

## ABOUT THIS MONITOR FARM

Farm name	Mill of Inverarity, Inverarity, Forfar, Angus, DD8 2JN
Meeting Number	15 – Plant Diversity and Soil Health
Meeting Date	Tuesday 19 <sup>th</sup> November 2019
Next Meeting	12 December 2019
Report date	21 <sup>st</sup> November 2019

Mill of Inverarity Farm is run by The Stodart family and in total the business farms 358 hectares. The farm is a traditional mixed unit growing 130 hectares of cereals, with 160 spring calving suckler cows and an increasing breeding flock of 860 ewes. The business also annually buys in store cattle and lambs for finishing and has an operational laying hen enterprise on farm of 4,500 hens.

This monitor farm meeting focused on plant diversity and soil health from guest speaker Joel Williams. Joel is an independent plant and soil health educator and healthy soils advocate. His particular interests include managing soil microbial ecology as well as crop and soil nutrition to optimise plant immunity, soil function and soil carbon sequestration.

**Management Group:** Graeme Mather, Fiona Lawson, Ian Pattullo, Neil McGowan, Stuart Lawrie, Duncan Wilson, Graeme Neill, John Kidd, Robin Norrie.

## KEY MESSAGES

- Plants should be considered as the fourth piece of the puzzle for soil health in addition to the traditional balance and interactions between chemistry, biology and physics.
- It is roots not shoots that build soil carbon, we should not be so fixated on what is going on above ground but start looking underground.
- In a monoculture system all the plants are at the same growth stage, therefore the roots are all excreting the same root exudates and are all searching for the same nutrients, which leads to an increased competition and potentially less growth.
- The best way to improve soil structure as well as soil carbon is by keeping soils covered year-round with living plants
- Make sure you know what your soil needs before choosing what cover crop to grow.

## AREAS OF DISCUSSION Expand on two of the key messages discussed and what were the key concerns or innovations

- Joel Williams started the day by introducing the group to the concept of considering plants as the fourth piece of the puzzle for soil health, in addition to the traditional balance and interactions between chemistry, biology and physics. He backed this up by stating that soil health, chemistry, biology and physics are all an indication of plant health.
- It was stated that 40-50% of applied Nitrogen, 10-20% of applied Phosphate and 40% of applied Potassium is taken up by the plant, the rest is either leached into water courses, washed out of the field or locked up in the soil in a form which the plant cannot use. It may be possible to reduce the amount of nutrients that are being applied onto fields or change the way in which we put them on. Mr Williams went on to say there are a number of ways that nutrient use efficiency can be improved these include:
  - Seed treatments
  - Foliar sprays e.g. urea
  - Carbon based inputs e.g. manure, compost
  - Integrated nutrient management which looks at using as many tools as possible to improve nutrient use efficiency
  - Plant species diversity e.g. cover crops or intercropping

The main point of discussion at this time was mainly based on foliar sprays, which included what is the best time of the day to apply them, to which Mr Williams responded early morning or afternoon when the stomata on the leaves are open. Spraying in the middle of the day when the sun is beating down on the plants the stomata will be closed to preserve water meaning the results of the spray would not be as beneficial. The optimum concentration on which to apply foliar sprays was also discussed, it was said that a concentration of between 1.5-3 EC would be a suitable application without scorching the leaves on the plant.

- 20-30% of the carbon that an annual plant takes in is secreted straight out again, this figure is much higher for perennial plants which sits around 30-50%. Much of this carbon is secreted through the roots as root exudates. This secretion allows plants to largely influence the rhizosphere as well as the organisms which exist within it. When a plant secretes root exudates into the soil they are used by organisms which exchange them for minerals which the plant needs for development.

It was explained that different root exudates excreted depends on:

- Plant species
- Age of the plant and growth stage
- Soil type
- Environmental factors
- Interacting organisms
- Plant nutrition

As the plant passes through growth stages it requires different types of nutrients. This results in the plant excreting different root exudates to bring in different nutrients. Mr Williams emphasised in a standard monoculture system where all the plants are at the same growth stage the roots are all excreting the same root exudates and are all searching for the same nutrients, which leads to an increased competition for and potentially less growth. Different ways to reduce this competition were discussed which identified that increasing species diversity and intercropping may be the way forward.



- Mr Williams then went on to explain ways to increase soil carbon sequestration. He began by explaining what soil aggregates are, that is the soil particles sticking together, this is very important for soil structure and gaseous exchange of Oxygen and Carbon Dioxide. It is essential to preserve these aggregates by disturbing the soil as little as possible.

It was clear within the group that most farmers in the area do not consider roots when thinking about carbon sequestration, most would consider stubbles and chopping straw back onto the land. Mr Williams highlighted that there is now scientific evidence that proves that retention of stubbles does not build soil carbon, it is their roots and decay that builds this. He emphasised very strongly that it is roots not shoots that build soil carbon. One member of the group brought up the question of farmyard manure, is it right to be spreading it on the fields and ploughing it in. Mr Williams responded by stating that yes spreading it and ploughing it in will increase soil carbon but will destroy the soil structure. If it is spread and if it is left on the surface of the soil the majority of the carbon will be released as Carbon Dioxide meaning the field will not get the most out of the application. Mr Williams emphasised that the best way to improve soil structure as well as soil carbon is by keeping soils covered year-round with living plants.

- Farmers should be taking a fresh new look at cover crops. One of the criticisms of cover crops in the past is that it is such a small part of the growing season that low levels of biomass is produced. However, Mr Williams stated that shoot growth follows root growth, so a cover crop which is only 3-4 inches tall, will still have a valuable amount of carbon underneath and that is what is important. When it comes to selecting cover crop varieties, Mr Williams insists that it doesn't have to be complicated or expensive. The general answer is that grasses will produce a more fibrous root

system than legumes or herbs, but some grasses will not produce deep tap roots so it is good to have diversity to bring different benefits. Diverse cover does come at a cost, but it is possible to have living cover on a budget, even if it is just one or two species. A question was raised about compaction, with some farmers finding the only way to eradicate compaction is by ploughing or sub-soiling. Mr Williams explained that having a diverse rooting system within the cover crop will help combat compaction. The smaller roots initially grow through the compacted soil opening it up just enough for a plant with a deep tap root to break down the compacted layer. Using this method will help to break up compaction as well as maintain soil structure and health.

- The session ended with Mr Williams looking at soil which came from an arable rotation, permanent pasture, long term set aside and a cover crop trial in which phacelia was grown. It was made clear very quickly that the soil in the arable rotation had the worst soil structure and was said to have a synthetic smell to it. The other soils which had not been ploughed or disturbed for a long time had an extensive rooting system which has led to a good soil structure. When deciding what mix of cover crop to plant in the field there are several factors to consider:
  - Presence of weeds, chickweed can be an example of too much nitrogen in the system, and docks or other weeds with tap roots can indicate compacted soils
  - Root colour, white roots can be an indication that plants have become lazy as there may be too much fertiliser in the system
  - Soil aggregation

## FARMERS UPDATE Summarise the development of the initiatives on the farm

- Not available

## ACTIONS FROM LAST MEETING Bullet points outlining what will be done between now and the next meeting

- Benchmarking data collection for the business group has started
- The Beef Monitor Weighing system will be put in with the Aberdeen Angus cattle which are near to finishing, making it easier to select when they may sell them.
- The next meeting on the 19<sup>th</sup> November 2019 will be advertised.

## FACILITATOR CONTACT DETAILS

David Ross  
SAC Consulting  
Arduathie Business Centre,  
Kirkton Road,  
Stonehaven,  
AB39 2NQ  
Tel: 01569 762305  
Email: [fbsstonehaven@sac.co.uk](mailto:fbsstonehaven@sac.co.uk)

Zach Reilly  
SAC Consulting  
77 North Street,  
Forfar,  
DD8 3BL  
Tel: 01307 464033  
Email: [fbsforfar@sac.co.uk](mailto:fbsforfar@sac.co.uk)



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