Welcome

Green Valley Golf Academy
Thursday 15th November 2018
Agenda

• The Story so Far
• Soil Sampling and Lime
• Worm Workforce
• Trace Elements for Animals and Plants
• Potash
• Nutrient Budgets
• Close
THE STORY SO FAR...
The Story so Far...
The Story so Far...
The Story so Far...
The Story so Far…
P Map

Phosphorus Status
- VH
- H
- M+
- M-
- L
- VL

Ordnance Survey
SOIL SAMPLING
Soil Sampling

• Why?
• Measures the plant available nutrients in the soil
• Gives you information to manage deficits and surpluses in soil nutrients
• Measures the acidity of the soil - Ph will dictate what is actually available to the plant
• Corrections of low ph and nutrient deficits will improve the productivity of your crop and save you money!
How to sample

• Twist a gouge or pot corer down to 7.5cm
• Walk the field in a ‘W’.

• Avoid gateways, feed areas or former muck-heap sites
• Collect 25 plugs of soil in a clean bucket
• Seal a well-mixed sub sample in a plastic bag or box and label
• Send to an accredited soil testing laboratory (either direct to the laboratory or via a local co-op, fertiliser merchant or independent company)
Value for Money

Basic Soil Report

**Soil Report**
**INTERTM REPORT**

<table>
<thead>
<tr>
<th>Determination</th>
<th>Result</th>
<th>Units</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lime req (Arable)</td>
<td>0.00</td>
<td>tha</td>
<td></td>
</tr>
<tr>
<td>Lime req (Grass)</td>
<td>0.00</td>
<td>tha</td>
<td></td>
</tr>
<tr>
<td>Extractable Phosphorus</td>
<td>15.9</td>
<td>mg/l</td>
<td>High</td>
</tr>
<tr>
<td>_extractable Potassium</td>
<td>520.5</td>
<td>mg/l</td>
<td>V High</td>
</tr>
<tr>
<td>Extractable Magnesium</td>
<td>182.0</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>Extractable Calcium</td>
<td>870</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Extractable Sodium</td>
<td>34.00</td>
<td>mg/l</td>
<td></td>
</tr>
</tbody>
</table>

Broad Spectrum Soil Report

**Soil Report**
**INTERTM REPORT**

<table>
<thead>
<tr>
<th>Determination</th>
<th>Result</th>
<th>Units</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lime req (Arable)</td>
<td>0.00</td>
<td>tha</td>
<td></td>
</tr>
<tr>
<td>Lime req (Grass)</td>
<td>0.00</td>
<td>tha</td>
<td></td>
</tr>
<tr>
<td>Extractable Phosphorus</td>
<td>6.99</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>Extractable Potassium</td>
<td>272.0</td>
<td>mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Extractable Magnesium</td>
<td>125.0</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>Extractable Calcium</td>
<td>1600</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Extractable Sodium</td>
<td>54.30</td>
<td>mg/l</td>
<td></td>
</tr>
<tr>
<td>Extractable Sulfur</td>
<td>19</td>
<td>mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Extractable Copper</td>
<td>1.49</td>
<td>mg/l</td>
<td>Low</td>
</tr>
<tr>
<td>* Extractable Manganese</td>
<td>15</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>* Extractable Boron</td>
<td>0.71</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>* Extractable Zinc</td>
<td>1.7</td>
<td>mg/l</td>
<td>Mod</td>
</tr>
<tr>
<td>Organic Matter (LOI)</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Carbon Exchange Capacity</td>
<td>% by WH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* LOI: Loss on Ignition
* WH: Water Holding Capacity
Avoid sampling when soil is waterlogged….or too dry!
Sample amalgamated fields separately
Sample problem areas or known soil types separately
Try to sample at least 2 months after slurry/manure/fertiliser or lime applications
Sample at least every 4 years
For fields underperforming start with a soil sample
Try to sample the year before sowing a crop to allow time to correct any deficits
THE FIRST PRIORITY
Why Do We Need to Lime?

• Leaching
• Crop Uptake
• Impact of Ammonium Nitrate Fertiliser
• Acid Rain
How Much Lime?

Eg Silage Land

Acidic effect of Fertiliser 175kg
Crop Removal 1\textsuperscript{st} cut 80kg
Crop Removal 2\textsuperscript{nd} cut 45kg
Leaching/Drainage 100-250kg
400- 550kg /Ac/Yr

So 2 ton /Acre every 5 years to standstill !!!
Why Do We Need to Lime?

<table>
<thead>
<tr>
<th>pH</th>
<th>N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 5 (very strong acidic)</td>
<td>53%</td>
<td>34%</td>
<td>52%</td>
</tr>
<tr>
<td>pH 5.5 (strong acidic)</td>
<td>77%</td>
<td>48%</td>
<td>77%</td>
</tr>
<tr>
<td>pH 6.0 (medium acidic)</td>
<td>89%</td>
<td>52%</td>
<td>100%</td>
</tr>
</tbody>
</table>
At What Cost?

<table>
<thead>
<tr>
<th>Ph</th>
<th>Utilisation % Nitrogen</th>
<th>Cost of Poor Utilisation</th>
<th>Cost - 4 cwt bags/ac applied per year</th>
<th>Cost – 7 cwt bags/ac applied per year</th>
<th>Cost of Lime/ac applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>53</td>
<td>£6</td>
<td>£24</td>
<td>£42</td>
<td>£132</td>
</tr>
<tr>
<td>5.5</td>
<td>77</td>
<td>£4</td>
<td>£16</td>
<td>£28</td>
<td>£66</td>
</tr>
<tr>
<td>6</td>
<td>89</td>
<td>£1.50</td>
<td>£6</td>
<td>£10.50</td>
<td>£33</td>
</tr>
</tbody>
</table>
Soil Quality:
Soil Indicators

Dr. Paul Hargreaves
SRUC Dairy Research and Innovation Centre
Soil – air, water, minerals

- Air 25%
- Water 25%
- Mineral Particles 45%
- Organic Matter 5%
    - Organisms 10%
    - Roots 10%
    - Humus 80%
Soil functions

- Support hooves and wheels

- Reduce gas losses, $\text{N}_2\text{O}$, $\text{N}_2$, $\text{NH}_3$ and $\text{CH}_4$

- Recycle nutrients in wastes

- Prevent $\text{NO}_3$ and pesticide leaching losses

- Store water and plant nutrients – minimise runoff, sediment and fertiliser losses

Good soil function increases profitability and conserves the environment
Soil Profile

‘O’ horizon – Organic horizon, generally dead plant material. Can be missing - deeper in forest soils.

‘A’ horizon – Top-soil, usually contains most organic material and has the greater mass of roots – most biological activity, with greater soil structure

‘B’ horizon – Sub-soil, can be several metres thick, usually of a greater density than the top soil, less organic material, greater mineral content. Lighter in colour.

‘C’ horizon – Parent material, generally undefined layer containing more minerals, can be from the underlying rock material or bedrock, but not always the case.
Soil Structure

Structure is the how the particles bind together to form aggregates that allows:

- roots to anchor the plant
- water to drain through pores and cracks
- water retention
- air to roots for favourable gas exchange
- mineralisation of nutrients and release to crop roots
- biodiversity of microbes
Organic Matter

- Soil plays a major role in the global carbon cycle, with the global soil carbon pool estimated at 2500 gigatons, 3.3 times the size of the atmospheric pool and 4.5 times the biotic pool.
- Organic material in the soil comes from the breakdown of plant and animal material.
- Depending on their chemical structure, decomposition is rapid for sugars, starches and proteins (days), slow for cellulose, fats, waxes and resins (months) or very slow for lignin (years).
- 35-80% of the non-living part of organic matter is humus.
Living Soils

- Huge quantity of organisms
  - Fauna: 1-5 t/ha
  - Fungi: 3.5 t/ha
  - Bacteria: 1.5 t/ha

- Fantastic diversity
  - Until recently: only access to culturable microorganisms
  - Methodological progresses
    - Possibility to extract DNA from soils
      - $10^4$ – $10^6$ bacterial genotypes / g soil

- A lot to be explored on the relations between below & aboveground diversity

What lives in the soil?

Life in the soil

Modified drawing by S. Rose and E.T. Elliott
Soil Biota

The Soil Food Web

- Nematodes - root feeders
- Arthropods - shredders
- Arthropods - fungal/bacterial feeders
- Nematodes - predators
- Protozoa
- Bacteria
- Earthworms
- Plants shoots & roots
- Organic matter
- Mycorrhizae
- Fungi

Birds

Animals
Earthworms

Can be very good indicator of soil quality as:

• they do not move very far (10 metres)
• can live for up to 10 years
• exposed to soil changes – pH, waterlogging, compaction, organic matter
Earthworms

Three main types:

**Litter Feeders** (Epigeic) – found close to the soil surface or in the litter layer

**Shallow Burrowers** (Endogeic) – found in extensive borrows close to the soil surface and feed on organic material

**Deep Burrowers** (Anecic) – more vertical borrows and mix mineral soil with organic material from the surface
Soil Pores

Dye labelling

Computer-aided tomography
Aggregates Sizes
Soil After Compaction Treatments

Trampled

No Compaction

Tractor
Earthworms and Compaction

![Bar chart showing total mature worms under different compaction conditions]

- **Tramp**
- **Tract**
- **No Compaction**

The chart illustrates the number of mature worms under various compaction conditions, with 'No Compaction' showing the highest number of mature worms.
Earthworms and Compaction

![Bar chart showing the number of immature earthworms under different compaction conditions: Tramp, Tractor, and No Compaction. The chart indicates significantly higher numbers under Tractor compaction compared to Tramp and No Compaction.]
Earthworm Identification I

Key to common British earthworms of amenity grasslands

By David T. Jones and Chris N. Lowe

There are 26 British species of earthworm. This guide covers the seven most common species that occur in grass lawns and playing fields. It does not include the red striped earthworms that occur in compost heaps, other species that occur in gardens, or woodland species.

Start here

Is it more than 2cm long, AND does it have a clearly developed saddle?

If yes, it may be a species not on this guide.

If no, the saddle is usually a different colour to the rest of the body, and slightly wider.

Turn over

Is the body from the first segment to the saddle partly or entirely pale in colour (whitish, pink, gray or greenish)? It may have some reddish or dark segments.

Black-headed worm - Apomictodes longa

Hint: Often a dark purplish head

Long and thin

Is the body: 1. Long and relatively thin or 2. Long and relatively fat?

Long and thin

Are the male pores visible?

Yes

Is the upper surface of the body, from the first segment to the saddle, entirely dark in colour (dark red, purplish red or chestnut brown)?

Yes

Is the earthworm longer than 8cm when NOT moving?

Yes

Redhead worm - Lumbricus rubellus

Hint: Sometimes slightly flattened, its tail into a paddle shape

Redhead worm - Lumbricus rubellus

Hint: Sometimes slightly flattened, its tail into a paddle shape
Earthworms and Compaction

![Aporrectodea caliginosa](image)
Worm Numbers
Other Methods
Background - Soil Compaction

Soil Compaction Problem

• Severe or poor soil condition in 8 - 12% of grasslands*

• If moderate fields included then over 70%*

• Reduced pore space/increased water filled pore space

• Reduced oxygen diffusion

• Microbial activity decreases

Experimental Work

- An 8 ha perennial ryegrass field at SW Scotland split into two
- Two traffic management treatments: normal (N) and CTF
- 3-cut silage system
- 9 m triple gang mower (9 m working width)
Controlled Traffic Farming
– Working widths

3m width

3m width 6m width
Results of Experimental Work

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Normal Traffic</th>
<th>Controlled Traffic</th>
<th>Difference (t DM ha(^{-1}))</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Density (g cm(^3))</td>
<td>1.02</td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VESS</td>
<td>1.93</td>
<td>1.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>6.5</td>
<td>6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P (Index)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K (Index)</td>
<td>2-</td>
<td>2-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Silage Cut</strong></td>
<td><strong>Normal Traffic</strong></td>
<td><strong>Controlled Traffic</strong></td>
<td><strong>Difference (t DM ha(^{-1}))</strong></td>
<td><strong>P-value</strong></td>
</tr>
<tr>
<td>1(^{st}) Cut (t DM ha(^{-1}))</td>
<td>5.28</td>
<td>5.43</td>
<td>0.15</td>
<td>0.27</td>
</tr>
<tr>
<td>2(^{nd}) Cut (t DM ha(^{-1}))</td>
<td>3.58</td>
<td>3.88</td>
<td>0.30</td>
<td>0.72</td>
</tr>
<tr>
<td>3(^{rd}) Cut (t DM ha(^{-1}))</td>
<td>2.34</td>
<td>2.84</td>
<td>0.50</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>2(^{nd}) + 3(^{rd}) Cut</td>
<td>5.92</td>
<td>6.72</td>
<td>0.80</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Total silage</td>
<td>11.29</td>
<td>12.15</td>
<td>0.96</td>
<td></td>
</tr>
</tbody>
</table>
## Cost of guidance equipment

<table>
<thead>
<tr>
<th>Investment</th>
<th>Equipment</th>
<th>Repeatable positioning</th>
<th>Capital Cost</th>
<th>RTK Annual Fee</th>
<th>Total Annual Cost***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Low accuracy* Manual steering</td>
<td>No</td>
<td>£1,500</td>
<td>–</td>
<td>£468</td>
</tr>
<tr>
<td>Level 2</td>
<td>Low accuracy* Assisted steering</td>
<td>No</td>
<td>£5,000</td>
<td>–</td>
<td>£1325</td>
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<tr>
<td>Level 3</td>
<td>High accuracy** Assisted Steering</td>
<td>Yes</td>
<td>£10,000</td>
<td>£500</td>
<td>£3050</td>
</tr>
<tr>
<td>Level 4</td>
<td>High accuracy** Integrated steering</td>
<td>Yes</td>
<td>£15,000</td>
<td>£500</td>
<td>£4275</td>
</tr>
</tbody>
</table>

* (*+/-150–200 mm) These will result in an increase in trafficked area due to their inaccuracy and non-repeatable positioning

** (+/-20 mm) Real Time Kinematic (RTK)

*** The total annual cost includes interest rates (4.5%), depreciation (15%), maintenance (5%) and training (£100 year⁻¹) (Nix, 2015)
Cost benefits of CTF

Assumptions

• The average DM yield for 2 and 3 ‘cut’ managed grassland harvest systems in the UK is 12 t ha\(^{-1}\) and 16.6 t ha\(^{-1}\) respectively

• The crop has a value of £72 t\(^{-1}\)

• Normal traffic management covers 80% of the field area

• The use of CTF increases forage yields by an average of 13%

Benefits

<table>
<thead>
<tr>
<th>Trafficked area %</th>
<th>Yield increase ha(^{-1}) 2-cut</th>
<th>Yield increase ha(^{-1}) 3-cut</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>0.53 t</td>
<td>0.73 t</td>
</tr>
<tr>
<td>15</td>
<td>1.00 t</td>
<td>1.36 t</td>
</tr>
</tbody>
</table>

|                  | £38                             | £53                             |
|                  | £72                             | £98                             |
Assuming additional costs are for vehicle guidance:

- A break-even area of 175 ha for a 15% trafficked area and 3 cuts year\(^{-1}\) with four high accuracy (RTK)-integrated steering systems

- A break-even area of 50 ha for a 45% trafficked area and 2 cuts year\(^{-1}\), for four low accuracy-manually steered systems
Why measure soil quality?

- Think of it in terms of:
  - An MOT for your soil
  - Or A check up at the doctors

- Working towards
  - rolling out soil quality testing
First Questions

• What is the state of my soil?
• Depends on
  – Soil type
  – What you want to do with it

• How do I tell?
  • Need indicators as can’t measure everything
Components of soil quality

Putting it all together will need a different approach to sample collection – linking physical observation and soil samples sent for testing.
Rolling out soil quality testing - Scorecard threshold values


The traffic light system represents:

<table>
<thead>
<tr>
<th>RED</th>
<th>(High risk, need to investigate urgently)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMBER</td>
<td>(Moderate risk, need to investigate further)</td>
</tr>
<tr>
<td>GREEN</td>
<td>(Low risk, continue to monitor)</td>
</tr>
</tbody>
</table>
Practical considerations

Selected soil health measurements:

- Routine analysis (P, K, Mg, Ca, pH)
- LOI
- VESS
- Earthworms
- PMN

Why?

Combines physics, chemistry and biology

Lab set-up

Turn around time
# Potential scorecard

**NAME**  
ASD-2018-4897

**CUSTOMER**

**TEXT_ID**

**Field Name**  
West  
Mid  
East

<table>
<thead>
<tr>
<th>FID</th>
<th>Potentially Mineralisable N</th>
<th>Organic Matter (LOI)</th>
<th>pH</th>
<th>Extractable Phosphorus</th>
<th>Extractable Potassium</th>
<th>Extractable Magnesium</th>
<th>Extractable Calcium</th>
<th>Extractable Sodium</th>
<th>mean VESS</th>
<th>Mean worms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
<td>5.39</td>
<td>5.6</td>
<td>5.13</td>
<td>390</td>
<td>113</td>
<td>1500</td>
<td>14.5</td>
<td>2.7</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>5.38</td>
<td>5.8</td>
<td>13.5</td>
<td>321</td>
<td>118</td>
<td>1400</td>
<td>11.6</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>36.4 mg/kg</td>
<td>5.74 %</td>
<td>6.3</td>
<td>27.9 mg/L</td>
<td>305 mg/L</td>
<td>170 mg/L</td>
<td>2000 mg/L</td>
<td>13.1 mg/L</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Lime req (Grass)**  
tonne/Hectare  
4.7  
3.7  
0

**Lime req (Arable)**  
tonne/Hectare  
2.7  
0  
0

**Soil texture** = sandy loam

**Soil health recommendation**

- Soil structure (VESS) low in the West field
- Adding OM and upping pH should alleviate this
- Depending on OM source consider extra N to account for immobilisation
- Worm numbers would benefit from OM and reduced tillage
Potential for benchmarking

• As in the current SRUC ‘AGREcalc’ where you can see your carbon footprint in relation to others

• You will be able to see how your soils perform against comparable soils and over time

• Benchmarking will improve the more data is entered
Benchmarking Results
Summary

• Living soil is important for crop yield and quality
• Can be an indicator of soil health
• Compaction is important as it reduces yields
• Soil health monitoring is a combination of methods
• Benchmarking indicates the health of a soil compared to other fields in the area
Thank you

Any Questions?
TRACE ELEMENTS FOR PLANTS AND ANIMALS
Macro – Nutrients:
- N
- P
- K
- Ca
- Mg
- S

Micro – Nutrients:
- Fe
- Mn
- Zn
- Cu
- B
- Mo
- Co
- Se
- I
• Nitrogen is found in all amino acids, proteins and enzymes

• Life does not exist without Nitrogen!
• Phosphate
  – Essential for ATP
  – Part of DNA/RNA
  – Required for new roots

• Potassium
  – Regulates pressure and water flow in plants
  – Moves photosynthates across plant
  – Structure & Immunity
• Calcium
  – Strength
  – Soil structure
  – Soil microbes – nutrient recycling

• Magnesium
  – Photosynthesis
  – Mobilisation of Phosphate
  – Animal health issues

• Sulphur
  – N efficiency
  – Enzymes and Vitamins
Fe Mn Zn Cu B

- **Iron**
  - Oxygen Transportation
  - Chlorophyll

- **Manganese**
  - Growth
  - Immune Response
  - Photosynthesis

- **Boron**
  - Seed & cell wall formation
  - Calcium Mobility

- **Zinc**
  - Balanced excess K
  - Palatability

- **Copper**
  - Reproduction
  - Immune Response
• Molybdenum
  – N formation
  – Reduces Copper absorption

• Iodine
  – Thyroid Hormone Synthesis
  – Fertility

• Selenium
  – N fixation in Legumes
  – Palatability

• Cobalt
  – Growth
  – Immune Response
POTASH
The Role of potassium (K) in the plant

- Enhances resistance to pests and diseases
- Regulates water status and increases drought tolerance
- Improves photosynthates movement in the plant
- Building and strengthening of the plant
- Increases root growth

INTERNATIONAL POTASH INSTITUTE

SRDP FARM ADVISORY SERVICE

Scottish Government
Riaghaltas na h-Albann
gov.scot

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

SAC Consulting
Potassium in the Soil

Potassium dynamics in soils

- **Plant residues**
- **Organic & inorganic fertiliser**

**K-Uptake**

**K⁺ - ions in soil solution**

- Fast:
  - 6 to 45 kg K₂O ha⁻¹ soil

**Readily exchangeable potassium** (held on clay and humus particles)

- Slow:
  - 300 to 1,000 kg K₂O ha⁻¹ soil

**Slowly exchangeable potassium** (layers of clay minerals)

- Very slow:
  - 3,000 to 11,000 kg K₂O ha⁻¹ soil

**Potassium lattice** (soil silicates)

- 20,000 to 120,000 kg K₂O ha⁻¹ soil

**K-Leaching** (Sandy and other light textured soils)
Sources of Potash

Potassium Sources - Slurry/FYM

- Muriate of Potash (60%)
- Fibrephos (0-16-16)
- Potassium Nitrate (13-0-45)
- Sylvinite (16% K2O + 32% Na2O)
- Sulphate of Potash (50%)
Potash and Nitrogen
Distribution of K20 Uptake

Winter Wheat 8t/ha

Images from www.pda.org.uk
Symptoms of K Deficiency
NUTRIENT PLANS
What is a Nutrient Plan?
Why Do A Nutrient Budget?

<table>
<thead>
<tr>
<th>£ /Ton</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.5% N</td>
<td>£200</td>
<td>£230</td>
<td>£280+</td>
<td>81p</td>
</tr>
<tr>
<td>MOP 60%</td>
<td>£270</td>
<td>£275</td>
<td>£280</td>
<td>47p</td>
</tr>
<tr>
<td>TSP 46%</td>
<td>£280</td>
<td>£315</td>
<td>£354</td>
<td>77p</td>
</tr>
</tbody>
</table>
## Why Do A Nutrient Budget?

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact 200 Acre Farm</td>
<td></td>
<td>+£2100</td>
<td>+£3500</td>
</tr>
<tr>
<td>70t/Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>-</td>
<td>0.24ppl</td>
<td>0.40ppl</td>
</tr>
<tr>
<td>Beef</td>
<td>-</td>
<td>4p/kg</td>
<td>+7p/kg</td>
</tr>
</tbody>
</table>
What Difference Does DM Make?

<table>
<thead>
<tr>
<th>DM %</th>
<th>N (units/1000gal)</th>
<th>P (units/1000gal)</th>
<th>K (units/1000gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>5</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>4%</td>
<td>4</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>3%</td>
<td>3</td>
<td>2</td>
<td>17</td>
</tr>
</tbody>
</table>
## What Difference Does Timing Make?

<table>
<thead>
<tr>
<th>Season</th>
<th>N (units/1000gal)</th>
<th>P (units/1000gal)</th>
<th>K (units/1000gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>5</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Summer</td>
<td>2</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Winter</td>
<td>1</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>N(units/1000gal)</td>
<td>P(units/1000gal)</td>
<td>K (units/1000gal)</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Spring Splashplate</td>
<td>5</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Spring Trailing Shoe/Dribble Bar</td>
<td>7</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Summer Splashplate</td>
<td>2</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Summer Trailing Shoe/Dribble Bar</td>
<td>5</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>
What Difference Does Application Method Make?

<table>
<thead>
<tr>
<th></th>
<th>N (units/1000gal)</th>
<th>P (units/1000gal)</th>
<th>K (units/1000gal)</th>
<th>£££££</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splashplate</td>
<td>20</td>
<td>16</td>
<td>112</td>
<td>£10/1000gal</td>
</tr>
<tr>
<td>Trailing Shoe/Dribble Bar</td>
<td>28</td>
<td>16</td>
<td>112</td>
<td>£11/1000gal</td>
</tr>
</tbody>
</table>

Diff. ¼ cwt N/Acre.  £3.50/acre
## Slurry Comparison

<table>
<thead>
<tr>
<th>Source</th>
<th>DM</th>
<th>N (units/1000gal)</th>
<th>P (units/1000gal)</th>
<th>K (units/1000gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teagasc</td>
<td>5%</td>
<td>5</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>Wigtownshire</td>
<td>6.4%</td>
<td>8</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>SAC</td>
<td>6%</td>
<td>7</td>
<td>5.5</td>
<td>20</td>
</tr>
<tr>
<td>RB209</td>
<td>6%</td>
<td>7</td>
<td>5.5</td>
<td>21</td>
</tr>
<tr>
<td>Balwherrie</td>
<td>7.66%</td>
<td>5</td>
<td>4</td>
<td>23</td>
</tr>
</tbody>
</table>
Nutrient Plan

- 2 cuts silage
  - P = L
  - K = M-

- pH 5.6

- Slurry applied @ 2000gal/acre
**Nutrient Plan**

**CLIENT:** W&S Agnew, Balwhinnie Farm  
**DATE:** 04/10/2018

**Field Name:** 12 Total Area: 14.78

**Last Soil Analysis Date:** 27/09/2018  
**Ph:** 5.6

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Level</th>
<th>Policy</th>
<th>Application Rate</th>
<th>Fertiliser Grade</th>
<th>Total Product</th>
<th>Fertiliser Required</th>
<th>Fertiliser Applied &amp; Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate</td>
<td>L</td>
<td>Build Up</td>
<td>3.24</td>
<td>200</td>
<td>610</td>
<td>1</td>
<td>19/04/2018</td>
</tr>
<tr>
<td>Potash</td>
<td>M</td>
<td>Run Down</td>
<td>104</td>
<td>200</td>
<td>408</td>
<td>1</td>
<td>19/04/2018</td>
</tr>
<tr>
<td>Magnesium</td>
<td>L</td>
<td>Maintenance</td>
<td>43.1</td>
<td>1300</td>
<td>4600</td>
<td>1</td>
<td>19/04/2018</td>
</tr>
</tbody>
</table>

**Last Limed:**
- **Last Year Crop 2018:** Grass Slag x3
- **This Year Crop 2019:** Grass Slag x2

**RECOMMENDATION:**

<table>
<thead>
<tr>
<th>Application Date</th>
<th>Rate</th>
<th>Total Nutrient Supplied</th>
<th>Additional Straight</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/10/2018</td>
<td>0</td>
<td>-1</td>
<td>-16</td>
</tr>
<tr>
<td>12/04/2018</td>
<td>0</td>
<td>-5.2</td>
<td>-19</td>
</tr>
<tr>
<td>23/04/2018</td>
<td>0</td>
<td>36</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total:** 209 kg/ha  
**Scottish Government Riaghantha na h-Albca gov.scot**
Nutrient Plans

- Soil Sample
- Slurry/Dung Sample
- Take note of yield – no of trailers & stock grazing
- Take note of what is actually applied!
- Use SAC/RB209 for recommendations
- Call the Stranraer Office!
If You Only Remember 3 Things……

• Your soil is ALIVE – don’t squash it, drown it or starve it of Oxygen and food!

• Buying Lime is the best money you will spend

• Sampling soil, forage and animals will help you farm Smarter!
Thank You