Geophysical Research Abstracts,
Vol. 11, EGU2009-6097, 2009
EGU General Assembly 2009

Soil Organic Matter Dynamics in the Rothamsted Long-term Experiments

A MACDONALD and P POULTON

Soil Science Dept, Rothamsted Research, Harpenden, Herts, UK (andy.macdonald@bbsrc.ac.uk)

Soil science research at Rothamsted dates from 1843 when John Bennet Lawes and Joseph Henry Gilbert started the first of a series of what became long-term field experiments. The main object of these experiments was to examine the effect of inorganic and organic fertilisers and manures on crop yield and soil fertility. These "Classical Field Experiments" included studies on winter wheat (Broadbalk 1843), spring barley (Hoos Barley 1852) and permanent grassland (Park Grass 1856). Additional experiments were established in the 20th century to examine the value of ley-arable cropping, including the Highfield and Fosters Ley-arable experiments (1948) and the Woburn Ley-arable experiment (1938). More recently, the effects of incorporating organic manures and cereal straw have been examined.

Early results quickly showed the benefits of inorganic N and P fertilisers on crop production, but the effects of contrasting land uses and management practices on soil properties emerged more slowly. Measurements of soil organic carbon (C) and nitrogen (N) in soils taken at intervals from the long-term experiments indicate that the rate of soil organic matter (SOM) accumulation is controlled largely by the balance between the rate of organic matter inputs and its oxidation rate, and that these are strongly influenced by land use and management, soil texture (especially clay content) and climate. A recent examination of soil organic C data from two long-term grassland experiments in the UK (including Park Grass) indicates that any changes observed in soil organic C under long-term grasslands over the past 40 years are more likely to be due to changes in land use and management rather than climate change.

Data from the Rothamsted Long-term experiments have been used to develop and test biogeochemical models of C and N dynamics. In particular, the Roth-C model has successfully simulated soil C dynamics in the long-term experiments at Rothamsted and elsewhere. This model uses several organic matter pools, including decomposable and resistant plant material, soil microbial biomass, humified organic matter and inert organic matter and was one of the 31 models included in the GCTE SOMNET network.

The Rothamsted Long-term Experiments together with their archived samples and data have proven especially useful for examining the impact of land use and management on soil organic matter dynamics. They continue to yield important information and are an increasingly valuable experimental resource for todayś scientists. Whilst their future long-term uses cannot be predicted, provided they are well maintained, the application of new scientific techniques to examine both fresh and archived samples will continue to provide information of environmental and ecological significance to future generations.

Rothamsted Research receives grant-aided support from the Biotechnology and Biological Sciences Research Council and additional support from the Lawes Agricultural Trust. Presentation of this work forms part of the ANAEE EC design study (www.anaee.com).