Characterisation of soil quality following conventional and non-inversion tillage for organic farming

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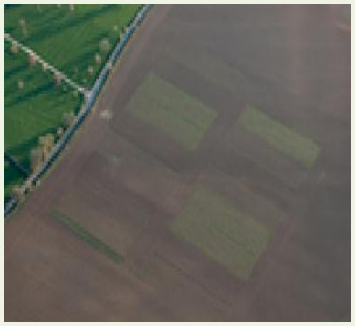
Introduction

Inappropriate and excessive long term conventional tillage has negative impacts on soil quality. In contrast, soils under conservation tillage are characterised by increased soil organic matter and enhanced microbial activity (Blevins & Frye, 1993). These changes in soil conditions could potentially improve soil structure and could possibly improve the functioning of cropping systems by increasing water holding capacity and enhancing nutrient conservation (Blevins & Frye, 1993).



Aim

To quantify the effects on selected soil chemical and biological properties between high residue non-inversion tillage (HRNIT) and low residue non-inversion tillage (LRNIT) against conventional tillage (CT).

Experimental design & tillage treatments

The study was conducted from Oct 2010 to Aug 2012 at the Royal Agricultural University's Harnhill Manor farm (NGR SP 075 006) near Cirencester, UK. Field experiment was designed in a randomized complete block with cultivation treatments as main plots (30 x 100m) replicated in six separate blocks. Treatments included :

- CT - mouldboard plough + power harrow combination (0% soil cover)
- LRNiT – 2 passes of ST bars attached Simba X-press + Vaderstad Rapid- A system disc combination seed drill (30% soil cover)
- HRNiT - 1pass of ST bars attached Simba X-press + Eco-dyn integrated seed drill (>50% soil cover)

In 2010/11 winter wheat was planted on 05 Nov 2010 and after harvest on 25 Aug 2011, the field was left with soil cover over the winter and the cultivation treatments were repeated by re-drilling spring wheat on 14 Mar 2012 and harvesting on 22 Aug 2012.

Results

Soil chemical and biological characteristics for tillage treatments

	pH	% C_{org}	% N_t	P mg kg^{-1}	K ppm	Earthworm numbers m^{-2}
CT	7.74b	2.39b	0.257b	13.56	202.08	65c
LRNiT	7.44a	2.57a	0.277a	14.11	219.17	106b
HRNiT	7.39a	2.65a	0.291a	15.50	218.06	141a
SED	0.037	0.061	0.007	0.99	8.01	13.33
P	**	*	*	ns	ns	***

Any two mean within columns not sharing common letters differs significantly. *** significance $p < 0.001$, ** significance $P<0.01$, * significance $p<0.05$, ^{ns} non-significant

Discussion & Conclusion

- Accumulation of organic matter on or near the soil surface by the continuous presence of soil cover and increased moist soil condition caused reduction in soil pH with non-inversion tillage compared with CT.
- Significantly higher soil C_{org} and N_t was found with non-inversion tillage compared with CT due to the limited soil disturbance together with considerable retention of soil cover, that have the potential to improve soil aggregates and accumulates organic matter to the soil profile compared to mouldboard ploughing, that can reduce soil organic carbon due to its loss as CO_2 (Reeves, 1997).
- Reduction of soil tillage with higher availability of organic matter on the soil surface under non-inversion tillage also significantly increased earthworm numbers compared to CT supporting the view of Edwards & Bohlen (1996).

After two years of contrasting tillage treatments, adopting non-inversion tillage in organic farming has the potential to improve soil quality compared to CT.

References

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