The effect of organic management on soil quality indicators

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ABSTRACT

A range of physical, biological and chemical parameters were measured in organic soil that had been managed in different ways and in a conventional control. Factors were identified that could be used to construct an index of soil quality.

Keywords: organic farming; soil quality; soil biological and physical properties

INTRODUCTION

A greater understanding of the attributes that contribute to sustainability is particularly important in organic systems. However, this is a complex area and many parameters, physical, chemical and biological, have been used to describe the 'health' or 'quality' of soil. Individual factors have key functional roles that may have direct implications for crop growth and productivity but it is their interactions that will ultimately be of importance. This paper examines the effect of contrasting management regimes on soil quality parameters five years after conversion from conventional to organic management. The results described are part of a much larger study examining other agronomic and economic aspects.

MATERIALS AND METHODS

Samples were taken from a site in Warwickshire (HRI Wellesbourne) with a sandy loam soil. It had been used to grow conventional cereals until conversion to organic management was started in 1996. A number of different rotations were investigated. These included long-term grassland, predominantly arable or predominantly vegetable cropping with fertility building periods of various lengths. The adjacent conventional cereal field was used as a control. The soil was sampled in spring 2001. Soil structural properties, organic matter pools and microbial community size, structure and functioning were determined using appropriate techniques to investigate the effect of the contrasting management regimes on soil quality

RESULTS

No clear differences between the treatments were found in total organic matter, potentially mineralisable nitrogen, water soluble carbohydrates, microbial biomass or ATP. There were, however, differences between treatments in light fraction organic matter (LFOM) C and N contents, in the activity of enzymes involved in nutrient cycling (in particular xylosidase, sulfatase, acid phosphatase and N-acetyl glucosaminidase), aggregate stability, water infiltration rate and soil resistance measured using a penetrometer.

Table 1 gives values for a range of soil parameters from areas that had been used for arable production (continuous cereals in the conventional area and a sequence of a grass/clover ley, cereals and potatoes in the organic area). The higher values of LFOM in the organic area suggest that this may be an early indicator of change in soil organic matter quality; increases in enzyme activities may be linked to an enhanced ability to recycle residues.

Table 1. Selected soil parameters from organic and conventionally managed arable areas. Values are the means of six 0.13 ha sample areas with SEM given in brackets.

Parameter	Organic	Conventional
LFOM N ($\mu g\ g^{-1}$ dry soil)	43 (2)	20 (1)
LFOM C ($\mu g\ g^{-1}$ dry soil)	1087 (65)	685 (60)
Acid phosphatase (nmol MUB/AMC $min^{-1}\ g^{-1}$)	27.2 (1.8)	15.9 (2.0)
Xylosidase (nmol MUB/AMC $min^{-1}\ g^{-1}$)	2.5 (0.2)	2.1 (0.2)
Sulfatase (nmol MUB/AMC $min^{-1}\ g^{-1}$)	1.4 (0.1)	1.2 (0.1)
Aggregate stability (mean weight diameter)	1.06 (0.08)	0.84 (0.03)

The results form this study will be used to produce an index that will be used to compare the quality of soil managed in different ways in the manner of Glover *et al* (2000).

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