Theory and reality of organic soil fertility – organic matter

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ABSTRACT

Results are reported suggesting no significant difference between the level of soil organic matter on established organic farms in Southern England and paired conventionally managed farms. We discuss the possible reasons for this and also examine why the literature on this subject is frequently contradictory.

Keywords: organic farming; soil organic matter

INTRODUCTION

One of the central assumptions of organic soil management is that it leads to an increase in levels of soil organic matter (SOM), resulting from large inputs of organic matter from leys and animal manure (Tinker 2000). A number of authors have measured higher levels of organic matter in organically managed soils (Reganold 1995) although other authors have failed to show this (Alfoldi *et al.* 1995). This paper gives results of a comparative analysis of organic and conventionally managed soils in southern England and discusses them in relation to other work.

METHODS

Soils were collected from 19 paired farms in the autumn of 1999. Each pair consisted of an organic holding and a conventional holding matched for enterprise (either mixed or stockless) and soil type. At each site, one field was selected at the high fertility end of the organic rotation, after ley, and one at the low fertility end, after several years cropping. A single conventional field was selected for comparison. Organic fields had been certified for a minimum of six years. Soils were sampled down to 20cm, bulking 20 cores collected randomly in each field. Soils were air-dried, ground and sieved before organic carbon was measured using a wet oxidation method; this was converted to organic matter using a conversion factor of 1.72.

RESULTS AND DISCUSSION

SOM content is shown in Table 1. These results indicate that there was no significant difference in the levels of organic matter between soils managed organically and those managed conventionally. There may be several reasons for the discrepancy. Many experiments looking for instance at the effects of manure on soils, have used unrealistically high application rates (Johnston *et al.* 1989). Likewise, experiments often compare manure application with zero application. In fact many of the conventional farms used in this work were mixed and so did receive manure, indeed some received very high manure application rates.

The influence of leys on SOM may also be overestimated. Where leys are cut for silage large amounts of organic matter are removed; also fresh organic matter

added when the ley is incorporated breaks down very rapidly and may have little long-term effect on SOM levels (Campbell & Zentner 1993). Yields must also be considered; those of organic crops are lower (only 50-80% in the case of winter wheat). Thus the return of crop residues will be much reduced. There is also a greater use made of spring cereals in organic systems which have lower yields, of grain, straw and below ground biomass (Hughes 1983). This difference in return of residues will help offset organic matter inputs from leys and manure. The balance of carbon inputs compared with oxidation is more important for SOM levels than whether the soil is managed organically or not. It therefore seems likely that only where conversion to organic production leads to a significant increase in manure use and/or organic matter inputs from leys, thus compensating for reduced crop residue inputs, will SOM levels increase. Indeed in pasture systems, which are managed in a similar way in both conventional and organic systems, authors have often failed to find a difference in the level of SOM between the two systems (Reganold 1995).

Table 1 Mean organic matter content of soils (%) with probability that two or more field types differ significantly (ANOVA).

System	Organic high fertility	Organic low fertility	Conven-tional	*P*
Mixed *(n =13)*	4.64	4.34	4.27	0.8066
Stockless *(n = 6)*	3.11	2.93	2.97	0.8150
All *(n = 19)*	4.16	3.89	3.86	0.7837

ACKNOWLEDGEMENTS

The work reported was funded by DEFRA (Project OF0164).

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From: Powell et al. (eds), *UK Organic Research 2002: Proceedings of the COR Conference, 26-28th March 2002, Aberystwyth*, pp. 137-138.