MAC

‘Typical’ total nutrient contents of *cattle slurry* (kg/m^3)

Dry matter	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Sulphur (SO_3)	Magnesium (MgO)
2%	1.6	0.6	2.4	0.3	0.2
6%	*2.6*	*1.2*	*3.2*	*0.7*	*0.6*
10%	3.6	1.8	4.0	1.0	0.9

Also, figures for separated slurries (solid and liquid portions) and dirty water

Total nutrient content of compost (kg/t fresh weight)

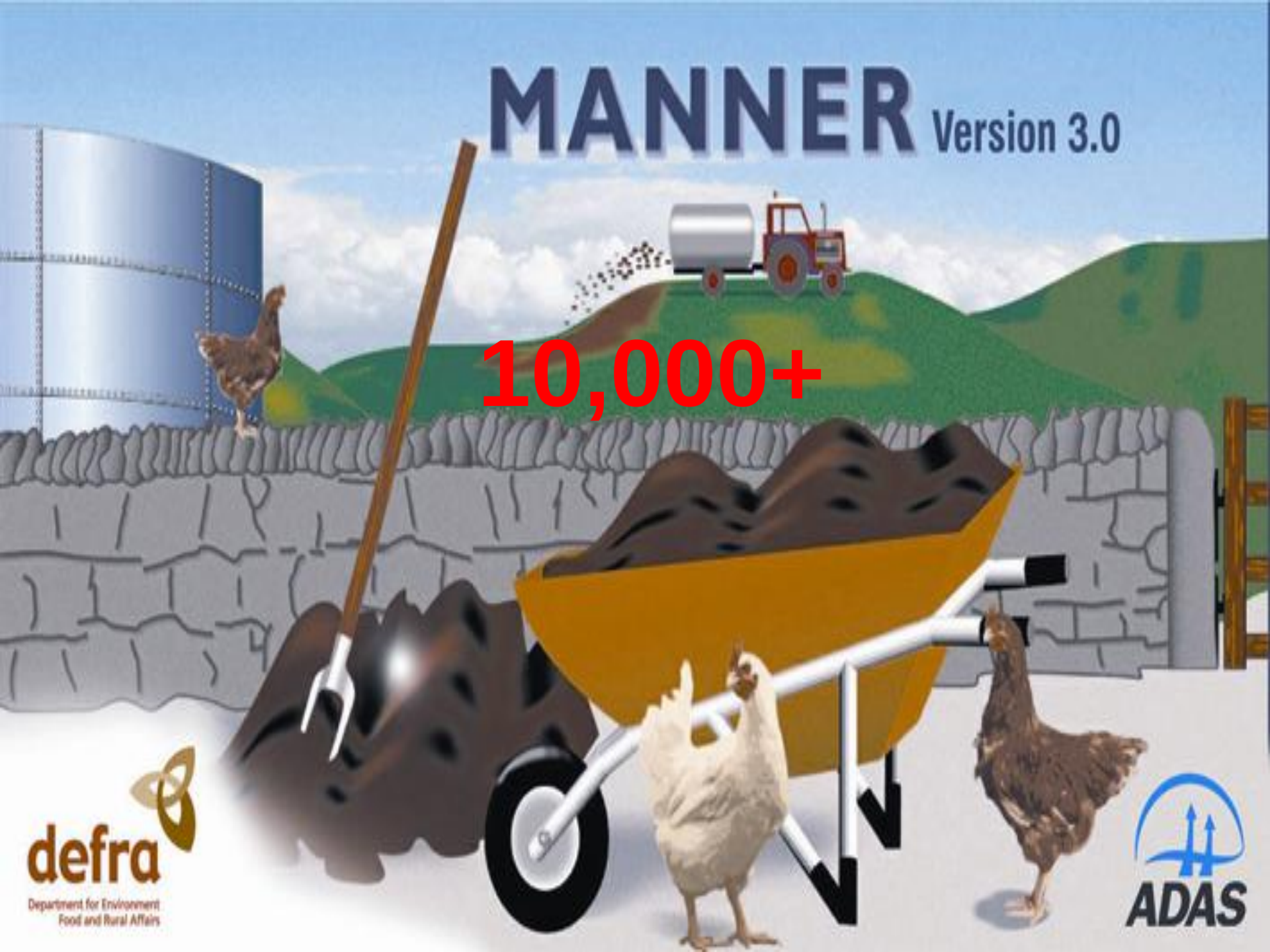
Compost type	Dry matter (%)	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Sulphur (SO_3)	Magnesium (MgO)
Green	60	7.5	3.0	5.5	2.6	3.4
Green/ food	60	11	3.8	8.0	3.4	3.4

Nutrient content of poultry manure (kg/t fresh weight)

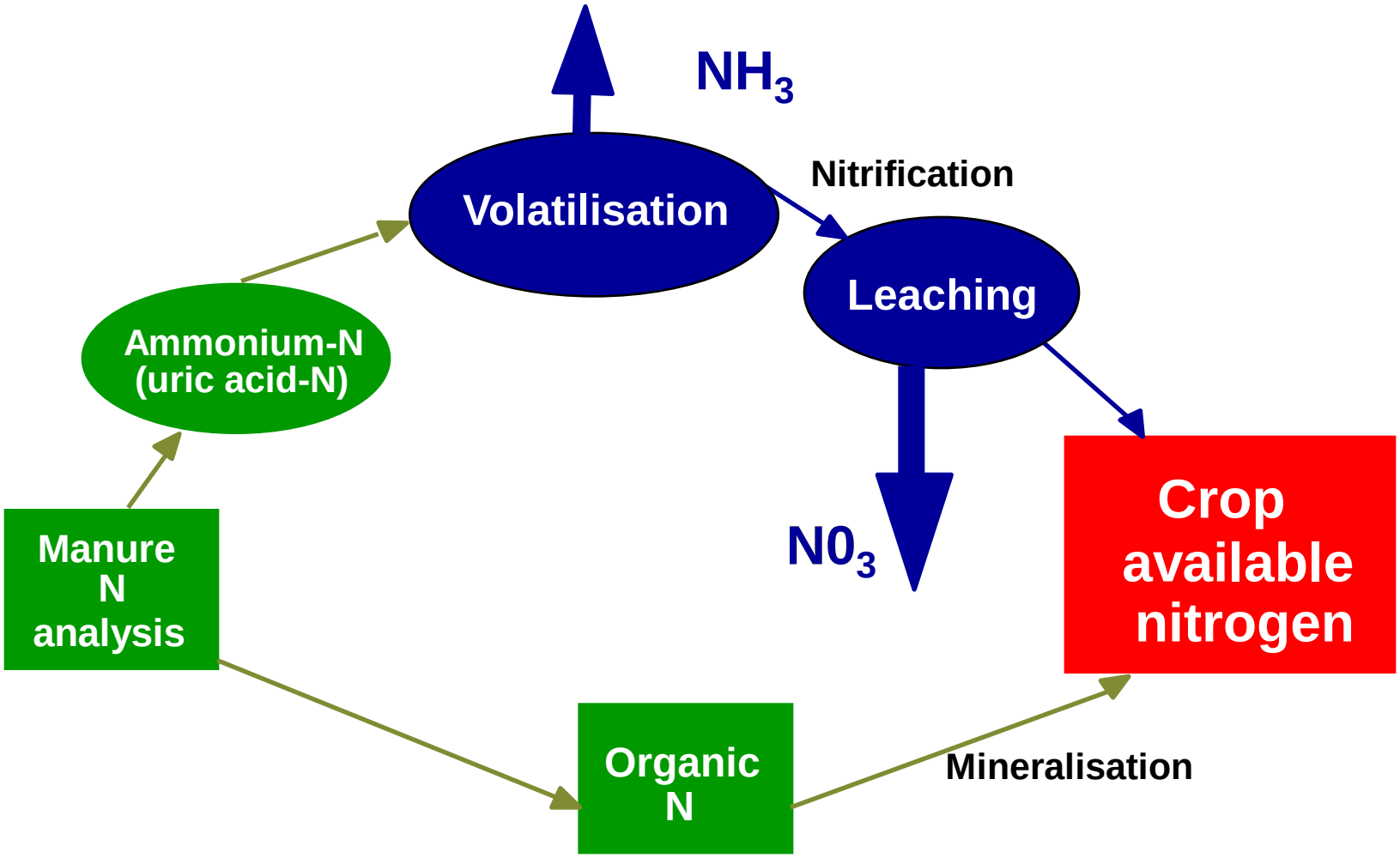
Compost type	Dry matter (%)	Nitrogen (N)	RAN	Phosphate (P_2O_5)	Potash (K_2O)	Sulphur (SO_3)	Magnesium (MgO)
Poultry litter	60	30	10.5	25	18	8.4	4.4
Layer manure	35	19	9.5	14	9.5	4.0	2.5

Nitrogen

- availability to the next crop grown


MANNER Version 3.0
10,000+
defra
Department for Environment
Food and Rural Affairs
ADAS

MANNER - Decision support system



RB209 (7th edition) recommendations are based on MANNER

MANNER is embedded in PLANET

MANNER-NPK

Used to produce the *new* "Fertiliser Manual (RB209)" look-up tables

defra

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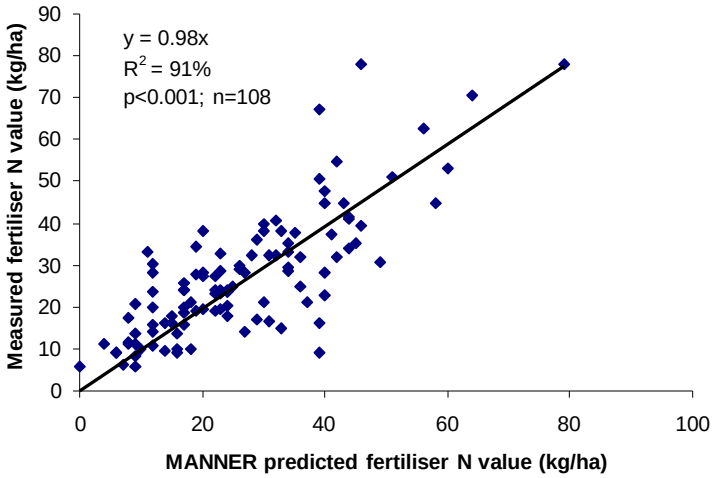
IGER

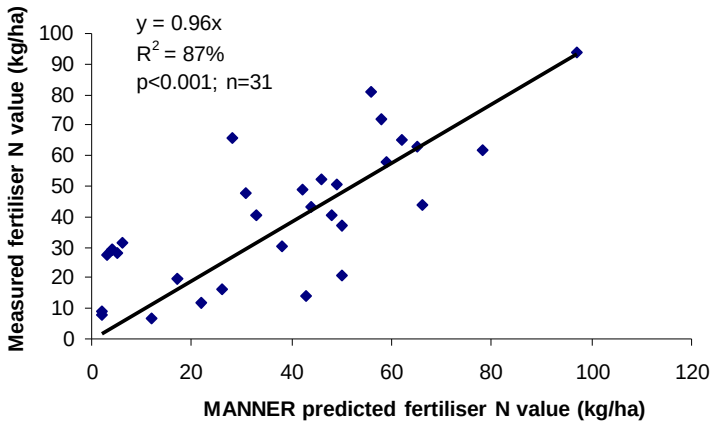
Validation of MANNER-*NPK*

Crop available N supply

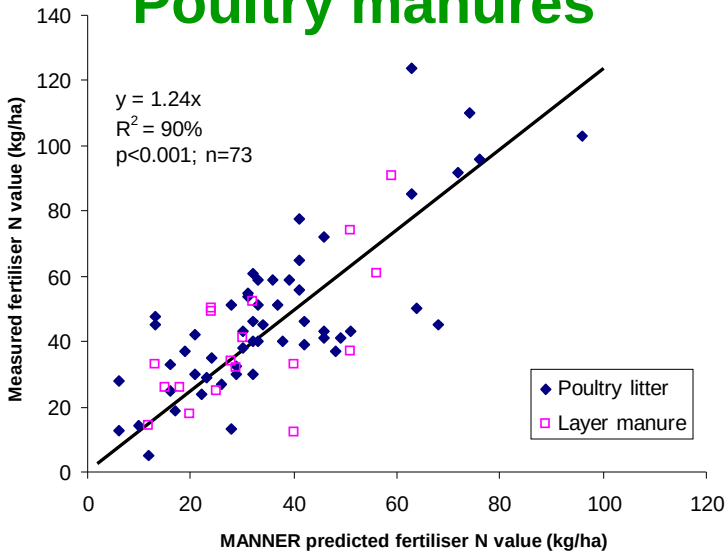
Cattle manures



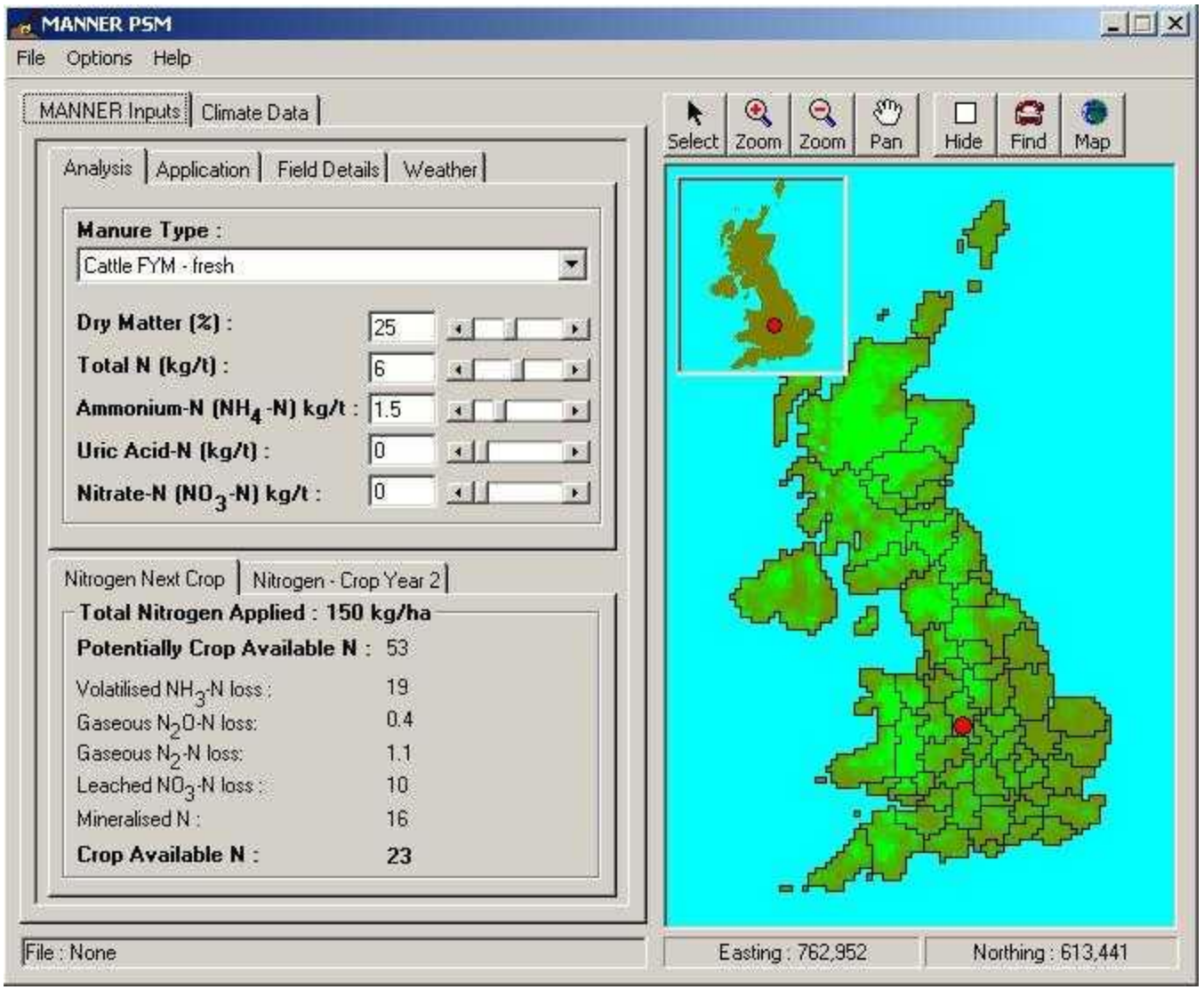
Pig manures



Poultry manures



MANNER-*NPK:* manure input and results screens



Manure spreading

- benefits of using slurry bandspreading/shallow injection application methods

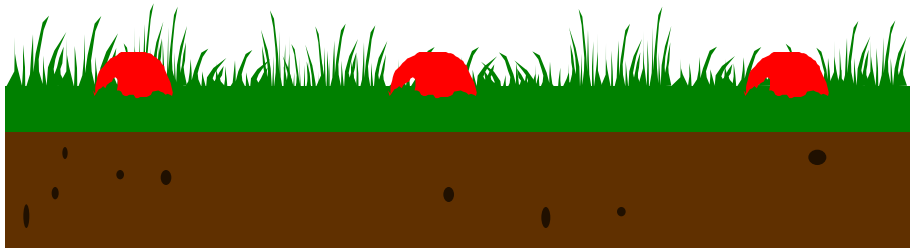
Slurry bandspreading / shallow injection reduces ammonia losses and odour nuisance

New slurry application techniques

↓ Ammonia (odour) emissions, *grass contamination*

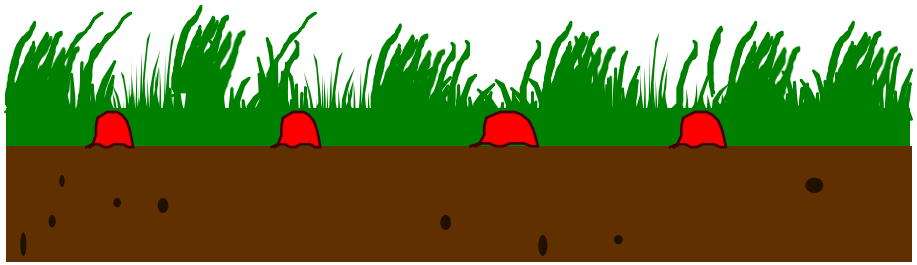
↑ N efficiency, *spreading days* and accuracy

30%



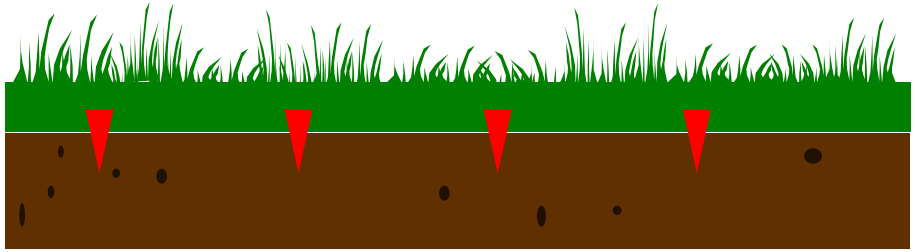
Trailing hose (arable)

40%



Trailing shoe (grassland)

70%



Injection - open slot (grassland)

Trailing hose vs. surface broadcast slurry application

Trailing hose

Surface broadcast

The "Fertiliser Manual (RB209)" - Making the Most of Manures

- **Nitrogen:**
  - **updated typical values and manure analysis guidance**
  - **crop available 'look-up' tables (MANNER-*NPK*)**
- **PK + S + Mg:**
  - **updated typical values**
- **Apply accurately and evenly**

It's not rocket science!

Thank you – Questions?