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ROTHAMSTED
RESEARCH

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



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Meteorological Data

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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 $\delta^{13}\text{C}$ 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



Rothamsted Meteorological Station, 2017

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.

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