Soil and Nutrient Network Farms Impact Report

Farm Advisory Service

Report produced by SAC Consulting

Executive Summary

There have been 24 Soil and Nutrient Network (SNN) Farms between 2017 and 2019 within the Farm Advisory Service, with an additional four farms planned to commence in 2020. Each farm holds a series of three meetings covering locally relevant topics which have included nutrient management: soil biological, chemical and physical analysis and manure and fertiliser budgeting. The information provided in this report highlights the impact this initiative has had on the agricultural community. The key objective within the farm network is to help farmers:

'Effectively target nutrient and manure use to improve agricultural efficiency while simultaneously reducing agricultures environmental impact by bringing farmers together'.

Introduction

The wide geographic spread of the Soil and Nutrient Network (SNN) Farms was implemented to provide advice and guidance to farmers across Scotland at a level which was relevant at both the local and international scale. The network of farms has ranged from the Western Isles to the Borders and each farm has held a series of three meetings which have investigated a range of topics such as: understanding soil structure and compaction; soil pH and nutrient planning, making best use of organic fertilisers and manures, soil biodiversity and organic matter and soil erosion.

With a further 4 farms planned for 2020, the aim of this initiative is to bring farmers together to learn about how soil management practices and targeted nutrient use can help to optimise agricultural productivity as well as improve the environmental efficiency of food production in Scotland. Each meeting is centred on farm with a host farmer. This structure provides a grounding for discussion which is then promoted and guided by the facilitator. Furthermore, the facilitator selects topics which are relevant to the local area, bringing in specialist speakers where necessary.

Figure 1 – A healthy soil, one of many blocks dug up and inspected by farmers across Scotland at Soil and Nutrient Farms.

Nutrient Network Farms

There have been 24 SNN farms under the Farm Advisory Service Crops and Soils theme, with a further 4 planned for 2020.

The locations of the new farms are in the Borders, Lanarkshire, Orkney and Fife.

Additionally, there are three ongoing farms from 2019/20 which will hold their final meeting in 2020.

The locations of the SNN farms are shown in figure one, the most recent farms are shown with large pins, while previous hosts shown with dots.

Figure 2 – The location of previous and current Soil and Nutrient Network farms.

Soil and Nutrient Network Host Farms

Figure 1 – Soil and Nutrient Network host farms, 2017 to 2020

Year	Farm Name	Location
2020	Lyking Farm Edenwood Farm Tbc Tbc	Orkney Cupar, Fife Borders Lanarkshire
2019/2020	Kirkton Farm Meddat Farm Redwell Farm	Aberdeenshire Easter Ross Angus
2018/2019	Auchlossan Dunadd Dormieston Farm Newmills of Boyne Bielgrange Balnellan Farm Midgarth Auckenneck Estate Balwherrie Farm Clachan Farm	Aberdeenshire Argyll Ayrshire Banffshire East Lothian Moray Orkney Stirling Stranraer North Uist
2017/2018	Limekilns Bogindollo Waternish Farm West Binny Farm, Wormiston East Balhalgardy Flowerbusn Mains Crumhaugh Farm Rhion Farm Girrick Farm Knockglass Farm 8 Sand Street	Dumfriesshire Angus Skye West Lothian Peebleshire Aberdeenshire Inverness-shire Lanarkshire Argyll-Kintyre Roxburghshire Caithness Lewis and Harris

Each farm produces a case study describing the farm and key findings from the meetings, historically, this has been published in two parts with the initial farm introductions produced in year one and key findings in year two.

Additionally, six SNN farms produced podcasts and five videos were recorded. These are all available on the FAS website at **www.fas.scot/soil-nutrient-network-host-farms/**

Furthermore, each meeting has a summary of the key themes for that meeting which is published in the meeting report. These can be found at the above web page.

Key Meeting Topics and Themes

Due to the variety of farms within the SNN and the wide range of local issues regarding soil and nutrient management, each meeting has provided unique insight and discussion, however, over the past three years, several themes have emerged which are summarised below. Quotes from attendees and host farmers have also been included to represent farmers and land managers opinions of the SNN.

Soil Analysis

"You need to monitor your soil to manage it" was a quote from Balnellan nutrient network farm, Morayshire and was a strategy in all the nutrient network farm meetings.

A foundational theme to the SNN meetings has been soil analysis. Host farmers and participants have regularly agreed that routine soil analyses are very important, however, analysis are often not carried out regularly, especially on grassland farms. One reason which has been discussed is the gradual move away from arable cropping on many livestock farms which has reduced the urgency for soil analysis which should be done every 3-5 years. This trend was addressed at the Stirling SNN farm, where pH analysis was expanded into a discussion about liming material, more information can be found at **www.fas.scot/crops-soils/soils/stirling-soil-nutrient-network-aucheneck-estates/**

Combined with routine sampling of pH, phosphorus and potassium, some farms analysed organic matter using the Loss On Ignition methodology. Historically this was often included in soil analysis but is rarely performed now. Organic matter in soil is crucial for water and nutrient retention, and organic matter levels on arable farms have been declining over the past 30 years. The impact of this has informed farmers of their soil organic matter levels and allowed actions to be taken to raise levels. For example, at Bielgrange in East Lothian their approach has been to replace bought in inorganic fertilisers with organic fertilisers such as mushroom compost and home produced FYM.

Niall Jeffrey, farmer at Bielgrange Farm, East Lothian said:

"The biggest benefit of the nutrient network farm project was bringing my soil knowledge and nutrient management up to date. As a direct result we have started to bring more organic manures onto the farm to replace inorganic fertiliser. We have also started to use our home-produced farmyard manure better by having it analysed and spreading it on fields more frequently with a lower rate."

Combined with the many benefits that increasing soil organic matter has on agronomic aspects of production, there are also far reaching environmental benefits such as a lower carbon footprint associated with lower fertiliser use and increasing the resilience of farming systems. The work in this area complements the Farming for a Better Climate initiative which focuses on finding farming friendly approaches to reduce on farm emissions.

A report summarising the results of all soil and organic manure analysis taken from 2016 – 2018 on the SNN farms was written, called Soil and Organic Materials Analysis from the Soil and Nutrient Network Farms 2016 – 2018" which is available to view or download on the FAS website at **www.fas.scot/publication/report-soil-nutrient-network-farms-2016-2018/**. The headline from this report is that "Acidic soils could be affecting production on many Scottish farms". Of 273 soil samples from the host farms, almost half of analyses showed that the soils had a pH below 5.8, one third were between 5.8 and 6.2 and 18% were above pH 6.2. The optimum soil pH range to aim for is 6.0 to 6.2 on mineral soils to improve nutrient availability and crop yield. Other key findings included the variability of P & K levels on soils and the different nutritive value of organic manures. Raising awareness of soil pH and nutrient levels has taken a key role in many SNN meetings.

Other Analysis

Livestock farms that regularly use slurry, FYM or other organic fertilisers were encouraged to test and analyse their organic manures. This has allowed farmers to understand the value of organic manures and adjust fertiliser rates as appropriate making considerable savings in purchased inorganic fertilisers. On Bogindollo farm in Angus it was found that the cattle manure had a significantly higher Potash content of 17.2kg/t compared with the standard analysis of 8kg/t. This is thought to be a result of oat straw being used for bedding, which in turn allowed the host farmer to reduce his application of potash from artificial sources.

Nutrient Budgeting

Nutrient budgeting has also been found to be a relevant and popular topic at many SNN meetings. For example, at Wormiston Farm, Peeblesshire a nutrient budget was calculated using Planet Scotland which gave a saving of £5,049 across the 12 fields sampled (98.01ha = £54.52/ha). In 2016 the total fertiliser cost including spreading was £15,636 on this farm and in 2017 this was reduced to £10,587 as a result of accurate fertiliser budgeting. This included a two-cut silage system, spring barley and grazing. Nutrient budgeting allowed for savings of over £5,000 on this farm increasing business efficiency and improving farm cash flow.

GPS Soil Sampling

A number of farms explored the use of GPS soil analysis as a more accurate way of analysing soil. At West Binny Farm in West Lothian the GPS sampling allowed for a saving of 18.56 tonne of lime over 18.11ha. Although this method of analysis is more expensive the additional costs of GPS was covered by the saving in lime and ensured a more even pH across the field benefitting crop and grass production.

Soil Structure and Use of Machinery

The role machinery has in either improving or degrading soil has been highlighted at several SNN farm events. This theme within the SNN farms has been closely integrated with compaction remediation and use of Visual Evaluation of Soil Structure workshops. For example, at the first meeting at Redwell Farm in Angus in August 2019 attendees discussed key principles of soil management with regards to cultivation such as weight, pressure, and critical working depth. Attendees said that this meeting would help them to improve nutrient management and profit margin, as well as help them to make better decisions. Although the monetary gains resulting from correct cultivations are more subtle, they are far reaching and will affect environmental impact -through reduced emissions - and production, by aiding the growth of healthy plants. Soil and Metal interactions has also provided links with other FAS meetings out with the Soil Nutrient Network, providing a collective move across FAS to promote soil health through correct cultivation of soil.

Figure 3 – Angus Soil and Nutrient Network Farms first meeting, the group learns the main components of a health soil from UK expert Philip Wright.

With soil compaction being topical after a very wet harvest at West Binny, West Lothian, there was a discussion on ways to reduce the risk of causing compaction through tyre selection and managing tyre pressures. This helped farmers appreciate the various types of tyres available and the difference this can make to soil compaction. Compaction issues were identified in a silage field on Balwherrie farm, Stranraer. The compaction was seen at a depth of 10-22cm and was characterised by poor root penetration and large blocky aggregates which did not break apart easily. After close examination it was concluded a swardlifter was the machine required to rectify the compaction.

Soil Biology

Often forgotten in conventional agriculture, soil biology has been a key theme in the Soil Nutrient Network. The SNN farms have promoted simple and effective biological reviews for land managers to carry out on their own farms such as earthworm counts. On Waternish croft on Skye this led to a more detailed discussion about corncrakes and wading birds found on the croft. Additionally, the second SNN meeting at Redwell Farm in Angus focused on the soil food web, with in depth discussion about the role soil biology has in nutrient cycling and water filtration, more information can be found at **www.fas.scot/downloads/angus-soil-nutrient-network-2nd-meeting-15-01-20-presentation-slides/**

One attendee commented after the meeting:

"I have been considering soil biology for years, but what we have discussed tonight has really turned the light on".

Figure 3 – Angus Soil and Nutrient Network Farms first meeting, the group learns the main components of a health soil from UK expert Philip Wright.

Feedback

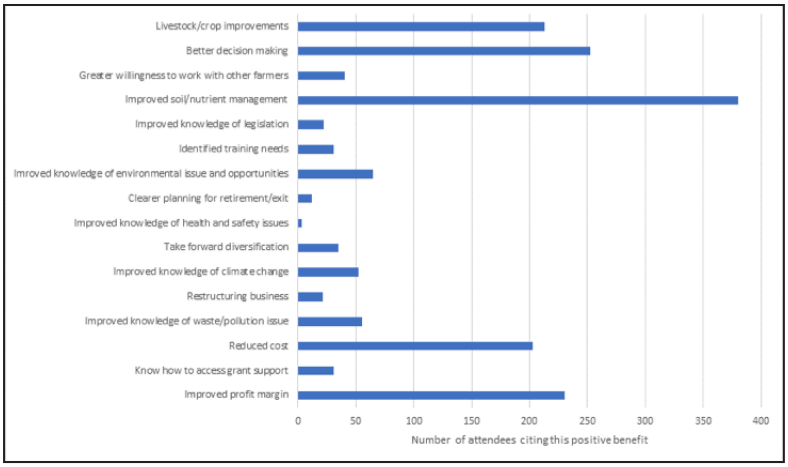
Following each meeting participants were asked to complete a feedback sheet. A total of 597 responses have been collected between 2017 and 2019 from the SNN farms. Below are the key findings from the feedback.

Figure 4 – Ratings by attendees for the SNN farm meetings

Measure	Ratings by attendees				
	Excellent	Very satisfactory	Satisfactory	Less than satisfactory	No answer
Overall delivery	364	218	7	0	8
How easy was it to understand the information provided	289	246	28	0	34
Opportunity to ask questions	365	184	5	1	42
How useful was the event	280	252	53	1	11
How relevant was the content of the event	313	210	59	0	15
Suitability of the event	322	250	13	1	11
Time keeping	257	243	46	2	49
Total	**2190**	**1603**	**211**	**5**	**170**
Percentage	**52%**	**38%**	**5%**	**0%**	**4%**

Alongside evaluation questions about the event, attendees were asked if they would make changes as a result of the information provided. 524 attendees intended to make changes, 36 did not and 37 did not answer this question. A summary of the intended changes is provided in figure 5.

Figure 5 – Improvements attendees intend to make due to information gained at a SNN event.



However, some attendees did not indicate that they would make a change. The following reasons were provided for this: six people cited they needed more information; five cited they did not have enough time; one cited that it was too costly; and one attendee cited that they did not learn anything new. Furthermore some information was gathered about the demographics of SNN attendees.

Figure 6 – Gender and age of attendees at SNN meetings

Gender	% of attendees
Male	92%
Female	8%

Gender	% of attendees
Age	
20 or younger	1%
21 to 30	14%
31 to 40	9%
41 to 50	20%
51 to 60	26%
61 to 70	21%
Over 71	10%

Quotes from Participants

Graham Mackie farms alongside his parents at Westerboard Farm near Kilsyth. Graham attended the meetings at Crumhaugh over the two years of the project. Graham said:

> *"Even though a lot of the information was things we learnt at College it was amazing how much of it I had forgotten. Following the first meeting we carried out soil sampling at home and were surprised at how low the pH was, we have put lime on to rectify this and are starting to notice a difference in grass yields".*

Robert Parkin farms along with his father at Higher Daviesdykes Farm, Newmains.

> *"In the past we have struggled with storage capacity on the farm which has meant we have not been able to take advantage of the nutrients in the slurry as much as we would have liked, we have recently increased capacity meaning we can now spread slurry at times when the grass can take it up. I have been surprised at how much fertiliser we can actually save by taking into account the nutrient content of the slurry".*

Robert's recent soil analysis shows a variation across fields which he would previously have treated the same. From 3 fields sampled, one requires lime and the other two are low in both phosphate and potash.

> *"Previously we would have applied the same slurry and fertiliser to all of your silage fields however knowing the soil results is going to let us target the fertiliser better".*

Conclusion

Overall, the aim of the SNN farms has been to increase farmers, and land managers, awareness and knowledge of soils and nutrients. This allows them to make more accurate decisions about inorganic fertiliser and organic fertilisers. Furthermore, these meetings have led to a better understanding of soil biodiversity and soil structure, benefitting both farm efficiency and the wider environment.

The SNN Farms have provided Scotland wide, on farm meetings spanning several years. The meetings have offered diverse content and a place for discussion for farmers to talk about soil health and nutrient management. The information and management techniques available at these events will increase farm efficiency while reducing the environmental impact of agriculture in Scotland. For the remainder of 2020, it is planned to continue providing high quality information at SNN events, covering physical, biological and chemical soil properties.