



ROTHAMSTED  
RESEARCH



# CONFERENCE PROGRAMME

**THE FUTURE  
OF LONG-TERM  
EXPERIMENTS IN  
AGRICULTURAL  
SCIENCE**

**21-23 MAY 2018**

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## Soil health assessment in a long-term tillage experiment from central Kansas

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Conservation Agriculture was adopted over 125 million hectares worldwide in order to address an ever-growing demand for soil quality, food security, and climate change mitigation. Here we present a soil health assessment of a long-term tillage experiment (28 yr.) from central Kansas, United States. The experiment had plots with maize (*Zea mays* L.) under chisel tillage (CT), no-tillage (NT), and N sources. The CT treatment received fall chisel plow (15 cm) and offset disk preplant (10 cm). NT consisted in planting directly through crop residues with minimal soil disturbance. The N treatments were: 168 kg N ha<sup>-1</sup> as ammonium nitrate or urea (MF), 168 kg N ha<sup>-1</sup> as cattle manure or composted waste (OF), and a control (CO) without N. Maize grain yields were similar under CT and NT receiving N: 7.0±2.8 and 6.6±2.6 Mg ha<sup>-1</sup>, respectively. Soil C, δ<sup>13</sup>C, total N, and δ<sup>15</sup>N stocks were measured to 90 cm depth. Organic fertilization increased initial SOC of the 0-5 cm soil layer (9.3 Mg C ha<sup>-1</sup>) to 16.2 and 30.2 Mg C ha<sup>-1</sup> in CT and NT, respectively. NT increased the proportion of large macroaggregates (> 2,000 μm) and OF increased C within aggregates until the saturation of aggregate-protected C pool in NT OF. Significant C accrual (1.3 Mg C ha<sup>-1</sup> yr<sup>-1</sup>) was observed in the 5-15 cm layer due to translocation of C from saturated surface layer as confirmed with δ<sup>13</sup>C analysis. Further results of soil health assessment will be presented, including soil PLFA and enzymes.

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## Interest of long-term experiments for education: examples from the INRA-Versailles field experiments

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Long-term experiments are an excellent source of data and material for educational purposes, as they provide many examples of well-designed, statistically significant results of the effect of agricultural practices and fertilization on soil properties and crop production. Here, we present two examples that we have been using for teaching agronomy and soil science in Spain and France during the last five years. They have been selected from two long-term field experiments at the INRA-Versailles site: the assay of agriculture systems “La Cage” and the 42-plot long-term bare fallow experiment. The experiment of La Cage, initiated in 1997, is used as an example for the diverse effects of conservation agriculture on soil properties, including susceptibility to erosion, aggregate stability, soil biodiversity and organic carbon stocks and distribution. The 42-plot trial, established in 1928, illustrates the long-term impact of fertilization on soil properties and the link between chemistry and physics in soils, through the effect of the modifications of pH and exchange complex on aggregate stabilization, porosity and bulk density. These two cases permit a successful teaching of key processes in agronomy and soil science, showing not only the exceptional value of long-term experiments as a tool for education, but also the importance of their conservation for allowing students’ visits to the sites and for the continuous acquisition of new results.