Soil and Nutrient Network

Helping farmers improve soil and nutrient management

Farm Advisory Service
National Advice Hub
T: 0300 323 0161
E: advice@fas.scot
W: www.fas.scot

Case study -
Midgarth Farm, Stronsay, Orkney

Midgarth is a suckler cow unit owned and operated by Adrian Miller and his wife Marion. It is located on the island of Stronsay which is a 1 ½ hour long ferry crossing from Orkney's main town of Kirkwall. The farm extends to almost 300 acres and carries a spring calving suckler cow herd of around 100 head. Off-spring are sold mainly as forward stores from November to January and are sired by a mixture of Simmental or Aberdeen Angus bulls. The business has taken on additional land in recent years and seeks to increase productivity by enhancing soil fertility and structure where appropriate with studious use of inputs including FYM and slurry.

The soil at Midgarth is all derived from a parent material of Old Red Sandstone however there are 2 main soil types within this. The best land is of the Thurso association (Bilbster Series) composed of brown forest soils with brown rankers. The poorer land is Canisbay association (Tresdale Series), the dominant soil type of which is non calcareous gleys. The entire farm is classified with land capability class 4.2 which is land primarily suited to grassland with some limited potential for other crops such as barley and oats.

Maintaining soil pH at target levels

Maintaining the pH at around 6.0 on the mineral soils at Midgarth is a critical requisite which will underpin the success of the entire farming business. The high rainfall experienced in Stronsay will accelerate the acidification of the soil therefore it is paramount to regularly soil test to rectify and maintain soil pH levels. Shell sand has historically been used as the liming agent of choice on the island but its availability is in question due to planning constraints. The alternative to this is granulated lime.

Granulime = £173/t delivered

Shell sand = £18/t delivered and spread

Granulime at 54% CaO = £3.20 per 1% CaO

Shell sand at 32% CaO = £0.56 per 1% CaO

SAC soil recommendations assume lime with 50% CaO

1 tonne of lime (as per SAC soil report) = 0.92t of granulime (50/54) costing £161.92

1 tonne of lime (as per SAC soil report) = 1.56t of shell sand with NV 32% CaO (50/32) costing £28.08

Whilst the shell sand works out cheaper, the granulime will work much faster in neutralising acidity and it can be applied using conventional fertiliser spreaders. The granulime however is typically spread in small quantities which means it has to be applied more regularly than shell sand.

An analysis of an actual sample of shell sand taken from Stronsay showed it to have a relatively high neutralising value (NV 36.9) whereby 1.35 tonnes of it would be equivalent to 1 tonne of lime. A valuable resource for the island potentially.

Stronsay ORKNEY KW17 2AN

Your reference:	G07127
Farm Sampled:	
Client Sample ID:	1

Lab sample no:	16500015
Case no:	ASD-2016-3127
Date received:	16/06/2016
Date reported:	22/06/2016

Determination	Result	Units
Neutralising Value	36.9	%CaO

* Not UKAS accredited

For more information on the Soil and Nutrient Network see www.fas.scot , For dates of SNN events, find us on Facebook or follow us on Twitter @FASScot.

The European Agricultural Fund for Rural Development
Europe investing in rural areas
Farming & Water Scotland
SAC Consulting
Scottish Government
Riaghaltas na h-Alba
gov.scot

Soil and Nutrient Network

Soil Analysis, Sand and Slurry

Being on a remote island where freight costs are high, it is critically important to understand and utilise the available resources to maintain soil fertility.

Analysis of the fields at Midgarth showed there to be some remedial action required in terms of addressing low pH, P and K levels. It was therefore decided that the slurry and FYM on the farm be analysed to determine its capacity to address the deficiencies.

Table 1: Comparison of nutrient value of Midgarth slurry against typical industry values

	Typical cattle Slurry	Midgarth Slurry
Dry Matter (DM) %	6%	7.29%
Total Nitrogen	2.6 kg/m^3	2.35kg/m^3
Total Phosphate (P_2O_5)	1.2 kg/m^3	1.45 kg/m^3
Total Potash (K_2O)	3.2 kg/m^3	4.3 kg/m^3

1,000 gallons of Midgarth slurry contains 6.58kg (13.16 units) of P_2O_5 and 19.52kg (39 units) of K_2O. The 100 suckler cows on the holding will produce around 220,000 gallons over the winter housing period which is therefore a substantial and significant nutrient resource.

Based on the fertiliser prices at the time, 1,000 gallons of this slurry was valued at £16.80.

This slurry would be ideal for addressing low potash levels in particular. For example, in an existing grass sward where potash is very low, 'SRUC Technical Note TN652 - Fertiliser recommendations for grassland ' recommends applying 60kg/ha (48 units/ acre) of K_2O. An application of this slurry at 1,300 gallons/acre would more than meet this demand. It is also ideal for replacing offtakes from silage where every 1 tonne of grass will removed 6kg of K_2O.

Table 2: Nutrient value of FYM when applied at 10 t/ha

Total nutrients (kg/t fresh weight) in different Farm Yard Manures Application Rate 10 tonnes per acre		
	Cattle FYM (Fresh)	Midgarth FYM
Readily available N (kg)	12	6 (12 units)
Total phosphateP_2O_5 (kg)	32	28 (56 units)
Total potash K_2O (kg)	80	29 (58 units)

The FYM at Midgarth was found to contain the equivalent of applying a 50kg bag of 12:56:58/acre if the FYM was spread at 10t/acre.

An application of this FYM at 10t/acre was valued at £38.66 based on its NPK content. The benefit to the soil in terms of added organic matter is unquantified.

The importance of accurate soil results

This nutrient network farm has so far highlighted the importance of adopting a good sampling regime to ensure accurate soil test results. It is critical not to take samples within 12 weeks of any fertiliser applications (organic & inorganic) and 6 months of any lime applications. Sampling too soon will only pick up residues and give false high readings.

Care should also be taken to avoid sampling the edges of the fields, particularly near gates where FYM and lime may have been stored in the past.

It is good practice to sample fields at the same point each year at a time when there will be no influence from previous fertiliser applications e.g. February.

An accurate soil analysis may cost only £20 and it will reveal invaluable information about your farm which may influence the productivity and profitability of the entire business.

Soil and Nutrient Network

Soil Organic Matter at Midgarth

Soil organic matter (SOM) can be defined as all living or once-living materials in the soil and includes roots, incorporated stubbles, straw, manures, slurries and compost.

SOM increases soil stability, improving its capacity to tolerate extremes of drought or flood. It also improves drainage, raises fertility and encourages biodiversity.

There are many factors which can reduce soil organic matter levels. For example, removal of crop residues without replenishing them with slurry or FYM. Excessive tillage will also reduce SOM, particularly in warm dry weather when the carbon can be oxidised into CO_2. Even the use of pesticides can affect levels as they may reduce the soil micro-organisms ability to break down raw materials into organic matter.

Soil organic matter levels can be tested in the lab and results benchmarked against recognised standards to determine the health of the soil. This was undertaken in 3 separate fields at Midgarth, the results of which are detailed in the table below.

Table 3: Soil Organic Matter at Midgarth

	% Organic Matter	% Target Range
Midgarth Grazing Field	13.13	4-10
Midgarth Silage Field	9.25	4-10
Midgarth Barley Field	8.96	4-10

The results highlight that all the soils analysed at Midgarth have healthy organic matter levels. Understandably, the permanent grazing field which endured the lowest offtakes; pesticide applications and cultivations had the highest organic matter level. The spring barley field with its exposure to annual ploughing, power harrowing and pesticides had the lowest SOM.

There are areas in Scotland where maintaining satisfactory organic matter levels in the soil can be a challenge. Some of the arable areas may have soils with SOM <4%. It is therefore not uncommon for arable units to house cattle over the winter, bedding them on home produced straw. The resultant FYM is then returned to the land to maintain organic matter which is critical to the soil health and viability of the arable enterprise

Read more in SRUC Technical Note TN650: Optimising the application of bulky organic manures available on the Scottish Farm Advisory's website.

Organic matter tips

- Maintain organic matter levels between 4 and 10%
- Be conscious of what is being removed and attempt to replace offtakes with FYM, slurry or compost.
- Too much organic matter can be detrimental. For example a peaty soil has a SOM > 35%
- Consider testing the level in the soil if you have concerns the level is not satisfactory

Soil and Nutrient Network

Sulphur at Midgarth

Sulphur is an important component of all plants as it is a constituent of some amino acids which are the building blocks of protein. Sulphur deficiency in agriculture has increased in recent years with the demise of heavy industry and resultant drop in atmospheric pollution. Deficiency symptoms are very similar to those associated with lack of Nitrogen i.e. yellowing of foliage, however sulphur tends to affect young leaves as opposed to old.

Sulphur can be measured in both the soil and in fresh plant material. Samples of herbage should ideally be taken 10 days before the grass is cut.

Table 4: Animal Feed (Grass) Analysis Report

Determination	Result	Units
Dry matter	333	g/kg
Phosphorus	2.37	g/kg DM
Potassium	12.0	g/kg DM
Magnesium	3.20	g/kg DM
Molybdenum	0.924	mg/kg DM
Calcium	2.94	g/kg DM
Sodium	1.29	g/kg DM
Copper	12.4	mg/kg DM
Zinc	64.6	mg/kg DM
Boron	<2.38	mg/kg DM
Iron	10500	mg/kg DM
Sulphur	1.45	g/kg DM

Read more about sulphur recommendations for crops in our Technical Note TN685. available at www.fas.scot.

Sulphur

- Many inorganic fertilisers contain sulphur to varying degrees
- Manures, including FYM and cattle slurry contain sulphur
- For manures, be aware that not all of the sulphur will be readily available to the crop in the year of application. Only 15% of cattle FYM and 35% of cattle slurry could be available.
- Most of the sulphur in manures should become available over a period of years.

At Midgarth a grass tissue analysis measured 0.15% total S in the dry matter which was less than the recommended 0.25%.

Could there be a potential deficiency issue?

Many fertilisers already contain sulphur in the form of SO_3. 370kg/ha (3 cwt/acre) of 20:8:12 would therefore supply 26kg. Manures also contain sulphur. Cattle slurry for example could contain 0.7kg/m^3 of SO_3. At a spreading rate of 22m^3/ha (2000 gal/acre) 15.4 kg of SO_3 would be supplied. Sulphur recommendations for grassland are pitched at 40kg SO_3/ha, which would suggest there should not be any deficiency. When taking into account the fact that salt laden maritime air contains sulphur, there is unlikely to be any issue at Midgarth.

Table 5: Sulphur content of various sulphur containing fertiliser compounds.

Sulphur containing fertiliser	SO_3 content (%)
20:8:12	7%
23:4:13	7%
27:6:6	3%
16:16:16	7.5%
14:14:21	7.5%
12:22:22	7.5%
Ammonium sulphate	60%