

# Nutrient Network Farm and manure

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# Typical NPK contents of cattle FYM with 25% DM (TN650, Table C)



FYM type	Dry matter %	ryTotal NReadilyitterkg/tavailable%N kg/t		Total P <sub>2</sub> O <sub>5</sub> kg/t	Total K <sub>2</sub> O kg/t	
Fresh	25	6.0	1.2	3.2	8.0	
Old	25 6.0		0.6	3.2	8.0	

FYM and slurry analysis expressed as kg nutrient per tonne or cubic metre



#### Major nutrients NPK:

- Value = % in fresh material
- Value x 10 = Kg per tonne or cubic metre
- Secondary nutrients Ca, Mg and Na
  - Value = % in dry matter (DM)
  - Value x DM/100 x 10 = Kg per tonne or cubic metre
- Trace elements Zn, Cu, Mn and S
  - Value = mg/kgDM
  - (Value x DM/100)/1000 = Kg per tonne or cubic metre

### NPK contents of FYM from East Balhalgardy



FYM type	Dry matter %	Total N kg/t	Readily available N kg/t	Total P <sub>2</sub> O <sub>5</sub> kg/t	Total K <sub>2</sub> O kg/t
Fresh	21.7	3.7	0.19	1.2	8.1
Midden	17.5	5.0	0.04	4.3	7.2

### % of total N available to next crop following application of cattle FYM (TN650, Table E)



FYM type	Incorporation time	Aug-Oct	Aug-Oct	Nov- Jan	Feb- April
		Shallow, S & SL	All other soils	All soils	All soils
Fresh & old	Over 24hr	5	10	10	10
Fresh	Within 24hr	5	10	10	15
Old	Within 24hr	5	10	10	10



- The availability of phosphate in organic fertilisers to the next crop grown is 50-60% of total P and is lower than from watersoluble P fertilisers.
- About 90% of potash in organic fertilisers is readily available for plant uptake.

# Inherent soil P sorption capacity map of Scotland (TN668, 2015)





# FYM analysis for secondary and trace elements



Determ	ination aqua regia	Fresh (%)	Fresh (kg/t)	Midden (%)	Midden (kg/t)
DM (%)		21.7		17.5	
Calcium	(%DM)	0.603	3.27	2.26	3.96
Magnesiu	m (%DM)	0.18	0.98	0.71	1.24
Sodium	(%DM)	0.2	1.09	0.85	1.49
Zinc	(mg/kgDM)	62.1	0.013	240	0.042
Copper	(mg/kgDM)	29	0.006	92.3	0.016
Manganes	se (mg/kgDM)	123	0.027	495	0.087
Sulphur	(mg/kgDM)	2400	0.521	5510	0.964

# Sulphur availability from organic materials (RB209, 2017)



Organic material	% total SO <sub>3</sub> available
Autumn applied	
Livestock manures	5-10%
Biosolids	10-20%
Spring applied	
Cattle FYM	15%
Pig FYM	25%
Broiler litter	60%
Cattle/pig slurry	35%
Biosolids	20%

### NPK contents of slurry from East Balhalgardy



Slurry sample	Dry matter %	Total N kg/t	Readily available N kg/t	Total P <sub>2</sub> O <sub>5</sub> kg/t	Total K <sub>2</sub> O kg/t
A	3.75	4.6	2.8	1.3	2.2
В	3.14	4.0	2.7	1.3	2.4

Estimated % total N available to cereals (grass & WOSR) following application of cattle slurry with 6%DM (greater % N available in spring for lower DM) (TN650)



Application method	Aug-Oct	Aug-Oct	Nov-Jan	Nov-Jan	Feb- April
	Shallow, S & SL	Other soils	Shallow, S & SL	Other soils	All soils
Incorp over 6 hrs	5 (10)	25 (30)	25	25	35
Band spread	5 (10)	25 (30)	25	25	40
Shallow injected	5 (10)	25 (30)	30	30	45

# Minimum slurry & poultry manure utilisation rates allowed in NVZs



Livestock manure	% N taken up by crop (after 01/01/2014)
Cattle slurry	40 %
Pig slurry	50 %
Poultry manure or litter	30 %

- In practice this means that you will not be able to apply as much N (organic or inorganic) on a field spread with slurry in autumn compared with February and spring
- PLANETv3.3.3 includes these new utilisation rates.

# Closed period for high available N organic manures in NVZs



	Grassland	Other land			
Sandy or shallow soils	1 <sup>st</sup> September to 31 <sup>st</sup> December	1 <sup>st</sup> August* to 31 <sup>st</sup> December			
All other soils	15 <sup>th</sup> October to 31 <sup>st</sup> January	1 <sup>st</sup> October to 31 <sup>st</sup> January			

# Slurry analysis for secondary and trace elements



Determ	ination in aqua regia	A (%)	A (kg/m <sup>3</sup> )	B (%)	B (kg/m³)
DM (%)		3.75		3.14	
Calcium	(%DM)	2.26	0.85	2.03	0.64
Magnesiu	m (%DM)	0.72	0.27	0.76	0.24
Sodium	(%DM)	0.94	0.35	0.98	0.31
Zinc	(mg/kgDM)	921	0.035	110	0.0035
Copper	(mg/kgDM)	608	0.023	265	0.0083
Manganes	se (mg/kgDM)	361	0.014	267	0.0084
Sulphur	(mg/kgDM)	6630	0.249	6880	0.216

# Financial value of tonne of FYM & cubic metre of slurry



FYM/Slurry	Available N*	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Value £/m3
Midden	0.36	2.67	3.35	6.38
A	1.31	0.81	1.02	3.14

\*assumes 10% & 40% of total N in FYM & slurry will be available after spring application – % will be lower from autumn application; assume total P and K will be taken up at some time;

£ value based on AN @ £245/t (71p/kg N); TSP @ £285/t (62p/kg  $P_2O_5$ ); MoP @ £280/t (46.5p/kg  $K_2O$ ).

# Conversions



- One kg/t = ? Units/t
- 50kg of 34% N contains 34 units N
- How many kg N in 50kg of 34% N?
- Typical rate of FYM (30t/ha = 12t/acre)
- 33 m<sup>3</sup>/ha = 3,000 gals/acre
- ? gals/acre = 1 m<sup>3</sup>/ha

P PLANET - Farm and Field Details

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#### **Farm Details**

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### Nitrogen cycle





#### Nitrous oxide (N<sub>2</sub>O) emissions by Scottish Government sector





1990-2014. Values in MtCO<sub>2</sub>e

Managing nitrous oxide by improving efficiencies in N utilisation



- Nitrous oxide is 300x more potent than carbon dioxide in Greenhouse Effect
- Nitrous oxide emissions arise from fertiliser and manure application

# Soil moisture and N<sub>2</sub>O





## Reducing N<sub>2</sub>O emissions



Major changes

- Improve drainage
- Make more use of legumes to supplement fertilisers
- Re-locate high N input cropping to drier areas
- Reduce intensity of animal production (only works if there is less consumption)
- Use alternative N fertilisers/ inhibitors

Minor changes

- Reduce fertiliser N inputs generally, but particularly in "hotspots"
- Target mitigation at short periods of high emission
- Use of medium to long term weather forecasts to plan fertiliser applications
- Careful management of manures e.g. composting, straw based systems rather than slurry, apply to arable rather than to grass