

# THEME REPORT



## NORTH AYRSHIRE MONITOR FARM IMPROVING SOIL STRUCTURE & FERTILITY

### THE CHALLENGE

When the monitor farm programme began in 2017, there was scope to improve the soil health at Girtridge Farm. The previous grazing methods of set stocking combined with the heavy soil and wet climate had resulted in considerable levels of compaction in various fields. A poor soil structure limits productivity, resulting in reduced yields. More attention was required to look at the nutrient and pH status of the soil so that lime could be applied where needed and fertiliser applications could be tailored to meet the crops' exact requirements based on the levels of nutrients already present.

John was keen to look into ways of improving the soil health with the aim to increase productivity. The three main areas for improvements were:

- Drainage
- Soil structure
- pH and nutrient status of the soil

### WHAT WE DID ON FARM

#### Improving Structure and Nutrient Status

Good soil health is essential for optimising grass growth. Various measures to make improvements have been explored through the monitor farm programme at Girtridge.

At the 3<sup>rd</sup> monitor farm meeting, guest speaker Michael Blanche (Farmer and Nuffield Scholar) discussed the importance of managing a farm from the soil up and not the stock down. Michael also explained that pH is the most important factor when it comes to managing grassland. Grass grown at a pH of below 5.7 will only effectively use a maximum of 49% of the available nitrogen, 36% of phosphate and 57% of potash, whilst a pH of 5.9 to 6.0 will allow grass to utilise a maximum of 82% of the available nitrogen, 50% phosphate and 82% of potash. It has been shown that only 27% of grassland in a nearby river catchment is on target for grassland soil pH. Soil phosphate, potash, calcium to magnesium ratio, structure and organisms must also be managed well. Healthy soils should contain 25 to 30 worms per 'spade cube' of soil!

At the 9<sup>th</sup> monitor farm meeting, Dr Bill Crooks spoke about various steps which can be taken to improve soil health. There was a particular focus on improving soil structure. Soil compaction has a major impact on grass growth as it limits root growth, impedes drainage, reduces fertiliser uptake and can potentially result in soil erosion.

At the meeting, a field was chosen that would be used to demonstrate how improvements can be made to the soil. One field in particular was identified that had been stocked heavily all-year-round and was showing signs of poor drainage and reduced grass productivity. To correct this issue the following steps were taken:



# THEME REPORT

- 1) **Understand the state of the drains** – use drainage maps and any changes were considered as well as ensuring outfalls were clear.
- 2) **Review the soil analysis** - soil analyses were carried out, and in John's case the pH was low in many fields. If pH is not on target then up to 50% of fertiliser could be wasted so a liming program was established to rectify the issue. Analysis of the P & K levels show that they were high, therefore any application of P & K would be an unnecessary cost – money saved on fertiliser.
- 3) **Digging a hole** - a hole was dug before conducting any cultivation or de-compaction to ensure that the problem was correctly identified, allowing the appropriate equipment to be used. In this case, a distinct cow pan from the surface down to about 10 cm was identified. The rest of the topsoil layer was firm, as was the subsoil, which is typical in old swards that receive a lot of traffic. The maximum rooting depth was poor at around 15 cm, partly due to how the grass was managed, although the cow pan and firm topsoil below was also a limiting factor.
- 4) **Devise a plan** - based on the information gathered, a plan was made to correct the issue. The recommendations made to John were as follows: make sure the drainage system is working; consider subsoiling to reconnect with the drainage system; bring the field into rotation or do a full re-seed. A pasture/sward lifter was the tool of choice to break up the cow pan at 8-10 cm deep.



Figure 1: Dr Bill Crooks talking about soil compaction

Three different types of equipment were viewed and discussed at the meeting, which are all suited to different jobs:

- Sub-soiler – a drainage tool, used to reconnect with your drains, and typically runs at a depth of 45-75cm.
- Sward lifter – targets compaction in the topsoil (most appropriate for removing John's cow pan).
- Aerator – a sward management tool that opens up the sward, allowing air into the root system, helping the grass to deal with compaction, and maintains a healthy sward.



Figure 2: Equipment demonstration to improve soil structure

# THEME REPORT

The sward lifter was used on John's field to allow its effect on grass growth to be assessed at a later meeting. The importance of only conducting these types of field operations when the field conditions are right was discussed. Too wet and you will make the problem worse and too dry may cause excessive soil surface heave and root damage leading to sward death.

## Drainage

Drainage was covered at the 10<sup>th</sup> monitor farm meeting by guest speaker Gavin Eldrick. Firstly the costs were discussed. It costs between £1,000-£3,000/acre (£2,500-£7,500/ha) to drain land intensively. The use of a trencher will reduce the amount of gravel required and therefore be cheaper.

With costs of drainage being so high, other cheaper options were covered including reducing compaction to improve drainage, spot drainage, and controlling rushes by ensuring pH levels are optimum.

## THE RESULTS

The test area that had been pasture lifted measured 500 kg DM/ha extra feed than the control area which equates to 3 tonnes (fresh weight) per hectare more grass. The field is now showing signs that the soil structure and drainage has improved.

Cost/Benefit Analysis showing return on investment:

<b>COST:</b>	Pasture Lifting	£56/ha contractor cost £13/ha fuel cost = £69/ha total cost
<b>BENEFIT:</b>	3 tonnes FW/ha extra feed at relative feed value £35/t FW for grazed grass (prices at pre-housing 2018)	= £105/ha total gain
<b>NET BENEFIT:</b>		<b>£36/ha</b>

The yield increase was an immediate effect of pasture lifting. However, the benefits of pasture lifting will last into the next grazing season at least, so further gains will be realised than is illustrated in the table above.

A soil analysis allowed John to ensure that pH levels were correct – lime was applied to correct them and ensure that nutrients weren't being locked into the soil. The analysis also enabled him to optimise fertiliser applications – only applying on fields that need it to ensure money was not being wasted.

# THEME REPORT



## WHAT HAS CHANGED ON FARM

A liming programme has been established to ensure optimum pH across the farm so that fertiliser inputs are being utilised as efficiently as possible. 40t of lime was applied in 2016, 119t in 2017, and 163t in 2018.

John is now able to follow the correct steps for improving soil health where a field has been identified that requires attention through a soil analysis or de-compaction.



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