

# Efficient Fertiliser Usage: Soil Testing and Use of Organic Fertilisers



# Efficient Fertiliser Usage

## 1. Basic Soil Conditions

- Drainage
- Structure
- pH
- Nutrient status

## 2. Accurate Yield Estimates

- Crop requirements
- Yield targets – How do we do this for grass?



# Soil Testing



- Standard test includes
  - Plant available P, K and Mg
  - pH
- Understanding your soil test – pH
  - pH: is a measure of the concentration of  $H^+$  in your soil using a negative *logarithmic scale*.

This means that a soil with a pH of 5.7 is *significantly* more acidic than one at 5.8

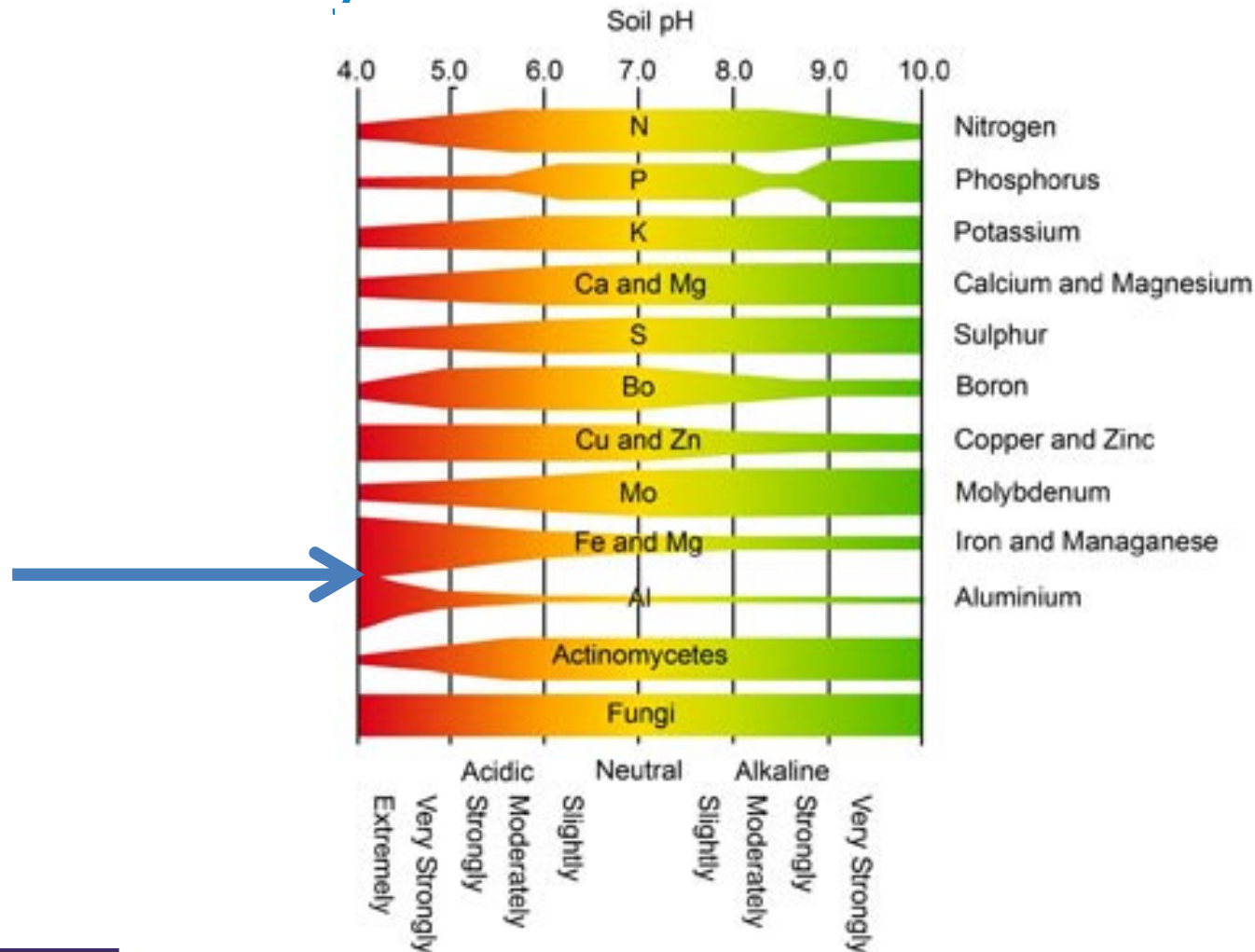
20% of yield variability due to soil pH status



# Soil pH: Impact on nutrient availability and form



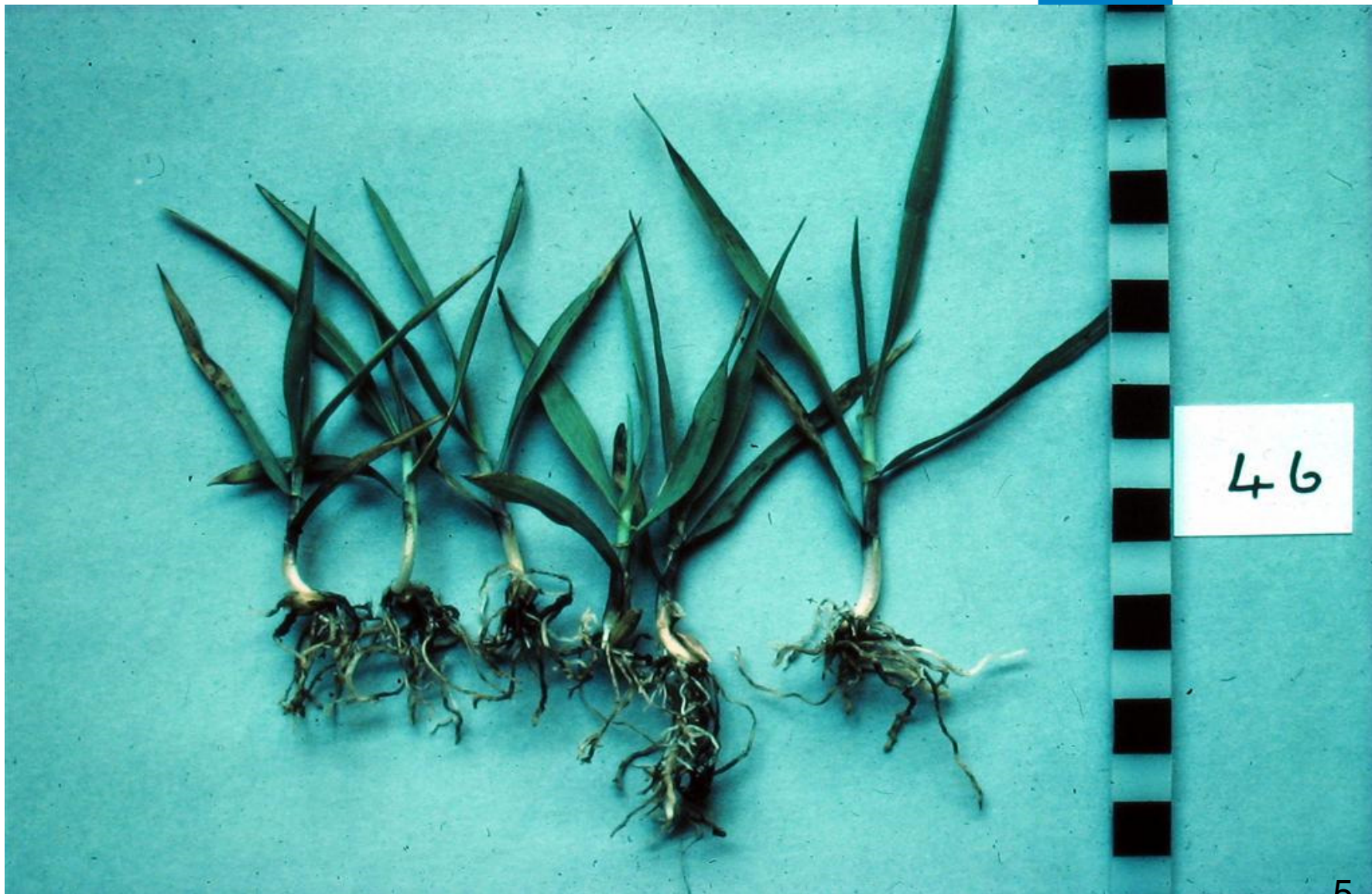
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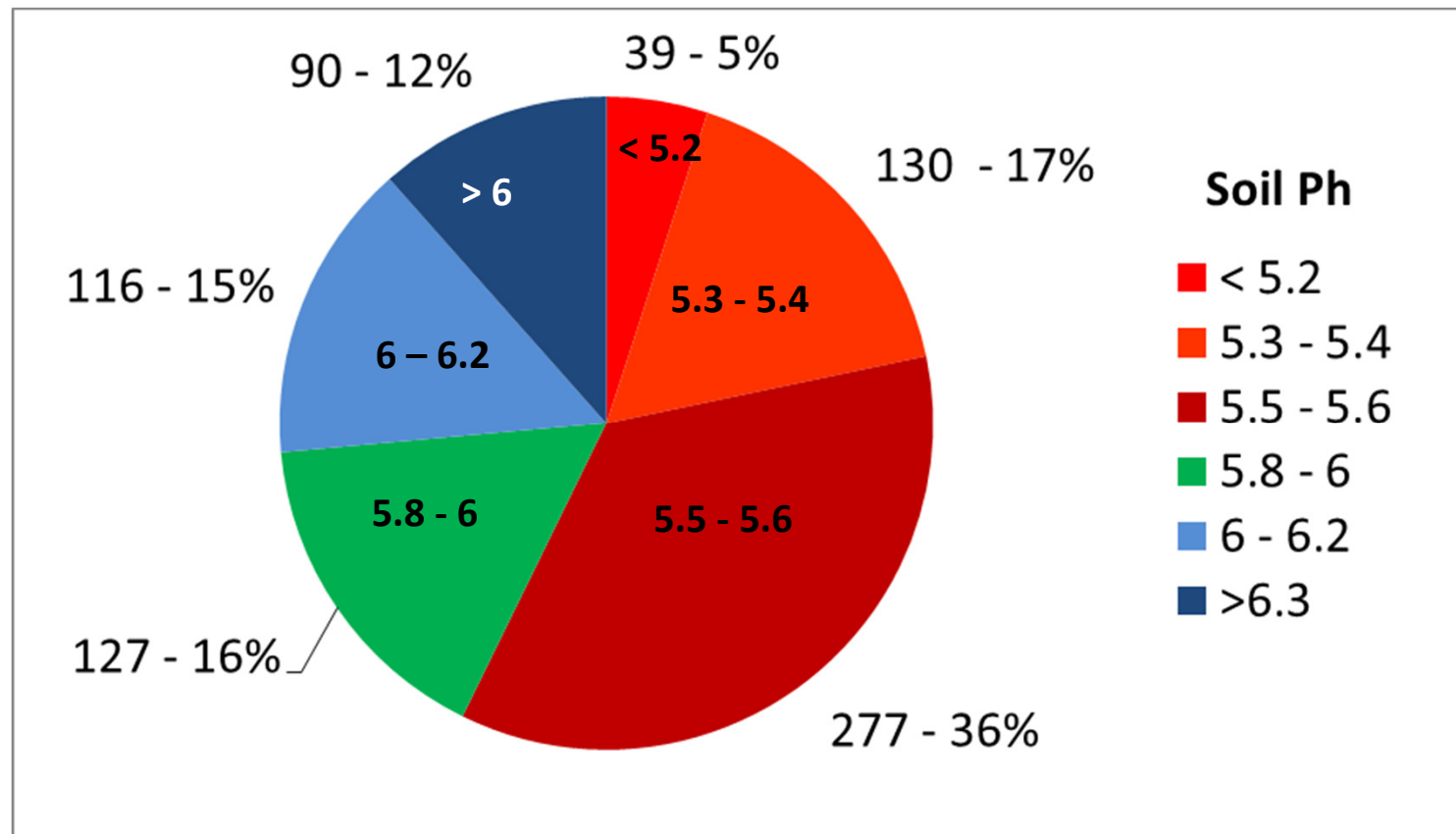
The European Agricultural Fund  
for Rural Development  
Europe investing in rural areas



Scottish Government  
Riaghaltas na h-Alba  
gov.scot



## Study of 779 Grassland fields - Soil pH



# Soil Testing

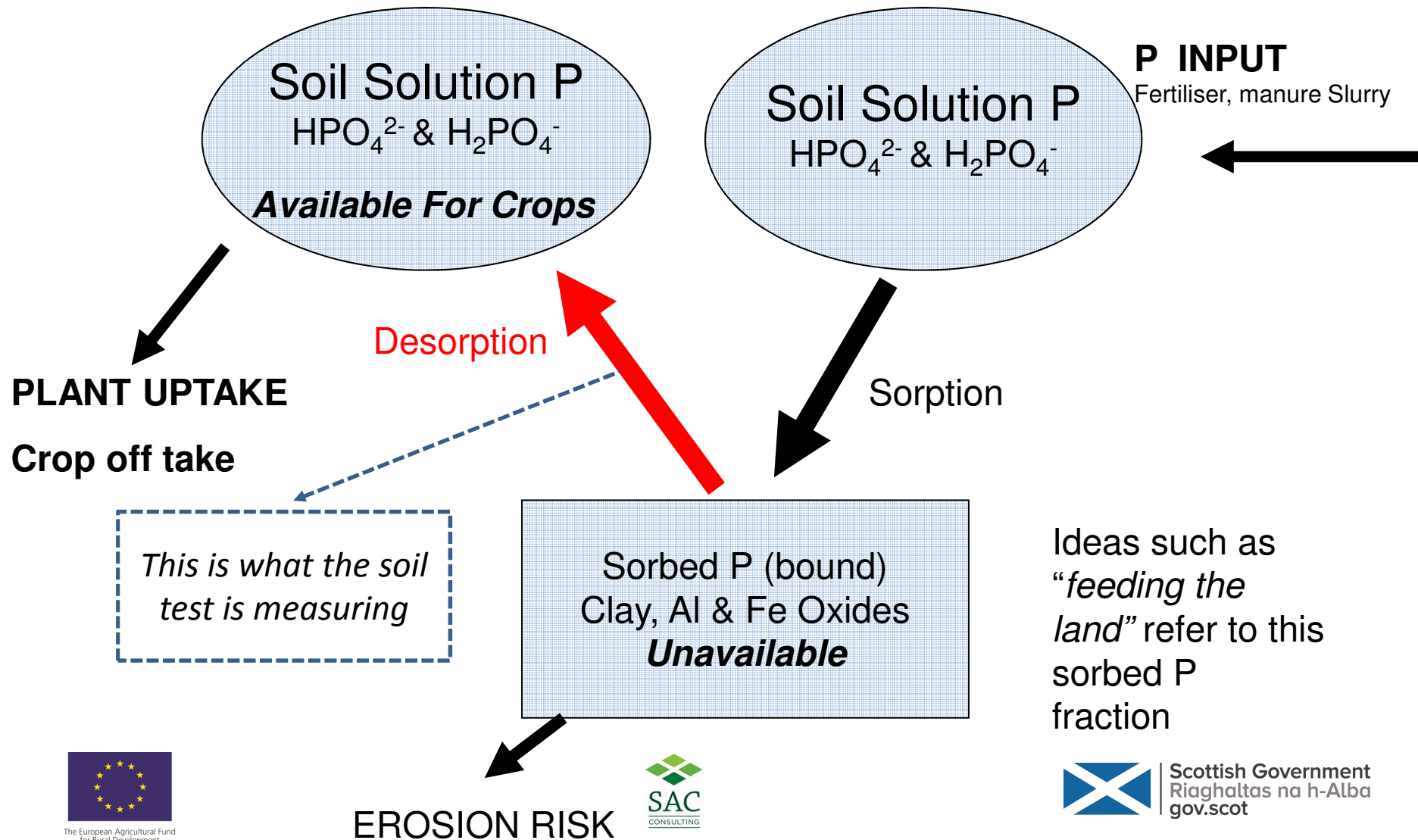


- Understanding your soil test: Plant available P and K
  - *Plant available* means the amount of P and K in your soil at the time of testing that is in a form that plants can **directly** access
  - Soil has the ability to “hold” on to P and K in a form that plants cannot use
  - This P and K is then released slowly over time





# Functional Soil P Cycle – This is what you manage



Ideas such as “feeding the land” refer to this sorbed P fraction



# P Cycle in Soil



- P is best managed by ensuring your soil is “**on target**” based on regular soil testing and effective nutrient budgeting
- Why ?

*P has a complex “physical” relationship with soil particles that dominates the amount available for plant uptake irrespective of how much is applied in any given year.*

# P usage – Basic Facts



- You are always fertilising next years crop
- Being on target for Available P (Moderate Status (M)) is the only proven method for ensuring adequate P will be available to support your crop
- Soil testing every 4 years is a requirement to efficiently manage P
- Once on target you must restrict additional P application to match annual crop offtake
- For soils that are above target savings can be made by reducing P fertiliser usage

# K usage – Basic Facts



- Direct response to K application in year of production
- Key reason for maintaining soil target are:
  - Early growth
  - Adequate levels for clover
  - Avoiding staggers resulting from fertiliser applications in the early spring
- For soils that are above target savings can be made by reducing K fertiliser usage
- ~70 % of soils in grassland study where above soil K targets

# Mg – Status



- Mg is an essential plant nutrient but in grass it is also an animal health concern
- Not usually an issue as Scottish soils are naturally high
  - Recently come across deficiencies in grassland soils in Fort William
- Testing will confirm there is no issue with availability



# P and K grassland targets



- For P:
  - Grass only is 6 mg/l – lower end of SAC moderate status (M-)
  - Grass/clover is 9 mg/l – middle of the moderate status (M-/M+)
- For K
  - ~ 140 mg/l – lower half of the moderate status (M)
- For Mg
  - Moderate or above on the SAC system

# Slurries – Nutrient Value



- Manures and Slurries are fertilisers
- A standard spread of slurry at 20 m<sup>3</sup>/ha (1800 gallons/acre) contributes between:
  - N: 2 – 25 kg/ha of total nitrogen
  - P: 24 – 52 kg/ha of total P
  - **K: 65 – 90** kg/ha of potash
- All the nutrients (100 %) in manure and slurry will be used by the crop within 2 years of application.
- ***They contribute very little to long term soil organic matter.***

# Manures– Nutrient Value



- A standard spread of Manure at 30 t/ha (12 t/acre) contributes between:
  - N: 9 – 27 kg/ha of nitrogen
  - P: 48 – 96 kg/ha of total P
  - **K: 216 – 240** kg/ha of potash
- All the nutrients (100 %) in manure and slurry will be used by the crop within 2 years of application.
- ***They contribute very little to long term soil organic matter.***

# Manures and Slurries – Variability



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- Maximum nutrient value from manures and slurries is achieved if applied when crop has the highest demand – Spring
- For both slurry and manure DM is the main factor

Slurry Dry Matter (%)	Total Nutrients (kg/m <sup>3</sup> )		
	N	P	K
5	2.2	0.9	2.7
6	2.6	1.2	3.2
8	3.5	1.6	4.3



# Slurry Analysis



Nutrient Kg/m <sup>3</sup>	Standard Slurry	Sample 1	Sample 2
N	2.6	1.1	2
P	1.8	1.2	1
K	2.4	4.5	3.5
Mg	0.7	.39	.27
Sulphate	1	.36	.26
pH		7.1	6.4

Tend to vary between tanks and farms but not over time

# Manures and Slurries – Variability



- Manure is usually ~ 25% DM with bedding material having a major impact on nutrient value
- Feed program and livestock type will also have a significant impact
- An analysis can help determine nutrient value but they must be representative!

# Manures and Slurries – Variability



- The maximum fertiliser value of manure and slurries is achieved when your soil status is on target for P and K
  - P usage efficiency increases from 50% to 100%
  - K usage efficiency increases from 90% to 100%
- P and K will be used to build soils up when they are low and will be wasted when they soil levels are too high

# Manures and Slurries – Nitrogen content



## For Slurry

- Spreading in the Autumn instead of spring on grass results in a 25% *reduction* in N use efficiency
  - This is ~ 14 kg/ha of N lost in a 20 m<sup>3</sup>/ ha spread
- Use of trailing shoe or band spreading increases N use efficient by ~ 5%
- Incorporation within 6 hrs. and shallow injection increases N use efficiency by up to ~ 10%
- *All these values are available from TN650: Optimising the Application of Bulky Organic Fertilisers*



# Adjustments for Soil Status

**Table G. Phosphate and potash adjustments for PK soil status in established grassland in kg/ha**

Grass management	P <sub>2</sub> O <sub>5</sub>				K <sub>2</sub> O			
	Soil P status				Soil K status			
	V. low	Low	Mod.	High	V. low	Low	Mod.	High
Grass with high clover, red clover	+80	+40	0	P offtake x 0.75	+60	+20	0	K offtake x 0.5
All other grass management options	+80	+40	0	P offtake x 0.5	+60	+20	0	K offtake x 0.5

- For a 2 cut silage system
  - If K is high, based on your soil test, then a savings of £43 /ha can be realised per year for 4 years (Total of £172 /ha over 4 years)
  - If P is high, based on your soil test, then a savings of up to £12 /ha can be realised per year for 4 years ( £48 / ha over 4 years)

# Adjustments for Soil Status



- Most northern area of Scotland are under applying P
  - Availability
  - Cost

# Scenario

- For 1 cut and grazing the standard annual fertiliser requirement (kg/ha) for:

Field with **Low P and K status** is

N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
190	82	160

Field that is **on target for P (M-) and K (M)** status is

N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
190	42	140

# New SAC fertiliser technical notes



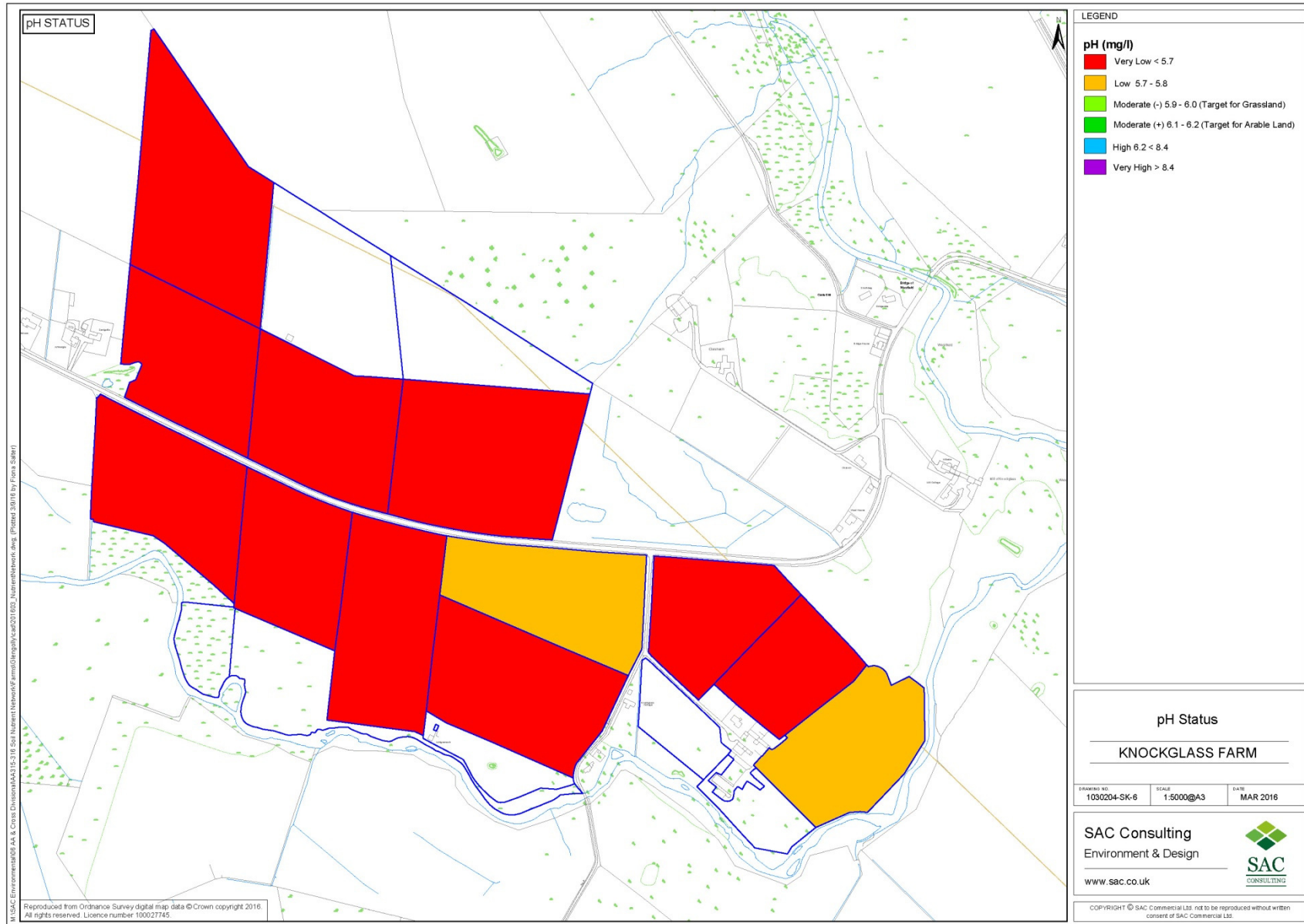
- **TN632** Fertiliser recommendations for grassland
- **TN622** Optimising the application of bulky organic fertilisers
- **TN621** Fertiliser recommendations for vegetables, minority arable crops and bulbs
- **TN623** Fertiliser recommendations for soft fruit and rhubarb crops
- **TN625** Nitrogen recommendations for cereals, oilseed rape and potatoes
- **TN633** Phosphorus, potassium, sulphur and magnesium recommendations for cereals, oilseed rape and potatoes

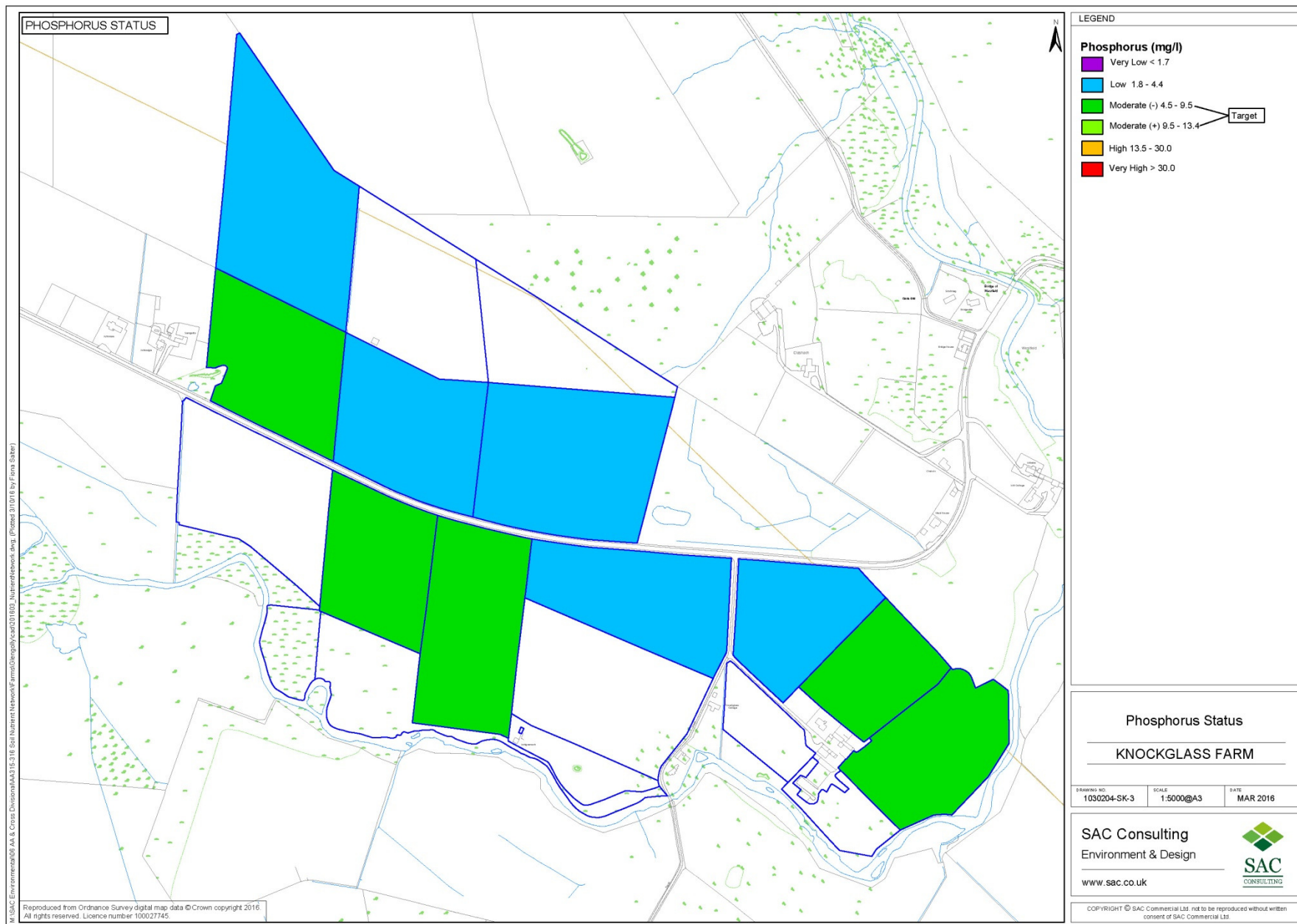


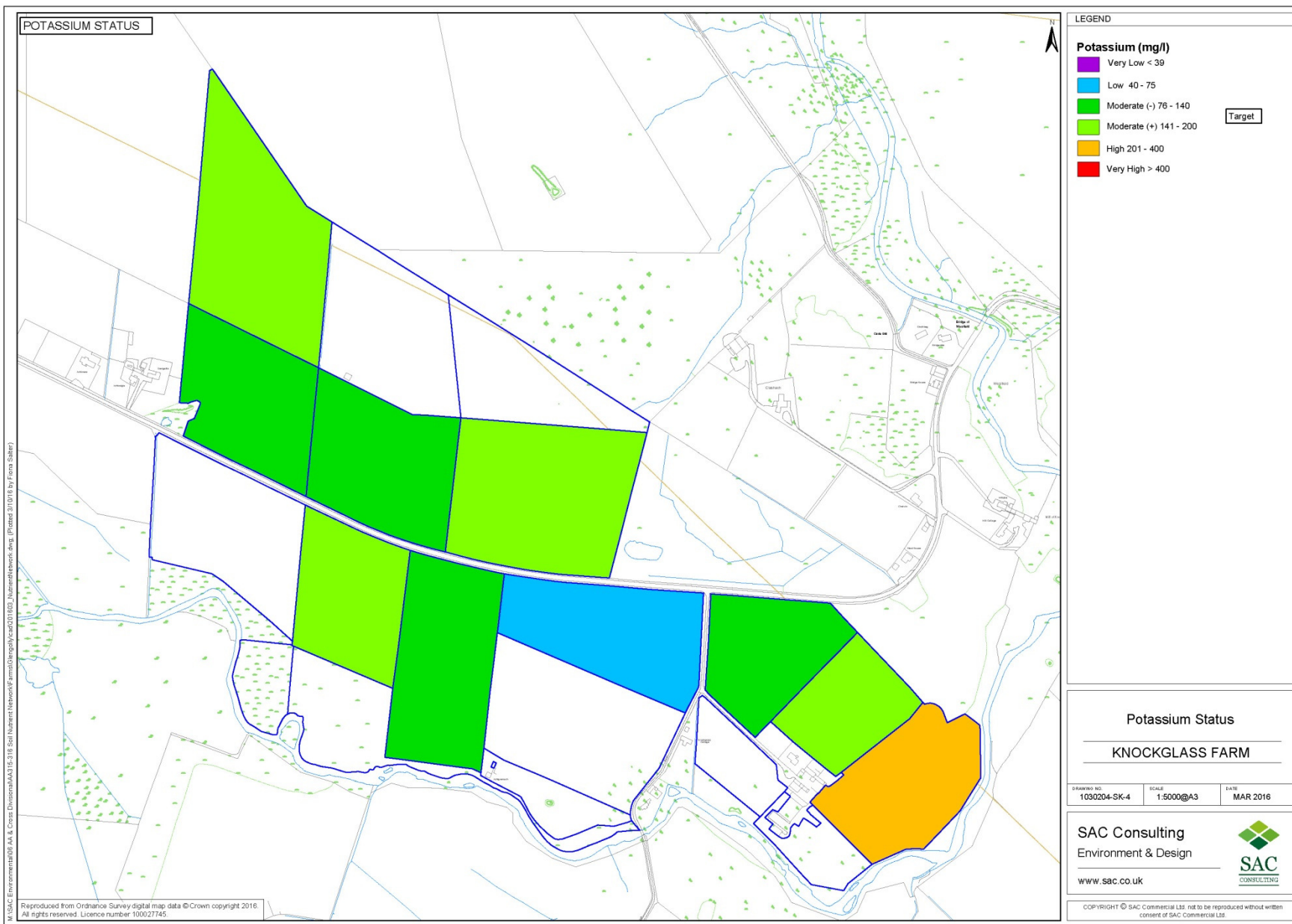
# Main Message



- Up-to-date soil analysis has a direct impact on recommended rates of both bagged and organic fertilisers
- Even if you are struggling to bring soils up to target it is important to know the weakest link









# PLANET Scotland



- Decision support system for nutrient management on farms in Scotland

**P**lanning  
**L**and  
**A**pplication of  
**N**utrients for  
**E**fficiency and the  
**e**nvironmen**T**