Agriculture Research and Development

Survey of the Physical and Chemical Properties of Agricultural Soils Receiving Dairy Manure in Western Newfoundland

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Project Objective

The objective of this project is to spatially characterise western Newfoundland soils in terms of chemical and physical properties in order to further understand the functioning of agriculture soils in the province. Soil fertility and nutrient fluxes are assessed across a land-use gradient and with different management systems.

Background

Newfoundland and Labrador (NL) has a boreal climate with characteristic podzolic soils. Unique soil formation and climatic limitations make NL challenging for agricultural development. Conversion of land and soil management creates challenges that can only be overcome through a comprehensive understanding of soil functions. Chemical and physical properties play a role in how a soil functions and is able to sustain a crop. The application of manure can change soil properties and is therefore critical to consider when analysing NL soil.

Technical Details

Agricultural and natural forest soil was sampled in 2016 from three depths at two locations; Codroy valley (CV) and Deer Lake (DL). Agricultural soil was sampled from depths 0-10cm in 2017 and forest soil was taken from three depths. In 2016 the CV farm had manure and non-manure treatments, and the DL farm was entirely manured. In 2017 both fields had manure and non-manure treatments. Soil was analysed for acidity, texture, compaction, extractable metals, organic carbon, and total carbon.

Peliminary Results

CV soil was significantly more acidic than DL (pH 5.6 vs. 6.3). There was no significant difference between the pH of manure and non-manure soil at CV. CV had more clay (8.6% vs. 7.0%) and silt (27.5% vs. 13.9%) than DL, DL had more sand than CV (69.0 vs. 63.9). Farmed soil was significantly less compact at CV (1.08g/cm^3) than DL (1.25g/cm^3). Organic carbon was 3.5% at CV and 2.8% at DL and significantly decreased with depth (Figure 1). Concentrations of sodium, aluminium, and iron were higher at CV than DL. Phosphorus, potassium, copper, zinc, and magnesium were higher in concentration at DL than CV (Figure 2).

CV farmed soil is more compact than natural soil (1.08 vs. 0.77g/cm^3). Soil is compacted by farming activities. There was no difference between compaction of farmed and natural DL soil. Less organic matter was found in farmed CV soil than in natural soil (3.87 vs. 5.33%) (Figure 3). Conversely, there was no significant difference in organic carbon between agricultural and natural soil of DL. Phosphorus, potassium, manganese, zinc, magnesium, and aluminium were higher in farmed than natural CV soil. Phosphorus, potassium, calcium, manganese, copper, zinc, magnesium, aluminium, and iron were higher in farmed than natural soil at DL (Figure 4).

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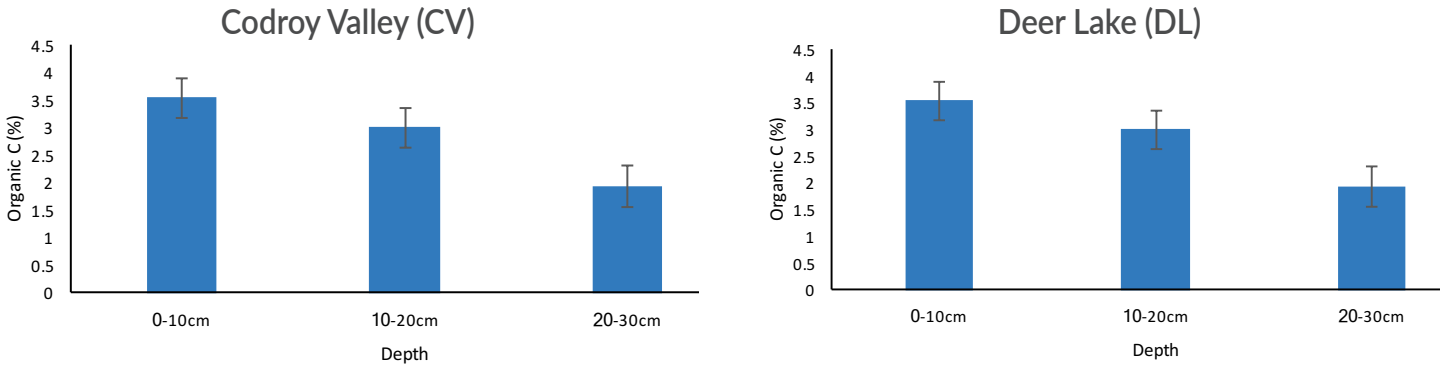

Figure 1. Organic carbon percentage for soil of depths 0-10, 10-20, and 20-30cm at Codroy Valley and Deer Lake (2016)

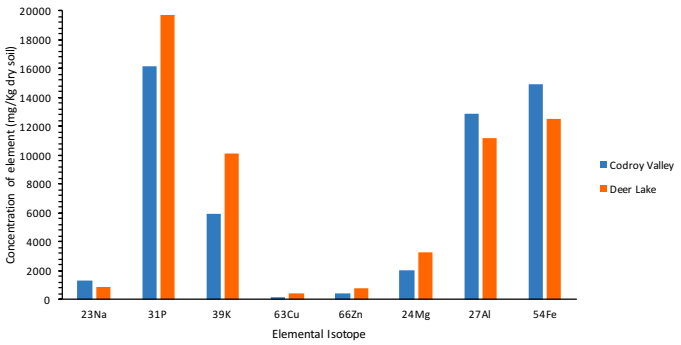

Figure 2. 2016 Elemental analysis (mg/Kg dry soil) for farmed soil of Codroy Valley and Deer Lake.

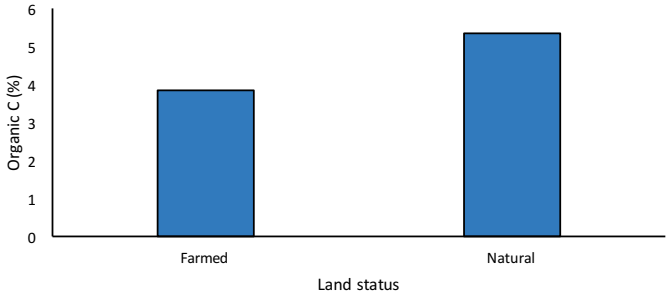

Figure 3. Organic carbon percentage of farmed and natural soil from Codroy Valley (CV)(2016).

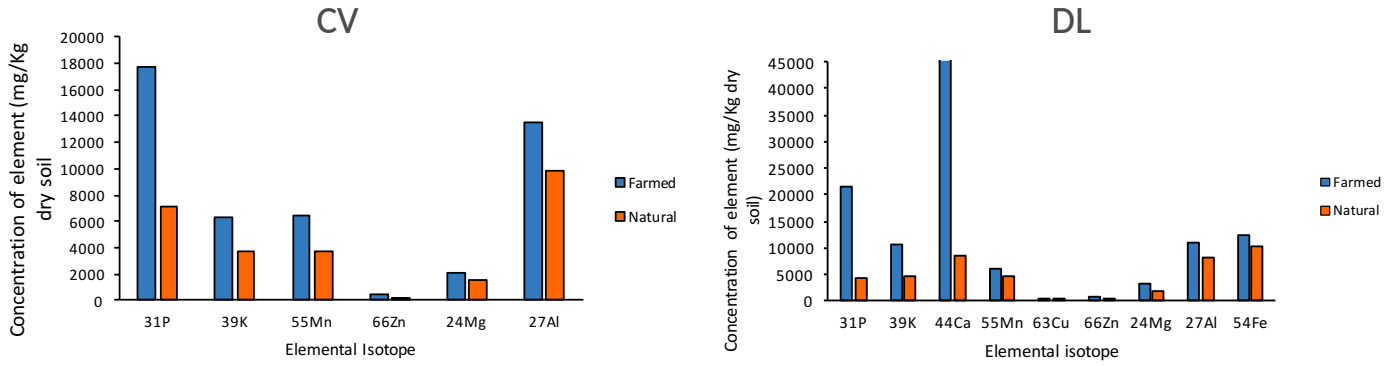

Figure 4. Elemental analysis of farmed and natural soil from Codroy Valley (CV) and Deer Lake (DL).

Recommendation And Industrial Benefit

Soil properties between natural and forest land in western NL is variable, and land conversion has a significant effect on soil fertility indicators. Soil characteristics vary with depth and location, and there is a need to consider local soil conditions when growing and choosing crops. While both are dairy farms with similar management there are sufficient differences to warrant a deeper look at the management history to identify sources of variability in the soil properties.

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