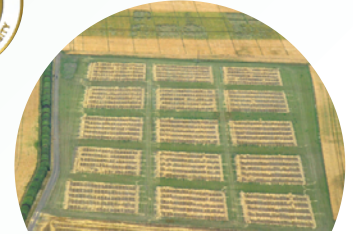


# Distribution of soil carbon and microbial biomass under different tillage regimes



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Figure 1: Experimental plots with different tillage treatments. Replicated 3 times across the field.

## Background

In many areas of the world, reduced tillage systems have been reported to sequester carbon, with favourable impacts to microbial biomass. Some of this work, however, only considers surface soils and/or presents results on a gravimetric basis. Differences in bulk density between treatments are not considered. We investigated the impact of different depths of soil tillage on carbon and microbial biomass for an experimental site in Scotland. This study integrated the measured properties to a depth of 60 cm and accounted for soil density effects.

## Field Experiment

Four tillage systems employed to manipulate the soil physical environment:

- (1) **Zero Tillage**;
- (2) **Minimum Tillage** to 7 cm;
- (3) **Plough** to 20 cm followed by harrowing;
- (4) **Deep-Plough** to 40 cm followed by harrowing

The experiment commenced in autumn 2003 and is on-going. It has been planted continuously with barley. Straw is baled and removed from all plots so it is possible to isolate the effects of tillage treatment rather than differences in straw incorporation. Soil samples collected to 60 cm depth, in increments depending on tillage treatment.

## Results

### Carbon

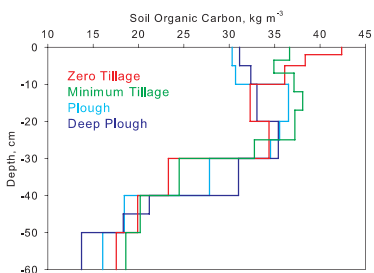


Figure 2  
Soil organic carbon content with depth under different soil tillage treatments.

treatment	0-5 cm	0-10 cm	0-60 cm
Zero Tillage	2.00 <sup>c</sup>	3.80 <sup>b</sup>	16.55 <sup>a</sup>
Minimum Tillage	1.79 <sup>b</sup>	3.63 <sup>b</sup>	17.38 <sup>a</sup>
Plough	1.51 <sup>a</sup>	3.07 <sup>a</sup>	16.25 <sup>a</sup>
Deep-Plough	1.56 <sup>a</sup>	3.19 <sup>a</sup>	16.47 <sup>a</sup>
P	<0.001	<0.001	ns
LSD	0.18	0.35	1.37

### Microbiology

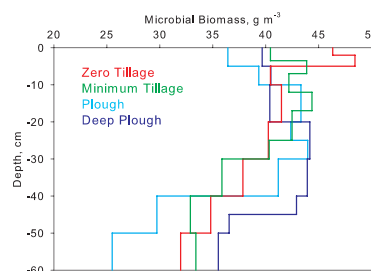


Figure 4  
Microbial biomass measured from ELFA with depth under different soil tillage treatments.

treatment	0-5 cm	0-10 cm	0-60 cm
Zero Tillage	2.95 <sup>a</sup>	4.70 <sup>a</sup>	22.67 <sup>a</sup>
Minimum Tillage	2.44 <sup>a</sup>	4.55 <sup>a</sup>	23.00 <sup>a</sup>
Plough	2.06 <sup>a</sup>	3.95 <sup>a</sup>	20.27 <sup>a</sup>
Deep-Plough	2.58 <sup>a</sup>	4.61 <sup>a</sup>	24.49 <sup>a</sup>
P	ns	ns	ns
LSD	0.98	1.20	4.96

### Major findings

SOC contents were significantly greater in the surface 10 cm of the zero and reduced tillage treatments. Over the entire depth to 60 cm the SOC contents were similar in all tillage treatments.

DOC contents were also greater near the surface of the Zero and Minimum tillage plots compared to the other treatments, although the difference was confined to the surface 0-10 cm where plant residues were concentrated.

The total microbial, bacterial (including actinomycetes) and fungal biomass contents did not differ between tillage treatments.

The fungal biomass contents of the soil surface (0-5 cm) under Zero and Minimum tillage were greater than under the Plough and Deep-Plough treatments, but not the bacterial and actinomycete biomass.

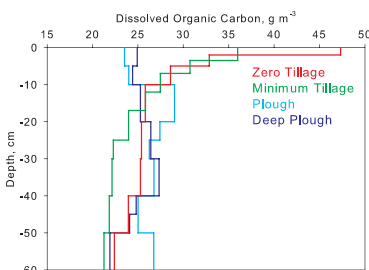


Figure 3  
Dissolved organic carbon content with depth under different soil tillage treatments.

treatment	0-5 cm	0-10 cm	0-60 cm
Zero Tillage	1.93 <sup>b</sup>	3.36 <sup>b</sup>	15.64 <sup>a</sup>
Minimum Tillage	1.74 <sup>b</sup>	3.21 <sup>b</sup>	14.60 <sup>a</sup>
Plough	1.16 <sup>a</sup>	2.34 <sup>a</sup>	15.53 <sup>a</sup>
Deep-Plough	1.25 <sup>a</sup>	2.47 <sup>a</sup>	15.01 <sup>a</sup>
P	<0.001	<0.001	ns
LSD	0.24	0.40	2.12

### Microbial community

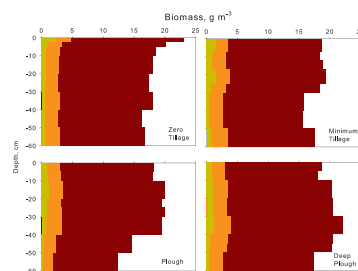


Figure 5  
Fungal (green), actinomycetes (orange) and other bacterial (brown) biomass determined by ELFA for the different tillage treatments.

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