

# Angus Nutrient Network Farm



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Soil Analysis and Fertiliser Budgeting  
Wednesday 14<sup>th</sup> February

# Today's Topics

- Recap
- Interpreting soil analysis
- Crop nutrient requirements
- Putting it into practise!



## Re-cap



- Euan Crichton farms Bogindollo, Denmill and Finavon
- Arable: SB, WOSR, WB, WW and ground let for peas and potatoes (Approx 150ha)
- Grass: TGRS and PGRS (Approx 30ha)
- Livestock: 110 breeding sucklers, all progeny finished

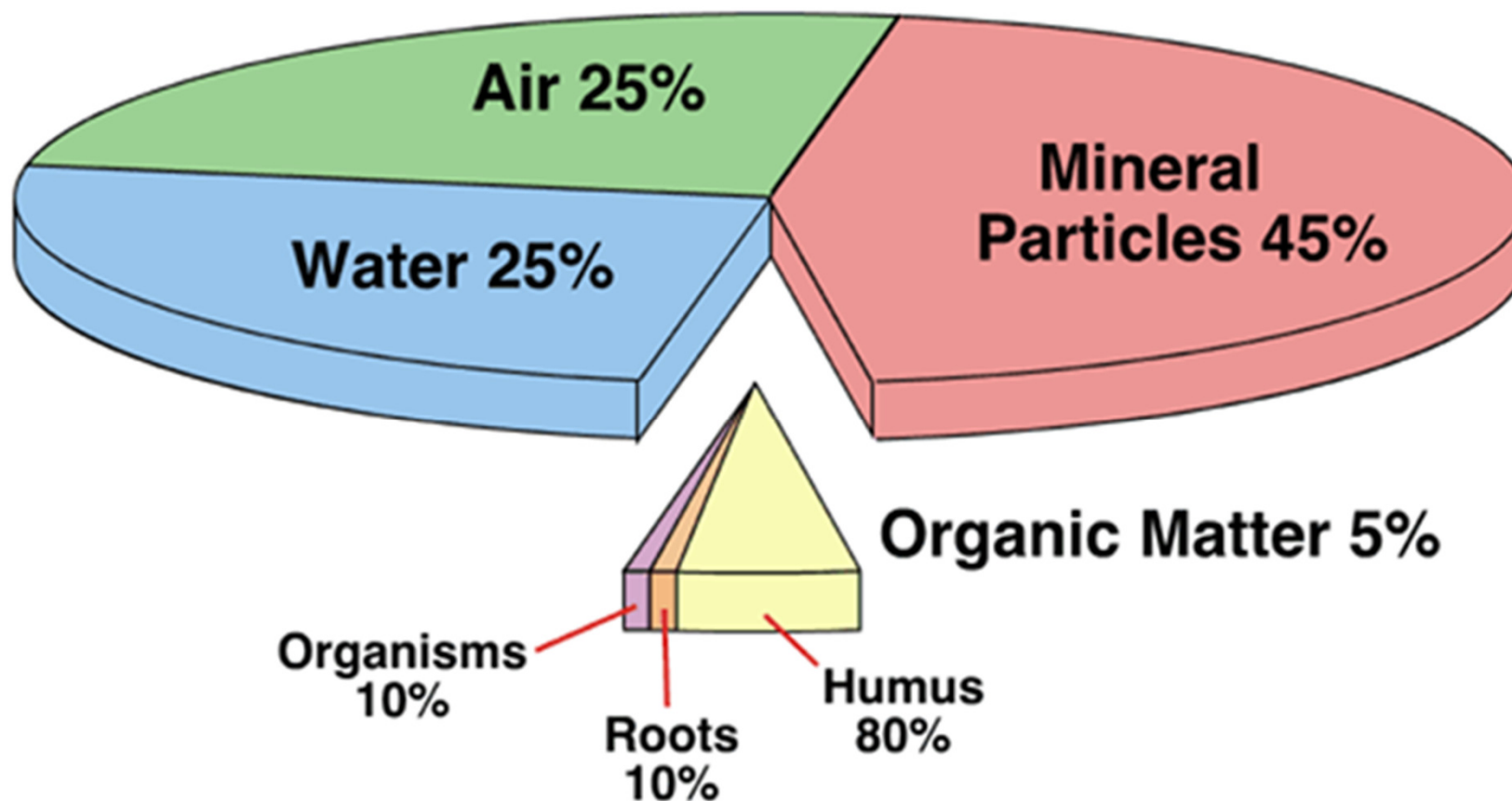
# Taking a soil analysis



- When:
  - 2 years after lime
  - 2 months after artificial fert
- Where:
  - Sub divide large fields (10acre blocks)
  - Areas which have been treated differently
- How:
  - Walk a 'W'
  - Take 20 or more samples with auger
  - Mix well and seal 500g in clean bag



# What's in soil?



# Arable Package – What's included?



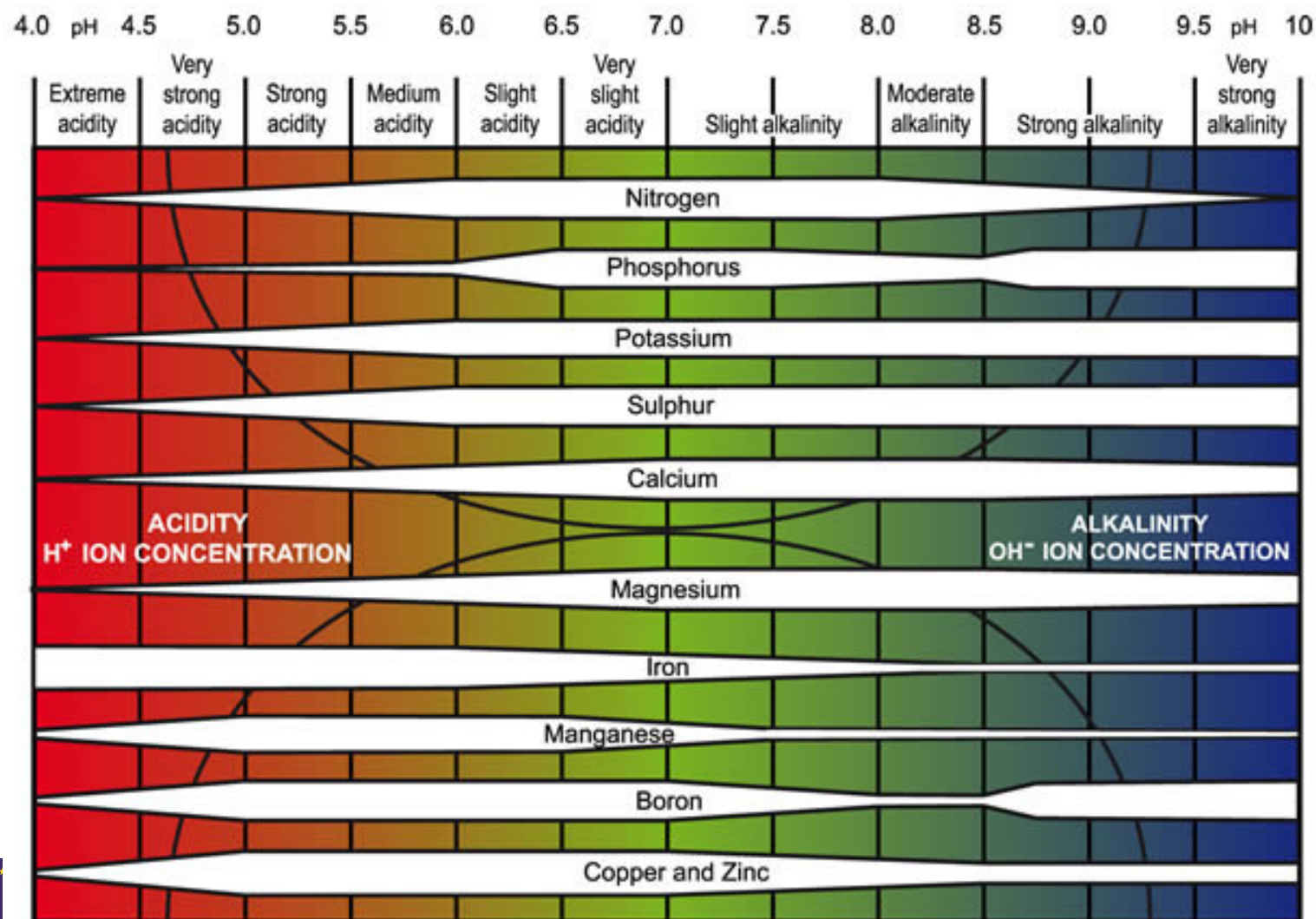
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Determination	Result	Units	Status
pH	6.2		
Lime req (Arable)	0.0	t/ha	
Lime req (Grass)	0.0	t/ha	
Extractable Phosphorus	6.34	mg/l	M(-)
Extractable Potassium	121.0	mg/l	M(-)
Extractable Magnesium	112.0	mg/l	Mod
Extractable Sulphur	4.4	mg/l	Low
Extractable Copper	1.67	mg/l	Low
Extractable Manganese	13	mg/l	Mod
Extractable Boron	0.58	mg/l	Mod
Extractable Zinc	0.66	mg/l	V Low
Organic Matter (LOI)	4.60	%	

# pH



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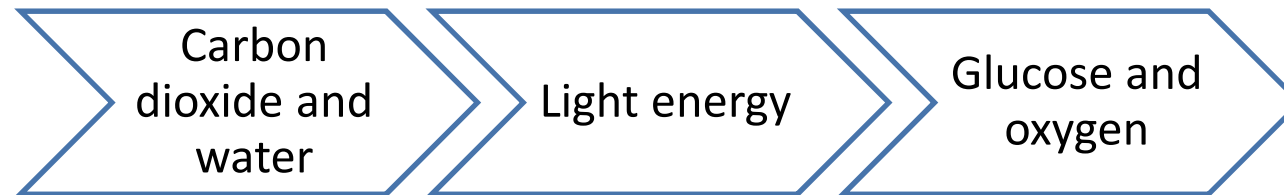
The European Union  
for Rural Development  
Europe investing in rural areas

redrawn by PDA from Troug, E. (1946)

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# Photosynthesis

- The chemical change in leaves of plants



- The light energy is absorbed by chlorophyll
- Some glucose used for respiration, the rest stored as starch



# Phosphorus (P)

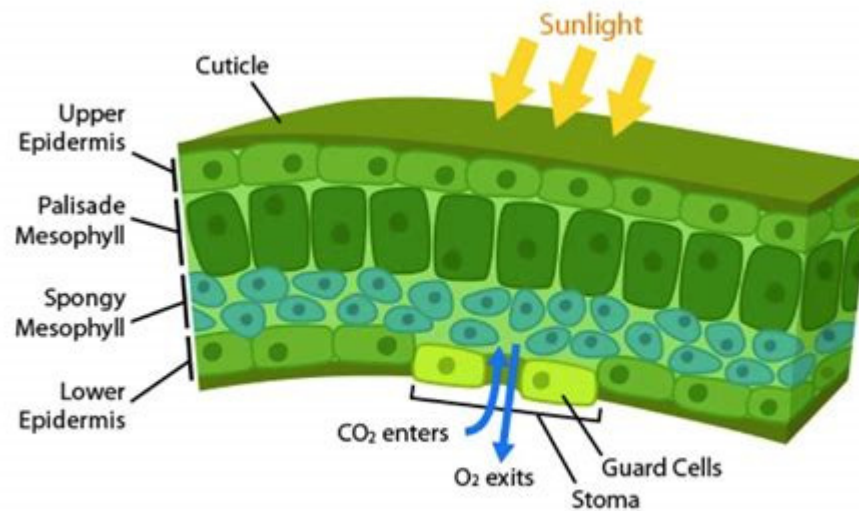


- Helps root development, early growth and the ripening of seeds
- Phosphorus enters the plant through root hairs, root tips, and the outermost layers of root cells

Photosynthesis = Carbon Dioxide + Water ..... Sunlight ..... Chlorophyll  
Phosphate Energy ➡ Oxygen + Carbohydrates

# Potassium (K)

- Controls the opening and closing of the stomata
  - Which controls water uptake, CO<sub>2</sub> intake and helps photosynthesis.
- Has been linked with reducing plant stresses (biotic, abiotic, water, temperature)



Most carbon dioxide enters plants through stomata that are tiny openings guarded by cells. Most stomata are found in the leaves of plants. Click for more detail.

# Magnesium

- The powerhouse of photosynthesis
- Chlorophyll molecules contain magnesium ions, it's the magnesium that makes chlorophyll green
- No magnesium no photosynthesis



# Sulphur

- Absorbed by roots as  $\text{SO}_4$
- Main use is protein production
  - cysteine, cystine and methionine
- Synthesis of oils (OSR has a very high use)



# Copper

- Copper is required for many enzymatic activities in plants and for chlorophyll and seed production
- Very small quantities needed (0.05ppm to 0.5ppm)
- Not usually an issue on mineral soils





# Manganese

- Photosynthesis, respiration, and nitrogen assimilation
- Not part of chlorophyll like magnesium, but deficiency looks similar
- Manganese less mobile, so younger leaves show symptoms first



# Boron

- Aids formation and strength of cell wall
- Provides structural integrity to cell wall
- Mobilised by xylem (roots → shoots and leaves)



# Zinc

- Moved through soil by diffusion
- Molecules taken up by roots in conjunction with N
- Linked with iron and manganese in chlorophyll production



# Organic Matter



- 3 parts to OM:
  - living biomass of microorganisms
  - fresh and partially decomposed residues
  - Humus - the well decomposed organic material
- Higher OM improves aeration, water holding capacity, nutrient reserves and soil organisms

# Nutrient levels



SAC Status	Extractable Phosphorus	Extractable Potassium	Extractable Magnesium
Very Low	0 - 1.7	0 – 39	0 – 19
Low	1.8 – 4.4	40 – 75	20 – 60
Moderate -	4.5 – 9.4	76 – 140	61 – 200
Moderate +	9.5 – 13.4	141 – 200	61 – 200
High	13.5 – 30	201 – 400	201 – 1000
Very High	> 30	> 400	> 1000

Scales of interpretation for soil extractable phosphorus, potassium and magnesium (mg/l)



# Nutrient levels

SAC Status	Extractable Manganese	Extractable Sulphur	Extractable Copper	Extractable Boron	Extractable Zinc
Very Low	< 1.5	< 3.0	< 1.0	< 0.3	< 0.5
Low	1.6 – 2.5	3.0 – 6.0	1.0 – 1.6	0.3 – 0.5	0.5 – 1.5
Moderate	2.6 – 20	6.1 – 10	1.7 – 8.5	0.51 – 1.0	1.6 – 10
High	21 - 40	> 10	8.6 – 80	1.01 – 3.5	10 – 80
Very High	> 40		> 80	> 3.50	> 80

Scales of interpretation for soil extractable manganese, sulphur, copper, boron and zinc (mg/l)

# What's needed in this soil?



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Determination	Result	Units	Status
pH	6.2		
Lime req (Arable)	0.0	t/ha	
Lime req (Grass)	0.0	t/ha	
Extractable Phosphorus	6.34	mg/l	M(-)
Extractable Potassium	121.0	mg/l	M(-)
Extractable Magnesium	112.0	mg/l	Mod
Extractable Sulphur	4.4	mg/l	Low
Extractable Copper	1.67	mg/l	Low
Extractable Manganese	13	mg/l	Mod
Extractable Boron	0.58	mg/l	Mod
Extractable Zinc	0.66	mg/l	V Low
Organic Matter (LOI)	4.60	%	

# Calculating crop requirements



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- Use soil analysis as starting point
- What will the crop require?
  - Crop grown and yields
  - Will the straw be baled or chopped?
- What else is applied?
  - Nutrients from FYM
- Work out the total bagged fertiliser needed

# Exercise 1

<b>Granny Field</b>	Spring Barley (malting) (following WW)
<b>Straw use</b>	Baled
<b>Expected Yield</b>	6.0t/ha
<b>Soil Type</b>	Other Mineral

- Use the Technical notes provided
- What is the crop requirement for N, P, K and S?

# Exercise 1 – soil analysis



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Determination	Result	Units	Status
pH	6.2		
Lime req (Arable)	0.0	t/ha	
Lime req (Grass)	0.0	t/ha	
Extractable Phosphorus	12.5	mg/l	M(+)
Extractable Potassium	88.90	mg/l	M(-)
Extractable Magnesium	189.0	mg/l	Mod
Extractable Sulphur	4.8	mg/l	Low
Extractable Copper	3.05	mg/l	Mod
Extractable Manganese	9.5	mg/l	Mod
Extractable Boron	0.53	mg/l	Mod
Extractable Zinc	1.4	mg/l	Low
Organic Matter (LOI)	3.49	%	



# What Euan applies



- 375kg/ha of 10:15:21:20S
  - N – 38 kg/ha
  - P – 56 kg/ha
  - K – 79 kg/ha
  - S – 75 kg/ha
- 250kg/ha of 33.5% N
  - N – 84 kg/ha
- Does Euan apply enough or too much?

# What should be applied

	What Euan will apply (kg/ha)	What should be applied (kg/ha)
N	38 + 84 = 122	118
P	56	53
K	79	73
S	75	40 + extra to make up deficiency

Very close to meeting requirements!

## Exercise 2

<b>Woodlane</b>	WW (following OSR)
<b>Straw use</b>	Chopped
<b>Expected Yield</b>	8.0t/ha
<b>Soil Type</b>	Other Mineral

- Use the Technical notes provided
- What is the crop requirement for N, P, K and S?

# Exercise 2 – soil analysis

Determination	Result	Units	Status
pH	6.6		
Lime req (Arable)	0.0	t/ha	
Lime req (Grass)	0.0	t/ha	
Extractable Phosphorus	3.74	mg/l	Low
Extractable Potassium	79.70	mg/l	M(-)
Extractable Magnesium	164.0	mg/l	Mod
Extractable Sulphur	6.0	mg/l	Mod
Extractable Copper	4.23	mg/l	Mod
Extractable Manganese	15	mg/l	Mod
Extractable Boron	0.38	mg/l	Low
Extractable Zinc	2.0	mg/l	Mod
Organic Matter (LOI)	4.61	%	

# What Euan applies

- 360 kg/ha of 0:20:30
  - P – 72 kg/ha
  - K – 108 kg/ha
- 185 kg/ha of 26:0:0:35
  - N – 48 kg/ha
  - P – 0 kg/ha
  - K – 0 kg/ha
  - S – 65 kg/ha
- 458 kg/ha of 33.5% N (two applications)
  - N - 153 kg/ha



# What should be applied

	Nutrients from Euan's fert	Crop requirements
<b>N</b>	201	190
<b>P</b>	72	67 + 40 = 107
<b>K</b>	108	83
<b>S</b>	65	40

- Less N
- More P
- Less K
- Less S

# Next time?



- What would you like to cover?
- Our thoughts:
  - Available nutrients from organic manures
  - Liming
  - Soil GPS analysis

# Thank You

