Contrasting soil tillage effects on UK organic spring wheat

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Introduction

There is a greater concern over agricultural sustainability from frequent conventional tillage damaging soil structure and quality [1]. In contrast, non-inversion tillage can potentially deliver multiple benefits such as improved soil structure and stability; enhanced soil biological activity, nutrient cycling and soil water holding capacity [1]. Organic growers, however, face many challenges with the use of non-inversion tillage including soil compaction, weed pressure and inconsistent crop yields [2].

Aim

To investigate contrasting soil tillage effects on soil bulk density, weed species development and crop performance under organic systems

Experimental design & tillage treatments

The study was conducted from Mar 2013 to Aug 2013 at the Royal Agricultural University's organic Harnhill Manor farm (NGR SP 075 006), UK. Experiment was a randomized complete block design with three tillage treatments (30 x 100m^2) replicated in three separate block. Treatments included:

- CT - mouldboard plough + power harrow combination
- LRNiT – 2 passes of ST bars attached Simba X-press + Vaderstad Rapid- A system disc combination seed drill
- HRNiT - 1pass of ST bars attached Simba X-press + Eco-dyn integrated seed drill

For 2013, land preparation techniques were commenced after 20 March 2013 and spring wheat cv. Paragon was drilled on 10 Apr 2013 and harvesting on 27 Aug 2013.

Results

Table 1. Soil bulk density, weed species and crop performance under contrasting tillage

	Bulk density (in gcm^{-3})			Phase I			Phase II			Grain yield (t ha^{-1})
	0-5cm	5-10cm	10-15cm	Wheat DM (t ha^{-1})	Broadleaf weed DM (t ha^{-1})	Grass weed DM (t ha^{-1})	Wheat DM (t ha^{-1})	Broadleaf weed DM (t ha^{-1})	Grass weed DM (t ha^{-1})	
CT	1.29b	1.33b	1.24b	3.27a	0.977a	0.201b	4.66a	1.25a	0.303b	3.10a
LRNiT	1.35b	1.39b	1.33b	2.53b	0.615ab	0.929b	3.61b	0.813ab	1.16ab	2.22b
HRNiT	1.48a	1.57a	1.46a	1.42c	0.073b	2.438a	1.99c	0.104b	2.87a	1.33c
SED	0.04*	0.06*	0.04*	0.18*	0.24*	0.27*	0.18*	0.27*	0.69*	0.23*

*Values followed by the same letter do not differ significantly (*p <0.05)*

Discussion & Conclusion

- Increase in tillage intensity with CT and LRNiT had significantly lower bulk density, after tillage, than HRNiT. Bulk density under HRNiT were exceeding the critical limit (>1.47gcm^{-3}) and were likely to have contributed to the negative impacts on crop performance.
- Among weed species, despite greater diversity of broadleaf weeds identified, their DM had less relevance, compared with grass weeds. More tilled soils such as CT gave significantly higher broadleaf weed DM than HRNiT supporting [3]. In contrast, grass weeds were significantly higher under HRNiT, as reported by [4].
- Factors such as higher soil bulk density and increase in total weeds (broadleaf + grass) showed more inverse relationship with wheat DM and in turn, grain yields.

Increasing tillage intensity under organic systems has improved crop yields and also largely reduced problematic grass weeds. Thus, CT was a more dependable option.

References

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4. **Hakansson . (2003).** Weeds and weed management on arable land: an ecological approach. Cambridge: CABI.