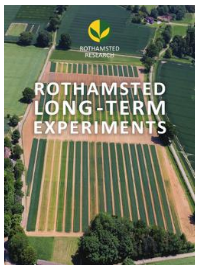
# Guide to the Classical and Other Long-term Experiments, Datasets and Sample Archive

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## Amounts of Straw and Continuous Maize Experiments (Rothamsted and Woburn)

### Rothamsted Research

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## Amounts of Straw and Continuous Maize Experiments (Rothamsted & Woburn)

Other more recent long-term trials were established to examine the effects of repeatedly incorporating the straw of continuous wheat or continuous maize on the contrasting soils at Rothamsted and Woburn (silty clay loam v sandy loam). The former, were established on the contrasting soils at Rothamsted (Great Knott III; silty-clay loam), and Woburn (Far Field I; sandy loam) in 1987; both were sown to continuous winter wheat. At Rothamsted sixteen plots were established in four replicate blocks with different rates of straw incorporation (0, 1, 2 & 4 times normal straw yield). The same treatments were tested at Woburn in three blocks of four plots. Yields of grain and straw were taken each year, and soil was sampled from all treatments after 7, 11 and 22 years of contrasting straw treatments. Incorporating just the amount of straw produced per unit area had only a small and not significant effect on soil organic C (SOC) even after 22 years. SOC was increased by incorporating greater amounts of straw, but only at the largest rate was the effect significant. (Powlson *et al*, 2011). The experiments were discontinued in 2016.

The Continuous Maize Experiments began in 1997, one was on silty clay loam at Rothamsted (Hoosfield) and the other on the sandy loam at Woburn (Stackyard). The experiments included six cropping treatments: 1. Continuous maize with stubble incorporated; 2. Continuous maize with stubble plus 10t maize tops incorporated; 3. Maize after three years of spring barley with straw removed; 4. Spring barley after five years of maize with stubble incorporated; 5. Continuous spring barley with straw removed plus 10 t maize tops

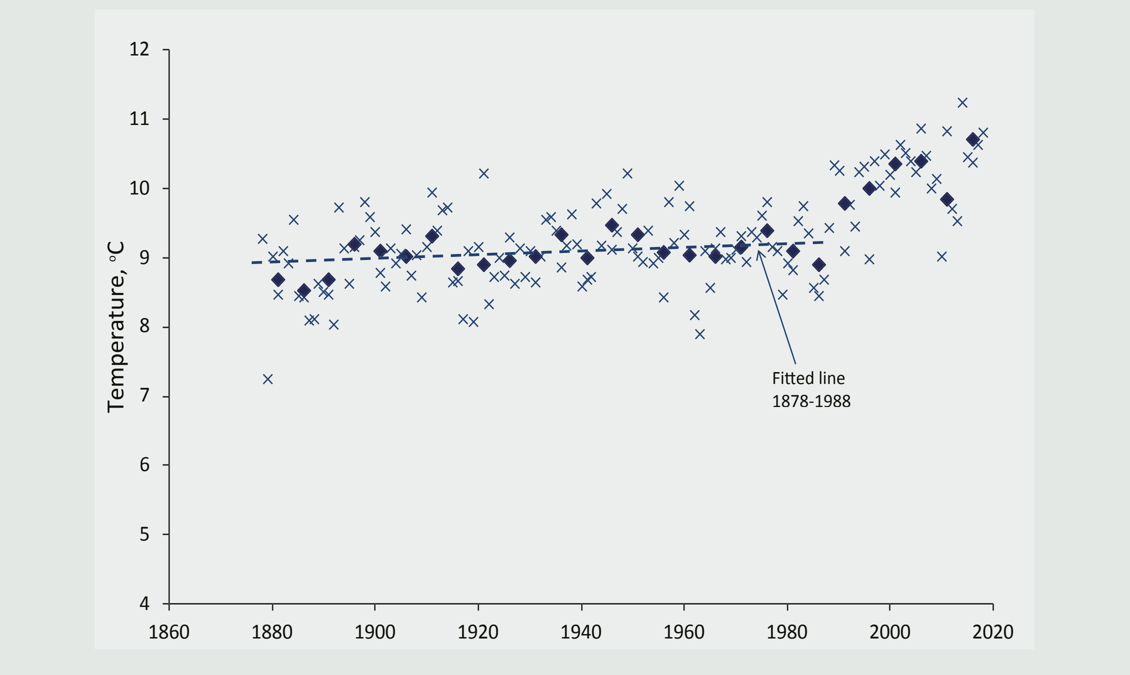


Fig. 14 Rothamsted; average temperature (°C), 1878-2018. Annual mean (x); 5-year mean (♦).



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incorporated; 6. Continuous spring barley with straw removed. In treatments with rotations only one phase was present each year. Crop yields were taken each year and soils were collected in 1997, 2008 and 2015. Maize and spring barley were chosen as crops with contrasting $\delta^{13}C$ enrichment in their residues to provide an opportunity to follow the fate of the C incorporated in the maize crop residues. The experiments were discontinued in 2015.

## METEOROLOGICAL DATA

Because of climate change it is important when interpreting data from long-term experiments that changes in temperature, rainfall (amount and distribution), chemical inputs (in rainfall and as dry deposition) *etc*., are all taken into account. Total rainfall has been measured at Rothamsted since 1853 and temperatures since 1873; other meteorological data have been collected subsequently. Annual rainfall averages 704mm (mean 1971-2000) but ranges widely from 380mm in 1921 to 973mm in 2000. Increases in temperature in many parts of the world are well documented (Hansen & Sato, 2016) and Rothamsted data (Figure 14) show that the average (1989-2018) annual mean air temperature was approximately 1.1°C warmer than the long-term mean of 9.04°C (1878 to 1988). There has been a similar rise in average annual temperature at Woburn. Much of that rise is accounted for by increases during the autumn and winter months. Average soil temperatures have also risen.

Rothamsted Meteorological Station, 2017

Since the 1850s, chemical inputs in rain have changed considerably. Inputs of acidity ($H^+$ ions) are small; less than 0.1 kg $ha^{-1}yr^{-1}$ up to the 1950s. They reached a maximum of 0.4 kg $ha^{-1}yr^{-1}$ in the 1970s and are now about 0.2 kg $ha^{-1}yr^{-1}$. Inputs of sulphate-S were about 5 kg $ha^{-1}yr^{-1}$ in the 1850s and reached a maximum of 65 kg $ha^{-1}yr^{-1}$ by 1980. After a dramatic decline, associated with decreasing emissions from power stations and a decline in heavy industry they are now about 5 kg $ha^{-1}yr^{-1}$. Inputs of nitrate- and ammonium-N in rainfall were 1 and 3 kg $ha^{-1}yr^{-1}$, respectively, in 1855, and increased to 8 and 10 kg $ha^{-1}yr^{-1}$ in 1980. In 1996, N in dry deposition amounted to 34 kg N $ha^{-1}yr^{-1}$; about three times that in rainfall. The total N input for wet and dry deposition at that time was about of 43 kg $ha^{-1}yr^{-1}$. Since then, atmospheric inputs have declined to about 21 kg N $ha^{-1}$ $yr^{-1}$ (Storkey *et al*., 2015) compared with about 10 kg N $ha^{-1}yr^{-1}$in the mid-1850s.

## LONG-TERM EXPERIMENTS AS A RESOURCE

Changes in agricultural practices or other factors influencing soil quality and soil processes can take decades to have any measurable effects. Effects of agriculture on



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