Soil Health Benchmarking
OSCIA Tier 1 – Renfrew SCIA

Purpose:

To assess the soil health of fields in Renfrew County and use the information as a benchmark to monitor soil health.

Methods:

A call was put out for up to 10 cooperators who wanted to have a soil health assessment completed on one of their fields and the cost of analysis would be covered. Many cooperators were interested in having more than one field sampled so they were offered the opportunity to have extra samples taken if they paid the approximately $100 it would cost per sample.

Some cooperators wanted samples taken from a good area and a poor area in the field. Others wanted a representative sample out of two or three fields. And some wanted to compare their field to a fencerow or a natural area.

Samples were taken June 1 and 2, 2016 by OMAFRA staff and students. The in-field assessment was taken from a 4 x 6m area of the field. 30-6" (15cm) soil cores were taken from the sample area, mixed together and divided in to three. The first portion was for lab analysis (phosphorus, potassium, magnesium, manganese, zinc, pH, organic matter and texture). The second part was sent for lab analysis for potentially mineralizable nitrogen and the third part was analyzed for aggregate stability.

Other measurements included sampling for nematodes where eight to ten cores were taken from the area for analysis. The top two inches (5cm) of soil were removed and the next six inches (15cm) were sampled. A soil probe was used to take a core of the soil profile to determine the depth of the A horizon. Infiltration measurements were taken using an eight inch (20cm) diameter ring. The ring was driven in the soil leaving about 2.5" (6cm) of the 4" (10cm) height of the ring above the soil surface. A plastic bag was placed over the ring and the soil. The equivalent of an inch (2.5cm) of water was poured onto the plastic. The plastic was removed and the time it took for the water to infiltrate was recorded. This was repeated and the second time was used for the infiltration measure. Infiltration was not measured on the fencerow areas. Three penetrometer readings were also taken in each sample area. The global position of the centre point of the sample area was recorded so samples could be taken in the future to measure change.

An additional biological indicator was placed in one of the participants fields. A new, washed pair of mens cotton briefs was buried in the field leaving the waistband exposed.

Cooperators were asked to fill out the Farmland Health Check-up so their practices could be assessed using the assessment part of the check-up. It was used to help

interpret the sample results and help to identify practices that could help to improve or maintain the health of a field.

Results:

A total of 28 samples were taken on nine cooperators farms. Samples were taken from fields in a variety of crops including: corn, soybeans, wheat, pasture, hemp, sunflowers and canola.

Physical properties: The depth of A horizon ranged from 5" to 11" (13 to 28cm) with an average depth of 7" (18cm). Those fields with A horizons less than 6" (15cm) may be less productive. Areas with an A horizon greater than 8" (20cm) will likely be more productive. Aggregate stability is a measure of the extent to which soil aggregates resist falling apart when wetted and hit by rain drops. The values ranged from 23% to 95% with only 6 samples on the low side (below 45%). Fields with low aggregate stabilities are more prone to wind and water erosion and are more likely to crust which can impact crop emergence and reduce water infiltration. Many of the high numbers were in fencerow areas or in long term pastures. The water infiltration rates were all all moderately rapid to rapid which are very good. The subsurface hardness measurements with the penetrometer were not reliable as the soil was too dry in most cases to get a good reading.

Chemical properties: The phosphorus (P_2O_5) levels ranged from 3 to 32 ppm with almost two thirds of the fields requiring some fertilizer. The potassium (K_2O) levels ranged from 63 to 393 ppm and again almost two thirds of the fields required a potash application. Magnesium levels were generally good as only one field had a low rating. There were very few fields requiring zinc and manganese. Only three fields required lime.

Biological properties: Organic matter levels ranged from 2.3% to 16.5% with an average of 4.1%. All but one were in the 2.3% to 5.3% organic matter range. The 16.5% came from an area of a field that used to be a wetland. Most organic matter levels were considered good for the soil texture of the field. Potentially mineralizable nitrogen (PMN) is an indicator of the capacity of the soil microbial community to convert (mineralize) nitrogen tied up in complex organic residues into the plant available form of ammonium. PMN levels were generally pretty good ranging from 8 to 93. Levels below 9 are considered poor while levels over 11 are considered very good. Many of the higher levels were from fencerows and long term pastures. The unexpected high levels for some fields could be due to the test picking up nitrogen broadcast on the field before sampling took place. The nematode samples were analyzed for total and parasitic nematodes. If over 30% of the nematodes are parasitic that is cause for concern. The samples ranged from 0% to 25% and the average was 6%. A healthy field should have over 10,000 total nematodes. Five fields had greater that 10,000 total nematodes. Generally the samples were very low for parasitic nematodes. One field had a higher level of root lesion nematodes which can have a negative impact on yield.

The underwear were dug up about 70 days after they were buried. In some cases there was very little of the underwear left (table 1). This indicates a very high level of biological activity in that field. In one field that had received very little rainfall the underwear was still mostly intact. We were unable to find one of the pairs of underwear.

Figure 1. Remains of underwear after being buried for 70 days.

The project was discussed and some of the results were presented at the Renfrew SCIA meeting July 27th. A meeting with the participants was held August 29th to discuss the results of the project and each participant was given reports for their fields. The second part of the meeting involved taking the group to one of the participants fields to learn more about soil health and management practices to maintain and/or improve it.

Summary:

Generally, the fields had pretty good soil health. In one field a good area was compared to a poor area. The poor area of the field had slower infiltration, poor aggregate stability, a moderate % parasitic nematodes, a lower PMN, a 5" A horizon depth, lower organic matter level and lower P and K levels. This area could be improved by applying potash, and improving organic matter levels as well as trying to lower the root lesion nematode levels.

A number of the fields would benefit from increasing organic matter levels in the field. This can be done with the use of no-till or minimum till, a crop rotation that includes forages and cereals, and the addition of organic amendments. Improving organic matter levels would also help the fields with low aggregate stability percentages. Many of the fields would also benefit from the addition of P and K fertilizer.

Next Steps:

There is interest in continuing the project for another year to sample more fields.

Acknowledgements:

Thanks to the participants for providing their fields and for completing the Farmland Health Check-up. Thanks to the summer students who helped with the sampling. Anne Verhallen's input was also appreciated. Thank you to Claire Coombs for data entry, analysis and preparation of the cooperator reports. Thanks to SGS-AgriFood Labs for the project discount on soil sample analysis.

Project Contacts:

Adam Hayes, OMAFRA adam.hayes@ontario.ca
Scott Banks, OMAFRA scott.banks@ontario.ca

Location of Project Final Report: