Talamh Beo

EIP Soil Biodiversity Project

Maurice's Trial Plot, Experiment and Baseline Soil Results

Pic 1

Pic 2

The W method was used during the phase 1 sampling in order to capture heterogeneity (variability) on a field basis.

Pic 3

1. Trial Plot

Pic 4. Field at the time of sowing

The trial plot was selected as it was a representative field on the farm while also being reasonably accessible. Of the fields being sown with Spring Barley on the farm that year it has the most consistent soil type across the field (except for one stony outcrop). The field has been in a typical rotation of arable crops with the predominant crop being barley.

Winter Cover crops are grown between the winter crop harvest and spring malting barley. The cover crops typically have been brassica based for grazing by sheep.

The previous cover crop had increase diversity with legumes included in the mixture.

Over The Next Few Months/Years...

Hoping to demonstrate the positive effect of inoculating seeds with biologicals including biochar as a home for microbiology.

Unless you practice no-till, there will always be soil disturbance when establishing arable crops. This soil disturbance mineralizes nitrogen which is beneficial to the growing crop providing a growth boost. However, the cost of the mineralization of nitrogen is the reduction of soil carbon linked to soil's biological components. Fungi are particularly damaged by soil disturbance, something to be aware of as they play a crucial role in cycling nutrients in the soil food web.

1. Trial Plot

Pic 5. Remains of a cover crop after ploughing

The aim of biological seed dressing is to stimulate the interaction between seed and soil, because it is the soil biology that feeds the roots of the plants in exchange for exudates. The idea is to feed to germinating seed and the soil, potentially mitigating some of the damage caused by disturbance. Long-term, this will help to build the biology and soil health, which would reduce the need for inputs inputs and disturbance while building soil carbon.

2. Site Investigation

Pic 6. First day of soil sampling

Soil Sampling was carried out in February to establish the base soil conditions.

- The day we sampled it had rained heavily and the soil surface was quite sticky. The field had been grazed by sheep with visible signs of some damage due to the recent rainfall.

- The surprising element was how dry the soil was further down the profile suggesting low water infiltration rates and possibly some surface compaction.

- There was a lot of variation between ground where there were plants growing and areas that were bare ground. One of the brassica species appeared not to be grazed by the sheep, possibly due to bitterness that developed with maturity. This may have accentuated the variation in the surface compaction.

The farm is in the process of converting from a conventional long-term plough-based system to conservation agriculture. The three pillars of conservation agriculture are cover crops, crop rotation and reduced tillage. The goal had been to establish the crop of heritage malting barley using minimum tillage however several factors affected the successful outcome of this. The late growth of the now unpalatable brassica in the cover crop, the surface layer appearing to have signs of compaction and the previous crop not being a break crop.

Pic 7. Soil sample being taken

3. Phase 1 – Soil Test Results

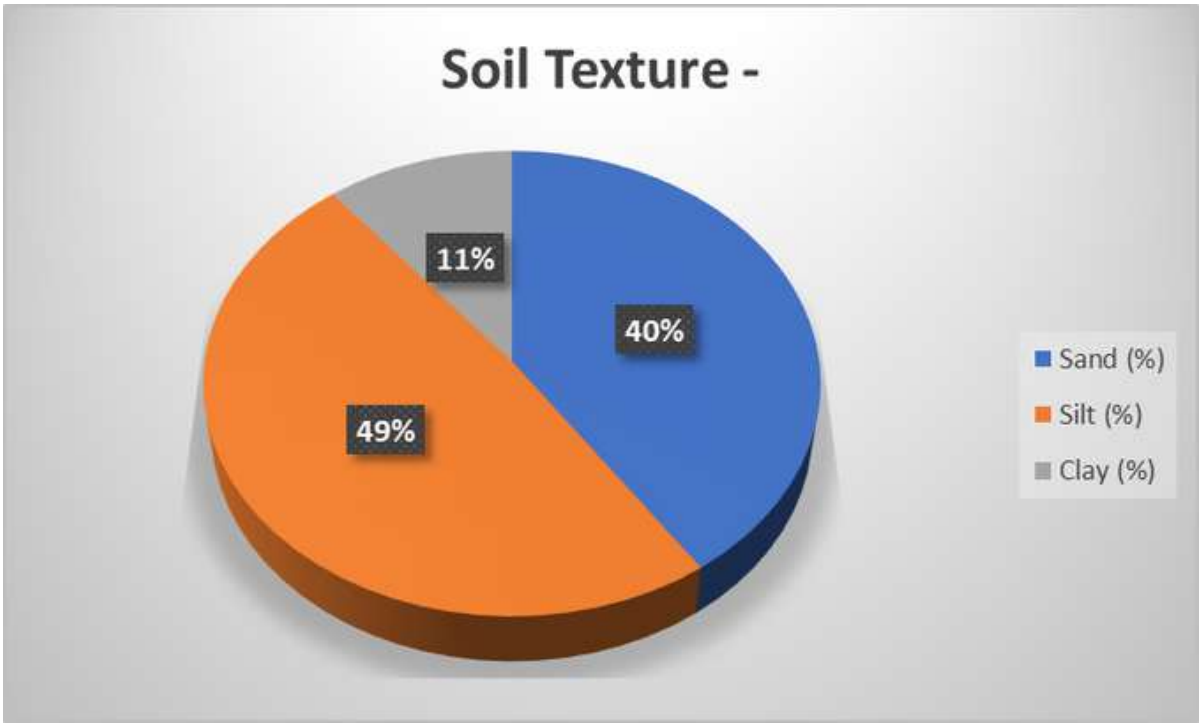


Table 3.1 Soil Texture

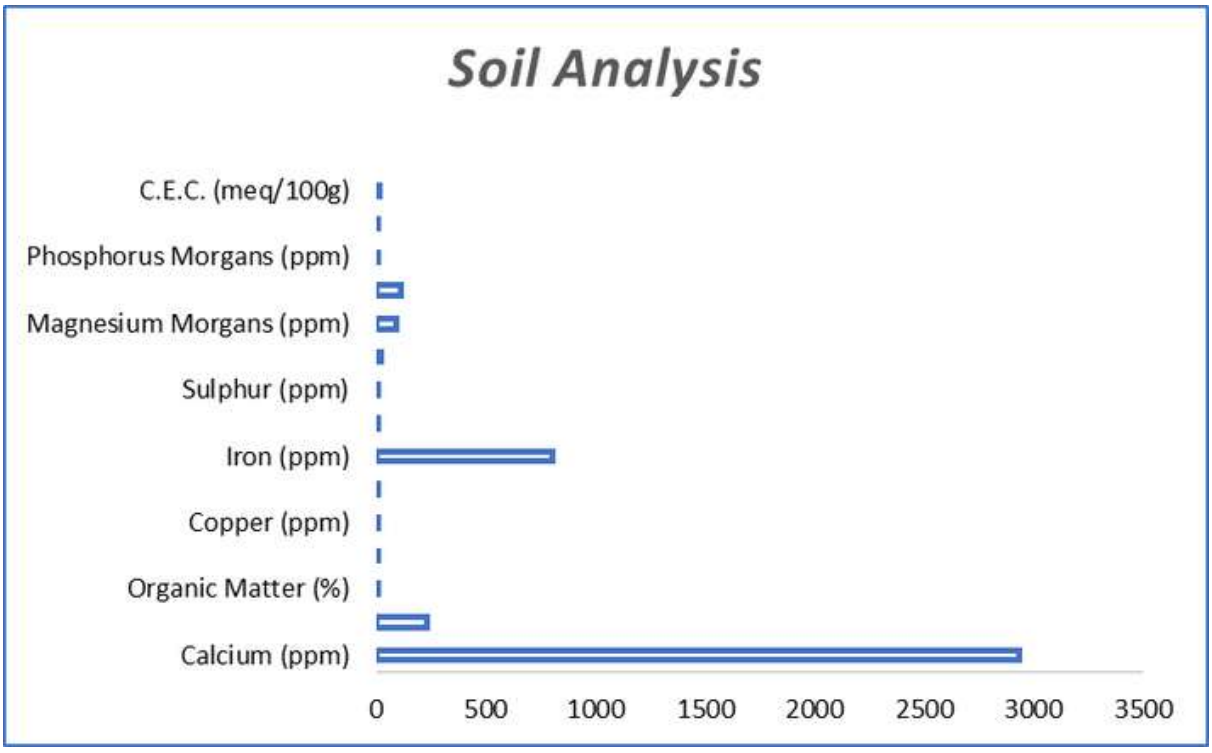


Table 3.2 Soil Chemical Analysis

Soil Analysis Results

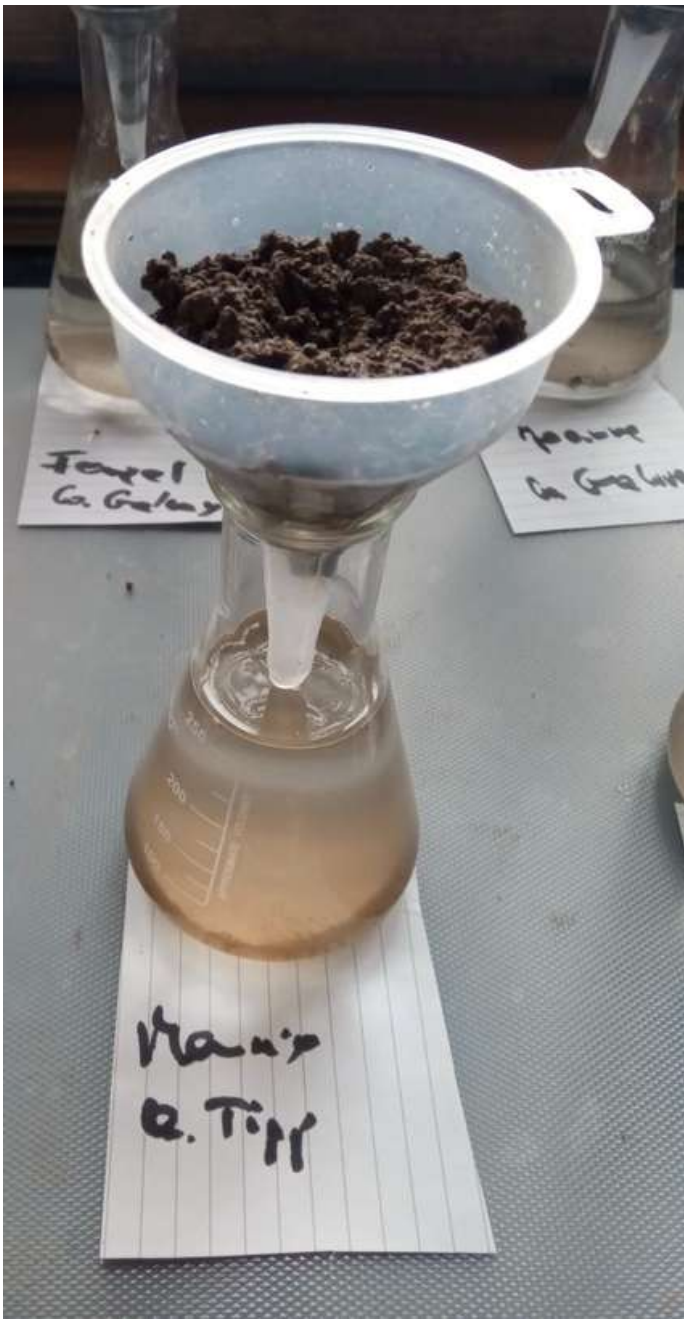
Analysis	Result	Guideline	Interpretation	Recommendations
pH	7.1	6.5	MEDIUM	Adequate level
Phosphorous Morgans (ppm)	6.9			Index 3
Potassium Morgans (ppm)	115			Index 3 – Consider maintenance applications only.
Magnesium Morgans (ppm)	92	51	MEDIUM	Index 3 – Adequate level
Calcium (ppm)	2392	2000	MEDIUM	Adequate level
Manganese (ppm)	232	75	MEDIUM	Adequate level
Boron (ppm)	1.73	0.50	MEDIUM	Adequate level
Copper (ppm)	6.6	8.0	SLIGHTLY LOW	Priority for livestock health
Molybdenum (ppm)	0.02	<0.5	SLIGHTLY LOW	No problems anticipated
Iron (ppm)	806	50	MEDIUM	Adequate level
Zinc (ppm)	5.6	7.0	SLIGHTLY LOW	Priority for livestock health
Sulphur (ppm)	4	10	VERY LOW	Consider treatment for optimum grass growth
Sodium (ppm)	19	90	VERY LOW	Treatment may improve grass palatability.
C.E.C (meq/100g)	17.3	15.0	MEDIUM	Cation Exchange Capacity indicates a soil with good nutrient holding ability.
Organic Matter (%)	7.2			

Table 3.3 Interpretation of Results & Recommendations

Interpretation

% Soil Organic Matter, this is reasonable considering the history of long-term ploughing and cropping, and the use of farmyard manure and slurry when available along with cover crops have probably been helping this. However, we would like to get to the 5% threshold where a lot of positive changes can happen with a reduction of inputs. There was a higher proportion of sand than perceived

Soil Aggregate Stability Test



Pic 8

A soil aggregate stability test was conducted to determine the strength of the soil in each participants trial area. Maurice's results showed that there was some sediment observed in the infiltrated water. More than 50% soil aggregates collapsed indicating that more fungal and bacterial glues are needed and possibly organic matter to improve aggregates stability."

Soil Biology Report

Sample Name: Soil 7cm
Sample Type: Soil
Present/Desired: Recently Ploughed
Pasture Plant Succession:
Productive Pastures, Row Crops
Soil Biology Report Performed by:
BioSoil Ireland

Beneficial Micro-organisms

	Recommended Range		Sample Results	
Fungi (ug/g)	135	1,350	0	None Detected: Please contact your Soil Biology Consultant.
Standard Deviation			0	Distribution of the target organisms in the sample was uniform; variation was small.
Bacteria (ug/g)	135	1,350	373	Good: The bacterial biomass is within the recommended range for your plant's stage in succession.
Standard Deviation			40	Distribution of the target organisms in the sample was uniform; variation was small.
Actinobacteria (ug/g)	1	4	0.13	Low: The actinobacterial biomass is below the expected range. This is not a problem.
Standard Deviation			0.3	Few target organism were present and variability was very high. Precision is very low.
F:B Ratio	0.9:1	2:1	0.0	The F:B ratio is low. Increase fungal biomass or reduce bacterial biomass, and check predators to assess balance. Please contact your Soil Biology Consultant.

	Minimum Value		
Protozoa (Total)	> 50,000	48,912	Low: The number of beneficial protozoa is below the minimum requirement. Please contact your Soil Biology Consultant.
Standard Deviation		72,914	Few target organism were present and variability was very high. Precision is very low.
Flagellate (#/g)	*(See Total)*	16,304	
Standard Deviation		36,457	
Amoebae (#/g)	*(See Total)*	32,608	
Standard Deviation		44,650	
Nematodes			
Bacterial-feeding (#/g)	300	0	None detected: Bacterial-feeding nematodes help keep bacterial populations in balance and enhance nutrient cycling.
Fungal-feeding (#/g)	100	0	None detected: Fungal-feeding nematodes help to release nutrients from fungal hyphae to the plants.
Predatory (#/g)	100	0	None detected: Predatory nematodes help reduce root-feeding nematode numbers.

Table 3.4. Biological Soil Results (Beneficial Microorganisms)

Detrimental Microorganisms

Detrimental Microorganisms

Disease-Causing Fungi	Maximum Value	Sample Results	
Oomycetes (ug/g)	0	0	None detected: No disease-causing fungi were observed in the sample. Great!
Standard Deviation		0	Distribution of the target organisms in the sample was uniform; variation was small.
Anaerobic Protozoa			
Ciliate (#/g)	0	0	None detected: No ciliates were observed in the sample. Aerobic conditions prevail. Great!
Standard Deviation		0	Distribution of the target organisms in the sample was uniform; variation was small.
Nematode			
Root-feeding (#/g)	0	0	None detected: No root-feeding nematodes were observed. Great!

Additional Comments: Vulvic and some Humic present in all FOVs

Table 3.5 Biological Soil Results (Detrimental Microorganisms)

Phase 2 Soil Test Results

Sample Ref: MD - TIPP - CONTROL
Sample No: IR012893A/01
Crop: AVAILABLE N STATUS
Distributor: YARA

Analysis	Result	Interpretation	Comments
Nitrate N (mg/kg)	22.7	Very Low	(Index 0.9)
Ammonium N (mg/kg)	3.1	Very Low	
Nitrogen (kg/ha)	77		

Table 3.6 Soil Analysis Results

Sample Ref: MD - TIPP - TRIAL
Sample No: IR012892A/01
Crop: AVAILABLE N STATUS
Distributor: YARA

Analysis	Result	Interpretation	Comments
Nitrate N (mg/kg)	23.4	Very Low	(Index 0.9)
Ammonium N (mg/kg)	2.4	Very Low	
Nitrogen (kg/ha)	77		

Table 3.7 Soil Analysis Results

4. Possible Solutions

What we planned to do to improve soil health

Inoculating seeds. For this experiment the biological seed dressing included:
• Seaweed (SeameGrow); a biostimulant
• Molassus; a biological feed
• Vermi Juice; extract from a worm bin
• Bacillus; a beneficial bacterium
• Biochar; Home for microbiology
o Rush; Made by Biomass-to-Biochar EIP
o Olive Stone; Made by Aringna Mines,

The liquids were mixed with the biochar and mixed into the seed by hand. We allowed 24 hours for the liquid to absorb into the seed to aid the seeds slow through the seed drill.

Pic 9. Biochar from Rushes

Pic 10. Seed treated with biological dressings

The variety of malting barley seed used is 'Hunter', and this is a heritage malting barley developed in Ireland. The seed is home saved seed from the previous year's crop. The seed was cleaned, however no fungicide was applied to the seed. The reason for this is applying fungicide would damage the microbiology that is on the seed, thereby limiting the effect of the biological seed dressing

5. Assessment of work to date

The seed treatment which included biochar did not have an inhibitory effect. Visual assessment would show it appeared to have a positive effect on the root development. It should be noted that the exact conditions that each seed germinated varies across the field as conditions are not perfectly homogeneous as you would find in a laboratory scenario.

Seed Treated + Biochar

Seed treated with biological dressings

Control

The grain is yet to be tested to see if there is any difference within the final crop.

A laboratory experiment would be useful to compare the different conditions and use of each seed treatment.

The main benefit if biochar would be the extend the useful lifetime of the seed dressing on the seed, therefore testing after different times of storage would be useful to evaluate the level of biology surviving over time.

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Talmhaíochta, Bia agus Mara Agriculture, Food and the Marine
The European Agricultural Fund for Rural Development: Europe investing in rural areas