

Carbon Sequestration and Soil Quality in Long Term Tillage and Rotation Plots

(Interim Report)

Purpose:

Long term tillage plots were established by Doug Young and Tony Vyn at Ridgetown Campus, University of Guelph in 1991 on a Brookston clay loam soil. The tillage treatments initially consisted of moldboard plow, chisel plow, ridge till and two no-till treatments. The ridge till treatment was later converted to no-till. The plots are in a corn-soybean crop rotation. These plots are to be plowed up in the fall of 2006 and put into weed control research plots.

Long term rotation plots were established by Doug Young and Tony Vyn at Ridgetown Campus, University of Guelph in 1995 on a Brookston soil. Five rotations were studied including continuous corn, continuous soybeans, soybeans-winter wheat, corn-soybeans and corn-soybeans-winter wheat underseeded to red clover in moldboard and no-till. Each corn and wheat plot has several nitrogen rates applied.

The purpose of the project is to take soil samples from both these plots for carbon content to determine if the crop rotations and tillage practices have contributed to carbon sequestration in these soils. Nitrogen, phosphorus and soil health measurements will also be studied.

Methods:

A Giddings soil sampling machine was used to take 1.2 m cores from the plots. Four cores per treatment were taken from each of three tillage treatments (moldboard plow, chisel plow and no-till with coulters and trash whippers) in all six reps of the tillage plots. Three cores were taken per treatment in the rotation plots. Cores were taken from the continuous corn (0 and 120 lbs N/ac N rates), continuous soybeans, the corn treatment of the corn-soybean (0 and 120 lbs N/ac), the corn treatment of the corn-soybean-wheat rotation (0, 120 and 180 lbs N/ac), and the soybeans in the soybean-wheat rotation.

The cores were divided into 11 segments (0-5, 6-10, 11-15, 15-20, 21-30, 31-40, 41-50, 51-60, 61-80, 81-100, 101-120 cm) and processed by treatment. The samples were weighed to determine bulk density. A small sample from each treatment was frozen for nitrate and ammonium analysis. The samples were air dried and are waiting to be sent for remaining analysis.

Soil quality measurements were conducted on the tillage plots in the moldboard plow, chisel plow and one of the no-till treatments. Earthworm counts were done by laying a 30 cm by 60 cm frame on the soil surface and counting the number of earthworm middens within the frame. Two counts were done in each plot of five of the reps. Bait lamina strips were inserted into the first five reps of the three tillage treatments. Ten strips were inserted in a 15 cm by 30 cm area in each plot.

Results:

Table 1

Tillage Treatment	Number of Earthworm Middens/sq m
Moldboard plow	13
Chisel plow	26
No-till	74

Figure 1

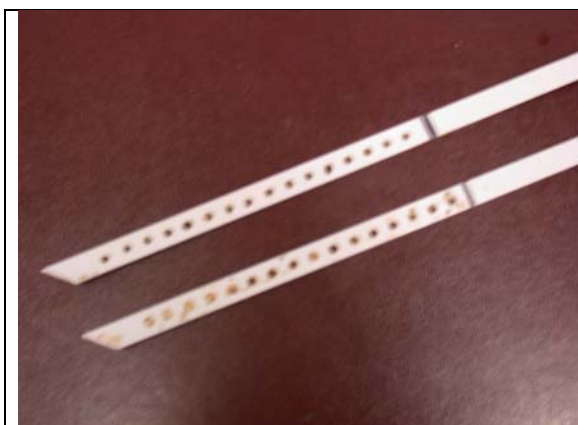
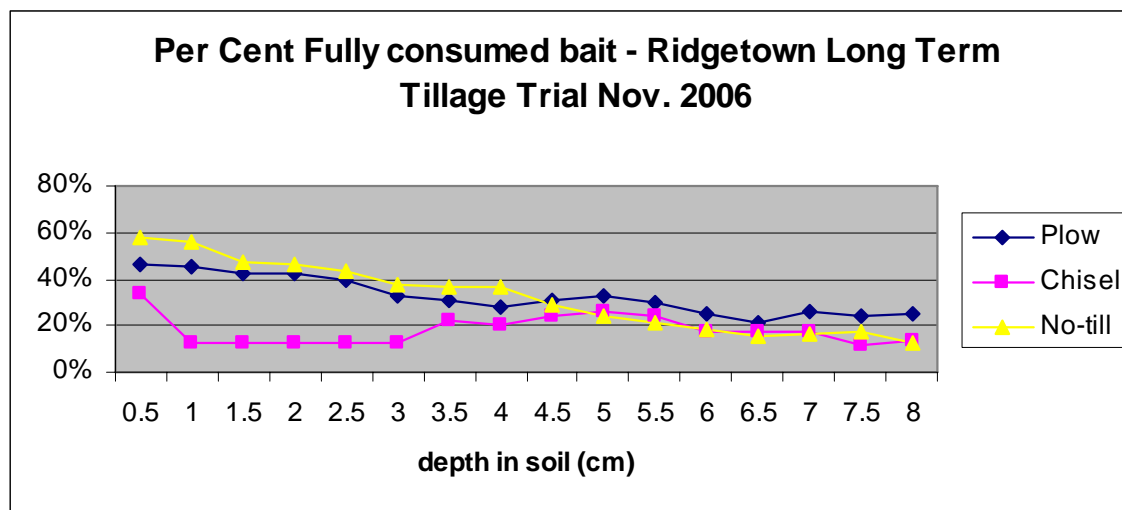


Figure 2



Figure 3

Summary:

The analysis is yet to be completed on the soil from the plots. Some soil life measurements were completed on the tillage plots this fall. Counts of earthworm middens were done on the moldboard plow, chisel plow and one of the no-till treatments. Middens are piles of residue and soil found on the top of large earthworm burrows. The

results in Table 1 show that the no-till had almost 6 times as many large earthworms as the moldboard and 3 times as many as the chisel plow.

Bait lamina strips, about the size of a coffee stir stick, Figure 2, were inserted into the long term tillage trials in the moldboard, chisel and no-till treatments in November. Bait lamina strips were developed in Germany to give a measure of biological activity at depth but does not indicate what is doing the feeding. The conditions at that time were cold and wet so there was less feeding than might have been expected. Figure 1 shows the results from the strips. The graph shows the percentage of the holes that were completely eaten out. The no-till generally had more feeding than the moldboard or chisel treatments especially in the top 4 cm. The chisel plow treatment had less feeding than might be expected.

Figure 3 shows the crop rotation plot. The soybeans in the fore ground are continuous soybeans and the taller soybeans in front of the corn are in the corn-soybean-winter wheat rotation. Both are in the moldboard plow tillage system.

Next Steps:

The soil samples will be analyzed for organic carbon, nitrogen and phosphorus. Some other soil health measurements will be taken from the rotation plots this season. The yield data from all years of the tillage and rotation plots will be analyzed along with the carbon data.

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Project Contacts:

Adam Hayes, OMAFRA, adam.hayes@ontario.ca

Location of Project Final Report: