



Stornoway FAS Meeting

30-09-17

Main Nutrients



- Nitrogen
- Phosphate
- Potash
- Magnesium
- Sulphur

Soil Testing



- Availability of nutrients is affected by the pH of the soil.

Low pH

- Phosphorus (poorer availability below 6)
- Calcium (poorer availability below 6)
- Sulphur (poorer availability below 5.5)
- Potassium (poorer availability below 5.5)

Lime recommendations for arable & rotational grass (t/ha with NV 50% CaO)



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Soil pH	Sand	Sandy loam / shallow	Other mineral soils	Humose	Peaty
6.2	0	0	2	0	0
6.1	0	2	3	0	0
6.0	2	3	4	0	0
5.9	2	4	5	2	0
5.8	3	4	5	3	0
5.7	4	5	6	4	0
5.6	4	6	7	5	2

Crops differ in their sensitivity to soil acidity

increasing
sensitivity
to
soil acidity

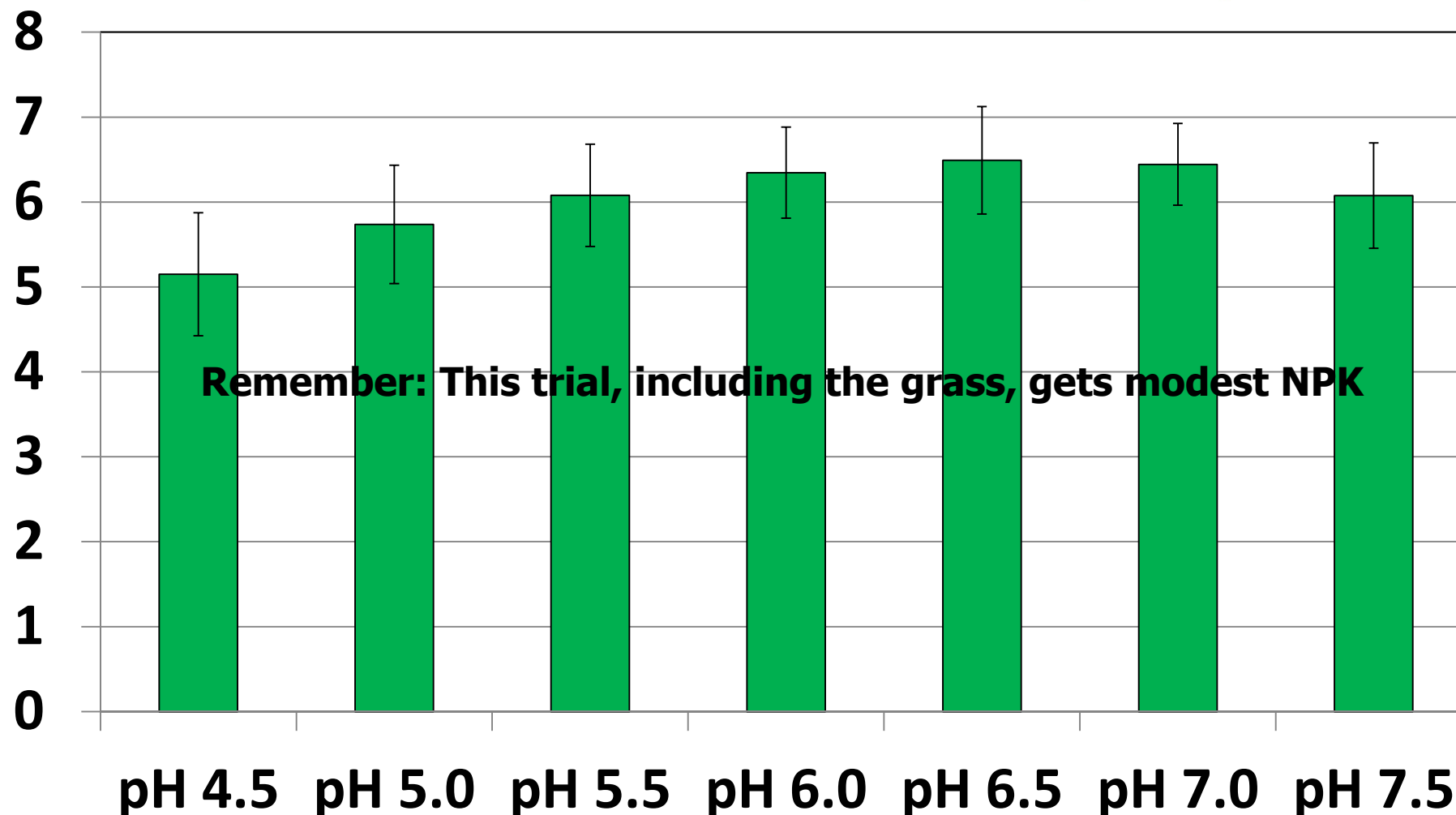


Potatoes, ryegrass

Oats, wheat, oilseed rape, clover

Barley, beans, peas, sugar beet

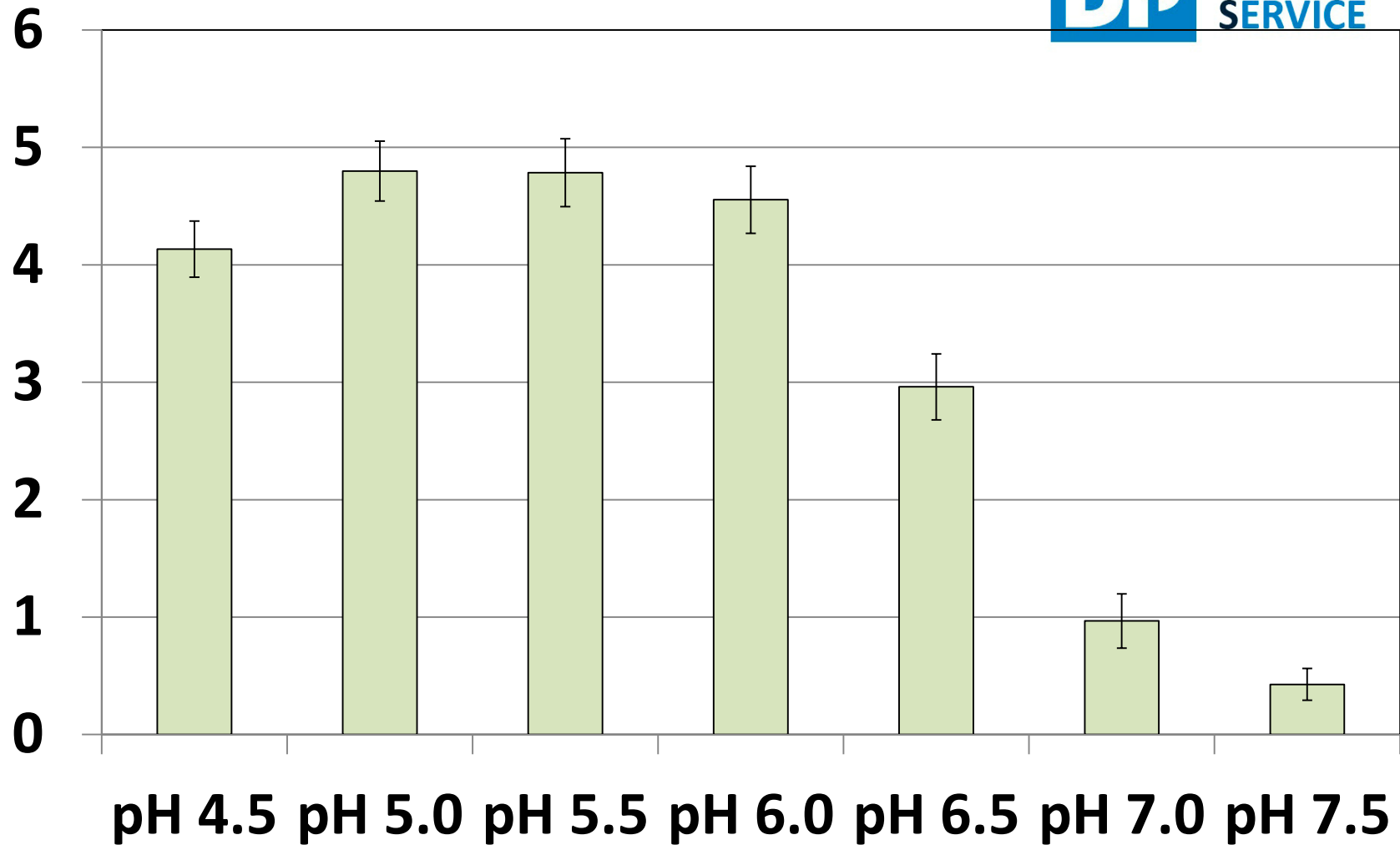
Hay (t/ha @ 85% DM)



Oats (t/ha @ 85% DM)



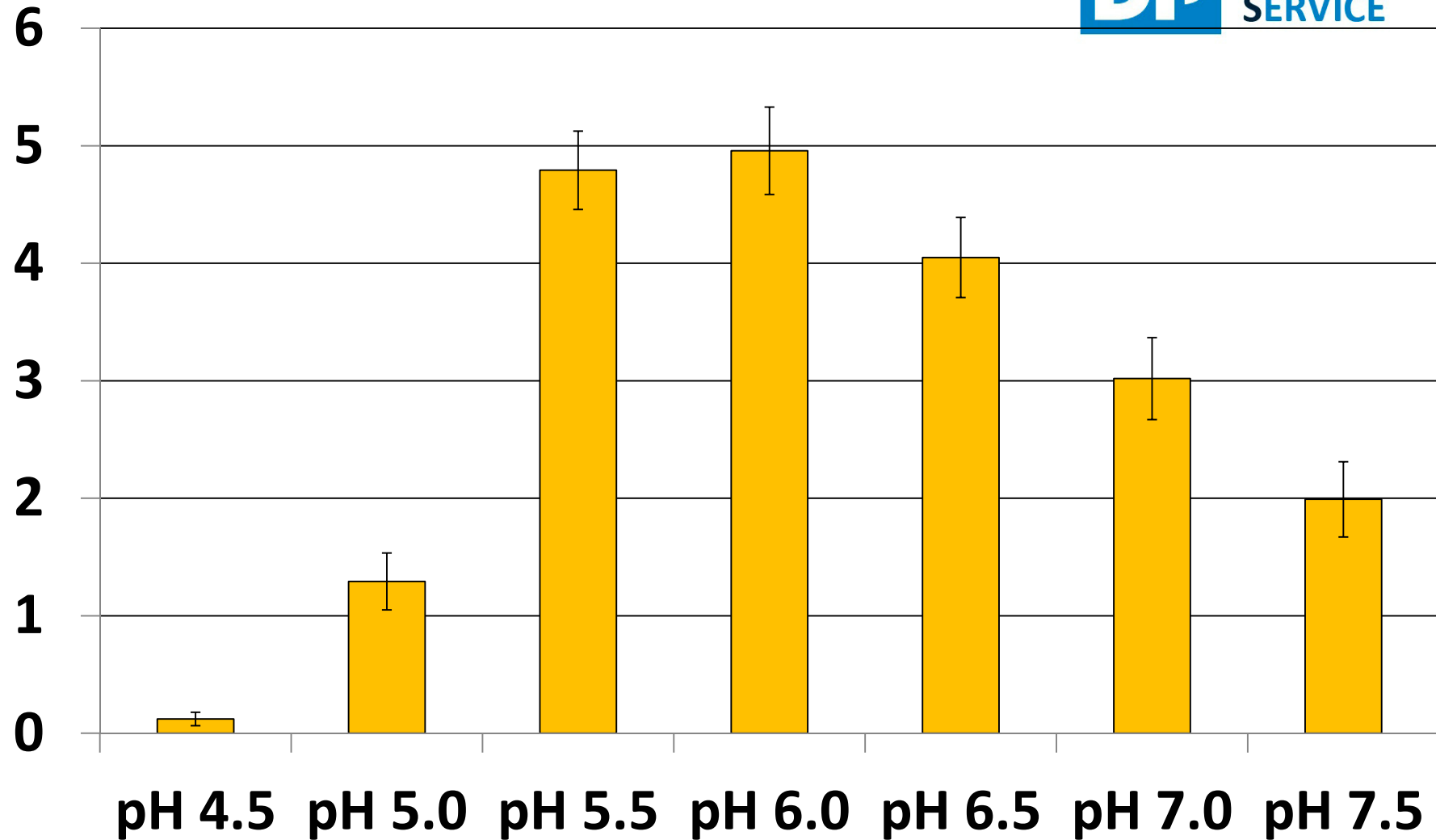
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Spring Barley (t/ha @ 85% DM)



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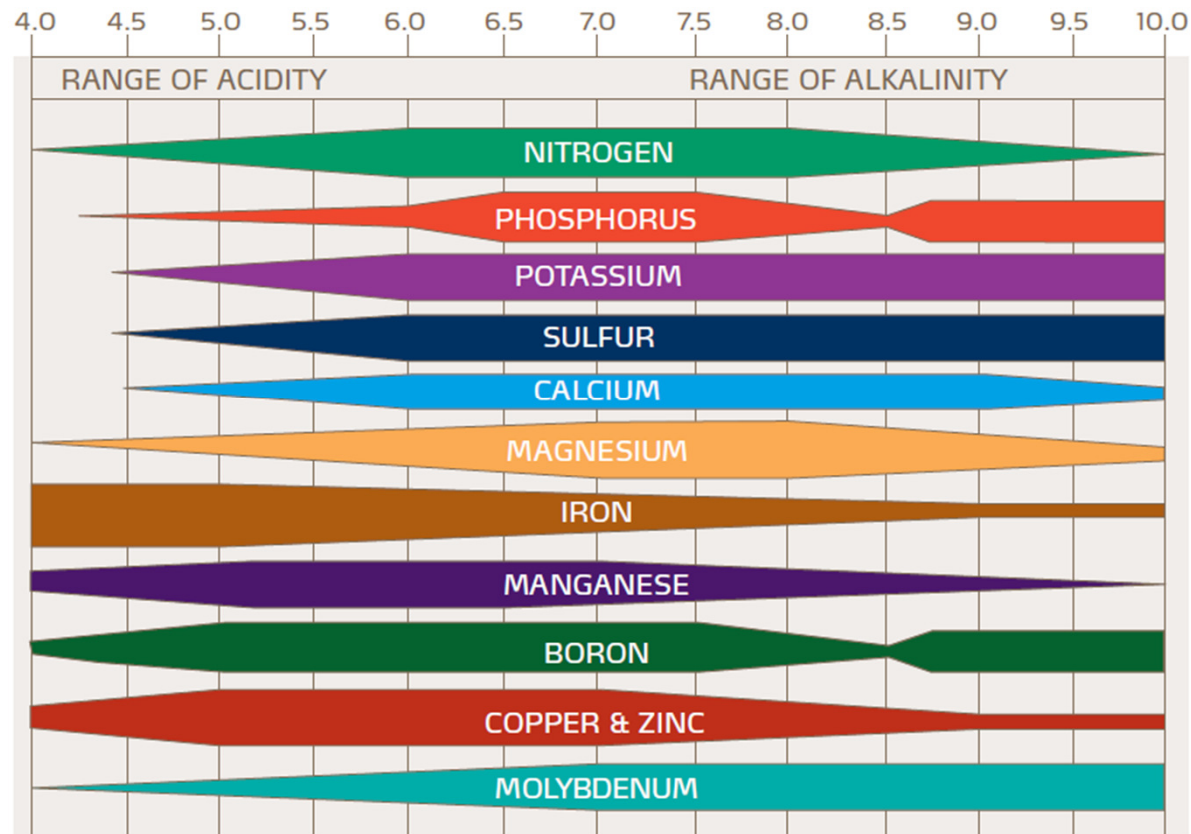


Nutrient Availability



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The Influence of Soil pH on Nutrient Availability



Nitrogen



- **Grass** – Better synthesis of amino acids, improved formulation of co-enzymes and nucleic acids, increased synthesis of chlorophyll and ATP, improved crop vigour and development.

Made worse by

- Low or high pH soils, sandy or light soils (leaching.)
- low organic matter. drought conditions,
- high rainfall (leaching),
- addition or high levels of non-decomposed organic matter/manure (e.g. straw),
- fast growing crops.

Phosphate



- **Grass** – Essential for energy transfer within the plant, therefore direct effect on yield and quality.

Made worse by

- Acidic or very alkaline soils,
- low organic matter,
- cold or wet conditions,
- crops with a poorly developed root system,
- soils with low P reserves,
- Soils with a high phosphate capacity, iron rich soils.

Potash



- **Grass** – Internal water regulation, vigorous growth and healthy foliage, required in large amounts.

Made worse by

- Acidic soils (low pH),
- sandy or light soils (leaching),
- drought conditions,
- high rainfall (leaching),
- heavy clay soils, soils with low K reserves,
- magnesium rich soils.

Magnesium



- **Grass** – Risk of Hypomagnesaemia (grass staggers), herbage uptake reduces as N and K levels increase.

Made worse by

- Sandy soils,
- acidic soils,
- potassium rich soils,
- soils receiving high potash applications,
- cold wet periods.

Sulphur



- **Grass** - Component of enzymes and other proteins, necessary for chlorophyll formation and efficient N-utilization.

Made worse by

- Acidic soils, light,
- sandy soils (leaching),
- low organic matter,
- poorly aerated soils (waterlogged soils.),
- Areas with low industrial emissions.

Crop Nutrient Requirements (based on Technical Notes TN633 and TN651)



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Nutrient requirement (kg/ha) following a Group 1 crop on a sandy loam soil type at (Moderate – Phosphate and Potash levels).

	Spring barley (feed)	Spring oats
N	130	100
P ₂ O ₅	52	53
K ₂ O	71	104

Grass Nutrient Requirements (based on Technical Notes TN652)



Nutrient requirement (kg/ha) for Site Class 1, on a sandy loam soil type at (Moderate – Phosphate and Potash levels).

	1 Cut Silage plus grazing	Hay plus grazing	Grass with high clover (1 cut plus grazing)	Grass establishment (grass /low clover mix) (direct reseed)	Grass establishment (high clover mix) (direct reseed)
N	280	220	100	40-60	0-20
P ₂ O ₅	39+3	41+3	39+3	50	70
K ₂ O	138+2	126+2	138+2	50	70

P & K Removal Rates



	Nutrients Removed	
Crop	P Removal (kg/t)	K Removal (kg/t)
Silage	1.7	6
Hay	5.9	18
Grazing *	1.4	1.8

P & K requirements – Grass



Soil Status	Crop	Yield - t/ha (bales per acre)	P requirement (kg/ha)	K requirement (kg/ha)
Moderate	1 cut silage	17.5 (14)	30	105
Low	1 cut silage	17.5 (14)	70	125
Very Low	1 cut silage	17.5 (14)	110	165
Moderate	Establishment		50	50
Low	Establishment		90	70
Very Low	Establishment		130	110

P & K requirements – Grass with High Clover



Soil Status	Crop	Yield (t/ha)	P requirement (kg/ha)	K requirement (kg/ha)
Moderate	Establishment		70	70
Low	Establishment		110	90
Very Low	Establishment		150	130

FARM YARD MANURES

Nutrients in farm yard manures

	Total nutrients (kg/t fresh weight) in different Farm Yard Manures						
	Cattle FYM (fresh)	Cattle FYM (old)	Pig FYM (fresh)	Pig FYM (old)	Layer manure	Broiler / Turkey litter	Sheep FYM (fresh)
N	6	6	7	7	19	30	7
Readily available N	1.2	0.6	1.8	1	9.5	10.5	1.4
P ₂ O ₅	3.2	3.2	6	6	14	25	3.2
K ₂ O	8	8	8	8	9.5	18	8
SO ₃	2.4	2.4	3.4	3.4	4	8	3
MgO	1.8	1.8	1.8	1.8	2.6	4.4	1.6

Nutrient content of slurries

Dry matter (%) and total nutrients (kg/t fresh weight)			
	Cattle slurry	Pig slurry	Dirty water
Dry matter (%)	6	4	0.5
N	2.6	3.6	0.5
Readily available N	1.2	2.5	0.3
P ₂ O ₅	1.2	1.8	0.1
K ₂ O	3.2	2.4	1.0
SO ₃	0.7	1	0.1
MgO	0.6	0.7	0.1

Nutrient availability from organic manures in year of application



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Nutrient availability in the year of application (%)

	Slurry	Poultry Manures	FYM	Dirty water
N	35-75	35-70	10-20	?
P ₂ O ₅	50	60	60	?
K ₂ O	90	90	90	95-100

Nutrient supply from typical FYM application

	Total nutrients (kg/t fresh weight) in different Farm Yard Manures Application Rate (25 tonnes per Ha (10 tonnes per acre))				
	Cattle FYM (fresh)	Cattle FYM (old)	Pig FYM (fresh)	Pig FYM (old)	Sheep FYM (fresh)
N	150	150	175	175	175
Readily available N	30	15	45	25	35
P ₂ O ₅	80	80	150	150	80
K ₂ O	200	200	200	200	200
SO ₃	60	60	85	85	75
MgO	45	45	45	45	40

Manures – a valuable resource



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- As the price of inorganic fertilisers is rising the manure benefit from organic manures can produce a considerable saving to the overall farm fertiliser bill.
- Typical prices at present:-
 - N £0.70/kg
 - P £0.61/kg
 - K £0.42/kg
- Cost of typical fertiliser grades
 - Ammonium nitrate £240/tonne
 - Triple super phosphate £280/tonne
 - Muiriate of potash £250/tonne

Value of a typical FYM application



	Financial Benefit (£ per Ha) of a typical Application Rate (25 tonnes per Ha (10 tonnes per acre) based on Available N and total P ₂ O ₅ and K ₂ O.				
	Cattle FYM (fresh)	Cattle FYM (old)	Pig FYM (fresh)	Pig FYM (old)	Sheep FYM (fresh)
Available N	21.00	10.50	31.50	17.50	24.50
Total P ₂ O ₅	48.80	48.80	91.50	91.50	48.80
Total K ₂ O	84.00	84.00	84.00	84.00	84.00
Total (£)	£153.80	£143.30	£207.00	£193.00	157.30

Value of a typical application (1)



**Financial Benefit (£ per Ha) of a typical
Application Rate (30,000 litres per Ha (2,671 gallons per
acre)
Available N and total P₂O₅ and K₂O.**

	Cattle slurry	Pig slurry
Dry matter (%)	6	4
Available N	23.4	48.75
P ₂ O ₅	22.32	33.48
K ₂ O	37.44	28.08
TOTAL (£)	£83.16	£110.31

Value of a typical application (2)



	Financial Benefit (£ per Ha) of a typical Application Rate (10 tonnes per Ha (4 tonnes per acre) based on Available N and total P₂O₅ and K₂O.	
	Layer manure	Broiler / Turkey litter
Available N	61.75	68.25
P ₂ O ₅	86.8	155
K ₂ O	37.05	70.2
TOTAL (£)	£185.60	£293.45

BIOSOLIDS

Bio solids



- Several different types - important to understand the key properties of those available to you.
 - **Main benefit:** a cost-effective fertiliser, generally rich in P, frequently with useful concentrations of N, S and Mg
 - **Main points to watch:**
 - Like some other BOFs, will contain PTEs and must be applied to land according to the Safe Sludge Matrix and Sewage sludge regulations [The Sludge (Use in Agriculture) Regulations 1989 and The Sludge (Use in Agriculture) (Amendment) Regulations 1990].
 - Pathogen content varies widely depending on treatment method. Choose appropriate material for intended end use.

Nutrients in bio solids and paper crumbl



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	Total nutrients (kg/t fresh weight) [DM]			
	Bio solids (digested cake) [25]	Bio solids (thermally dried) [95]	Bio solids (thermally hydrolysed) [30]	Bio solids (lime stabilised) [40]
Total N	11	40	10	8.5
Available N	1.6	2.0	1.0	0.9
P₂O₅	18	70	20	26
K₂O	0.6	2.0	0.5	0.8
SO₃	6.0	23	7.5	8.5
MgO	1.6	6.0	1.5	2.4

Value of a typical Bio solids Application



	Financial Benefit (£ per Ha) of an Application Rate (5 tonnes per Ha (2 tonnes per acre) based on Available N and total P ₂ O ₅ and K ₂ O.			
	Bio solids (digested cake)	Bio solids (thermally dried)	Bio solids (thermally hydrolysed)	Bio solids (lime stabilised)
Available N	5.60	7.00	3.50	3.15
Total P ₂ O ₅	63.00	213.50	61.50	88.91
Total K ₂ O	1.26	4.20	1.05	1.68
Total (£)	£69.86	£224.70	£66.05	£93.74

BIOSOILDS – Key Points



- High in total N and Phosphate
- Low in readily available N and Potash
- Watch out for the potentially toxic elements especially on acid soils (need SEPA para 7 agricultural exemption application before spreading)
- Only 50% of P available in first year but all will be available eventually, (Careful when reseeding in low P situations)

Any Questions?

