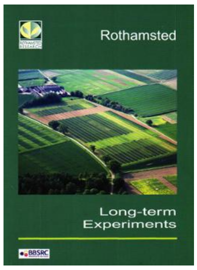
This work is licensed under a Creative Commons Attribution 4.0 International License.

Thank you for using eradoc, a platform to publish electronic copies of the Rothamsted Documents. Your requested document has been scanned from original documents. If you find this document is not readible, or you suspect there are some problems, please let us know and we will correct that.

ROTHAMSTED RESEARCH

The Long Term Experiments

Full Table of Content



Sample Archive

Rothamsted Research

Rothamsted Research (2006) *Sample Archive ;* The Long Term Experiments, pp 46 - 48 **- DOI: https://doi.org/10.23637/ROTHAMSTED-LONG-TERM-EXPERIMENTS-GUIDE-2006**

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

The progressive acidification of the Geescroft Wilderness and some soils on Park Grass has also resulted in the mobilisation of heavy metals, particularly aluminium.

Broadbalk has been used to investigate the influence of both amount and form of N on gene expression in wheat grain. Clustering of gene expression profiles separated high and low N treatments. In addition, where the crop was accessing N derived from an organic source (FYM) there was a unique gene expression pattern and separate clustering. Analysis of this profile indicated the presence of genes encoding N assimilation components, seed storage proteins and several unknowns. These patterns were confirmed in successive years on Broadbalk and on the Woburn Ley-arable experiment where gene expression differed between wheat receiving fertiliser N and that receiving N derived from the mineralisation of grass ley residues. The most recent studies are combining both transcriptome and metabolome profiling to gain insights into processes relating to nitrogen use efficiency in wheat.

SAMPLE ARCHIVE

The unique Sample Archive was established by Lawes and Gilbert in 1843 and its scientific value has been, and continues to be, immense. The Archive comprises, predominantly, soil and plant samples from the long-term field experiments at Rothamsted, Woburn and Saxmundham described in this guide. Plant samples consist of oven-dried, unground wheat and barley grain and straw and herbage from Park Grass, as well as more finely ground material from many other crops. Soils (air-dried) have been taken from top-soils/plough layer (generally 0-23 cm) and from sub-soils. They are usually stored as either 6.35mm, 2mm or more finely ground samples. There are also dried samples of organic manures and fertilisers that have been applied to the experiments, and several thousand soils from different locations in the UK and from other countries. Samples are stored in sealed glass bottles or jars, airtight tins, glass vials or card boxes.

Archived soils from Park Grass, 1876

There is a written record of samples that have been archived and, increasingly, information on the samples is being stored electronically in the Electronic Rothamsted Archive (see below).

The Sample Archive has been used extensively by Rothamsted staff and by scientists from other research institutes and universities in the UK and abroad. The retrospective analysis of archived material allows us to look back more than 160 years at, for example, many aspects of plant nutrition and soil fertility,

https://doi.org/10.23637/ROTHAMSTED-LONG-TERM-EXPERIMENTS-GUIDE-2006

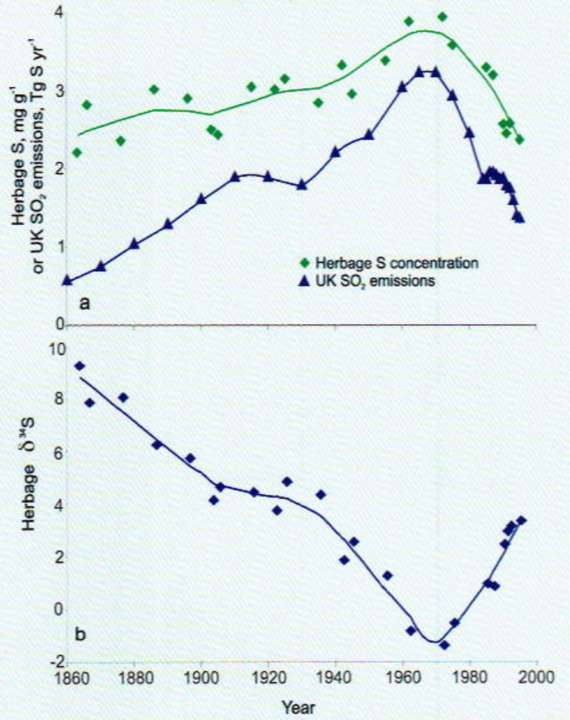
This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

and pollution that could not have been anticipated when the samples were taken. This is particularly true with respect to organic pollutants and environmental issues.

Thus, archived samples have been analysed for their heavy metal content following the application of sewage sludge, for cadmium following applications of phosphate fertilisers and for poly-aromatic hydrocarbons and dioxins, which have increased in the atmosphere since the early 1900s.

Sulphur dioxide (SO_2) was an important atmospheric pollutant in the UK for much of the 20th century but one that supplied much of agriculture's needs. Inputs have declined markedly since the 1970s. Soil and herbage samples from Park Grass were used to assess the impact of the changing inputs of SO_2 on S cycling in the plant:soil system. While concentrations of S in herbage were positively correlated with annual SO_2 emissions (Fig. 11), the trend in the stable S isotope ratio, $\delta^{34}S$, was negatively correlated with SO_2 emissions, reflecting the more negative $\delta^{34}S$ values associated with anthropogenic S sources. Calculations suggest that up to 50% of the herbage S uptake came from anthropogenic sources at the peak of SO_2 emissions in 1970.

Fig.11 Park Grass. The effect of changes in emissions of SO_2 in the UK on herbage S (a) and herbage $\delta^{34}S$ (b)



DNA of two important wheat pathogens, *Phaeosphaeria nodorum* and *Mycosphaerella graminicola*, has been extracted, and amplified, from archived wheat straw samples from Broadbalk over the period 1844-2003. From 1970-2003, the relative abundance of DNA of these two pathogens in the samples reflected the relative importance of the two diseases they cause in the UK, as assessed by disease surveys. Over the longer period, changes in the dominance of the two species were very strongly correlated with changes in atmospheric pollution, as measured by SO_2 emissions in the UK.

Data from the analyses of soils for their organic carbon and ^{14}C content were used to develop and validate RothC, a computer model that simulates the turnover of soil organic matter, a key component of soil quality. RothC is widely used by researchers worldwide and is now linked to the global climate model developed by the Hadley Centre.

https://doi.org/10.23637/ROTHAMSTED-LONG-TERM-EXPERIMENTS-GUIDE-2006

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Scientists at Southampton Oceanography Centre analysed samples of herbage from the Park Grass experiment over a 50-year period to measure concentrations of plutonium and uranium. They were able to detect the effects of, and distinguish between, nuclear bomb tests carried out by the US, USSR, UK and France, and show that plutonium contamination from weapons testing in the Nevada Desert in 1952/3 reached Northern Europe. Such measurements have only become possible in recent years with the development of more sophisticated analytical techniques.

THE ROTHAMSTED INSECT SURVEY

Between 1933 and 1937 and again between 1946 and 1950 the larger (macro) moths were recorded in a light trap run at the edge of Barnfield, one of Rothamsted's Classical experiments. In 1960, a trap of identical design was placed at the same site, immediately producing information on long-term changes in farmland moth populations. This provides the only quantitative insect data that compares populations before and after the important period around the Second World War, when many agricultural practices were changing rapidly. Between 1960 and 1970 a national network of Rothamsted-style light traps was developed that has continued ever since. Currently, there are about 90 such traps in operation throughout the UK, most of which are run by volunteers, and from which all macro-moths are identified and counted on a daily basis.

Light trap

In 1965, a 12.2m high suction trap was designed and set up at Rothamsted to monitor migrating aphid populations, and over the next few years a network of such traps was installed across the UK. Currently there are 16 traps in operation in England and Scotland with the English sites being coordinated from Rothamsted and

https://doi.org/10.23637/ROTHAMSTED-LONG-TERM-EXPERIMENTS-GUIDE-2006