Long-term Field Experiments Around the World

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Year established: 1843

Location: Hertfordshire, UK

Name: Broadbalk Experiment

The Broadbalk Experiment at Rothamsted Research in Hertfordshire, UK, is the oldest, continuously running agricultural experiment in the world. It had its first winter-wheat crop sown in autumn 1843, and this crop has been sown and harvested on all, or part, of the field every year since then. The experiment tests the effects of various combinations of inorganic fertilizer (supplying the elements N, P, K, Na, and Mg) and farmyard manure on the yield of wheat: a control strip has received no fertilizer or manure since 1843.

Soil: Aquic Paleudalfs (Stagnogleyic paleo-argillic brown earth, silty clay loam)

Annual rainfall: 708 mm

Elevation: 167 m
N 51°48’35”
W 0°22’24”

Current contact: Dr. Andrew Macdonald, Rothamsted Research Station, UK (andy.macdonald@bbsrc.ac.uk) and Dr. Paul Poulton (paul.poulton@bbsrc.ac.uk).

Year established: 1876

Location: Urbana-Champaign, Illinois, USA

Name: Morrow Plots

The Morrow Plots, located in the heart of the Urbana-Champaign campus of the University of Illinois, are the oldest continuous agricultural research fields in the United States. Established in 1876, they are predated only by the Rothamsted Field in England, which was started in 1843. The trials were originally started by Dr. Manley Miles, Professor of Agriculture, University of Illinois. The site was designated a National Historical Landmark by the Federal Government on Sept. 12, 1968.

Soil: Flanagan silt loam (fine, smectitic, mesic Aquic Argiudolls)

Annual rainfall: 1009 mm

Elevation: 229 m
N 40°6'16.44"
W 88°13'33.96"

Current contact: Dr. Robert Dunker, Agronomist and Superintendent, Crop Sciences Research and Education Center, University of Illinois (r-dunker@uiuc.edu)

Year established: 1888

Location: Columbia, Missouri, USA

Name: Sanborn Field

Sanborn Field was initiated in late 1888 as the “Rotation Field” by Dean J. W. Sanborn on the campus of University of Missouri-Columbia to demonstrate the value of crop rotations and manure in grain crop and forage production. One of the most significant discoveries from Sanborn Field was the isolation of the fungus *Streptomyces aureofaciens*, which produced one of first generation antibiotics, aureomycin. The field was designated a National Historical Landmark in 1965. The current objectives of Sanborn Field are to document soil changes, crop response, and nutrient balance under selected monoculture and crop rotations; demonstrate results of interactions that occur through differential management of the soil–plant–environment continuum; and properly archive soil and plant samples for future means of identifying effects of environmental changes.

Soil: Mexico silt loam (fine, smectitic, mesic Aeric Vertic Epiaqualfs)

Annual rainfall: 1027 mm

Elevation: 238 m
N 38°56’33.2”
W 92°19’14”

Current contact: Dr. Randy Miles, University of Missouri (MilesR@missouri.edu) or Dr. Newell Kitchen, University of Missouri, USDA-ARS (KitchenN@missouri.edu)

Year established: 1892

Location: Stillwater, Oklahoma, USA

Name: Magruder Plots

A.C. Magruder established these plots in the fall of 1892, simultaneously with the establishment of the Morrill Land Grant College. The plots were initially used to evaluate continuous winter wheat, with and without the addition of manure. One hundred fourteen years later, the check plots where no nutrients of any kind have ever been added still average 15 bu/ac. Six nonreplicated plots include a manure, check, P, NP, NPK, and NPK–lime where N, P_2O_5, and K_2O rates are 60, 30, and 30 lbs/ac, respectively. For the NPK–lime plot, lime is applied when soil pH < 5.5. To date, lime has only been applied twice, 1929 and 1954. More on the long-term experiments conducted in Oklahoma can be located at http://www.nue.okstate.edu/Long_Term_Experiments.htm.

Soil: Kirkland silt loam (fine, mixed, thermic Udertic Paleustolls)

Annual rainfall: 840 mm

Elevation: 272 m
N 36°07'11.1"
W 97°05'18.9"

Current contact: Bill Raun, Regents Professor, Oklahoma State University (bill.raun@okstate.edu)

Year established: 1911

Location: Auburn University, Alabama, USA

Name: Cullars Rotation

The Cullars Rotation experiment (circa 1911) at Auburn University, Alabama, was placed on the National Register of Historical Places in 2003 as the oldest, continuous soil fertility study in the South and the second oldest cotton study in the world. It is located on the site where Professor George Atkinson diagnosed cotton rust as related to a K deficiency in 1890. The 3-year rotation of cotton (winter legumes)–corn (wheat)–summer legume came from the nearby "Old Rotation" experiment, which was started by Professor J.F. Duggar in 1896. Professor Duggar noted that southern cotton production would become sustainable only "…when its fields are green in winter." The "Old Rotation" is the oldest continuous cotton experiment in the world, and was placed on the National Register of Historical Places in 1988.

Soil: Marvyn loamy sand (fine-loamy, siliceous, thermic Typic Kanhapludults)

Annual rainfall: 1340 mm

Elevation: 201 m
N 32°35.17'
W 85°28.57'

Current contact: Dr. Charles Mitchell, Professor, Auburn University (mitchc1@auburn.edu)

Year established: 1912

Location: Rutherglen Centre, Department of Primary Industries, Rutherglen, Victoria, Australia

Name: Permanent Topdressing Experiment

Research into pastures began at Rutherglen in 1912. It was shown that an application of superphosphate on native pastures resulted in an increase in general growth, and much was made of the benefits of this practice at the field day in 1913. Detailed experiments were established in 1914 with areas being treated with either superphosphate, super and lime, basic slag or nitrate of soda, or no treatment at all. These treatments were applied every year until 1919, after which they were top-dressed with superphosphate every four years until 1936, then every alternate year since then. These permanent top-dressing paddocks are still in operation today and provide an invaluable resource for scientists.

Soil: fine, sandy clay loam (Vertic, Mottled-Subnatric, Grey Sodosol) (Australian classification system)

Annual rainfall: 590 mm

Elevation: 167 m
S 36°6’31.857”
E 146°30’43.837”

Current contact: Dr. Anna Ridley, Department of Primary Industries, Victoria (anna.ridley@dpi.vic.gov.au)

Year established: 1931

Location: Pendleton, Oregon, USA

Name: Crop Residue Management Experiment

The Oregon State University's Columbia Basin Agricultural Research Center, near Pendleton, Oregon, is home to the oldest continuous cropping experiments in the Pacific Northwest and was initiated by Dr. George A. Mitchell, Professor of Agronomy at Oregon State. The Crop Residue Management Experiment, the most comprehensive of the long-term experiments at Pendleton, was initiated in 1931. The objective of this experiment is to determine the effects of crop residue burning, nitrogen application rates, and pea vine and manure applications on soil properties and productivity in a conventional moldboard plow, winter wheat–summer fallow production system. The experimental design is an ordered block consisting of nine treatments and two replications. The experiment contains duplicate sets of treatments that are offset by one year so that data are obtained annually. Plot size is 12 by 40 m. Results (74 years) show that soil organic matter continues to decline in wheat–fallow rotation, except where 10 tons (fresh weight) of manure have been applied during the fallow phase. Fall burning in wheat–fallow systems accelerates organic matter decline.

Soil: Walla Walla silt loam (coarse, silty, mixed, superactive mesic Typic Haploxerolls)

Annual rainfall: 570 mm

Elevation: 438 m
N 45°43.5'
W 118°37.8'

Current contact: Dr. Stephen Machado, Assistant Professor, Oregon State University (stephen.machado@oregonstate.edu)

Year established: 1961

Location: Tribune, Kansas USA

This plot was initiated by Mr. Roy Gwin (Kansas State University faculty member from 1957 to 1986) to determine the need for N, P, and K in irrigated continuous corn in western Kansas. The N rates 0, 40, 80, 120, 160, and 200 lb N/acre are applied annually to the same plots. Phosphorus has been applied at 0 and 40 lbs P_2O_5/ac annually with all N rates. Originally there was also a K treatment but this was dropped in 1992 because no response was ever observed and subsequently replaced with a higher P treatment (80 lbs P_20_5/ac), which remains today. Since it has continued for so long, it now allows evaluation of long-term impacts of fertilization on surface soil properties, nitrate movement, and phosphorus distribution along with determining optimal N rates. It also allows evaluation of the interaction of optimal N rates on environmental impact (nitrate movement).

Soil: Ulysses silt loam (fine silty, mixed, mesic, Aridic Haplustolls)

Annual rainfall: 443 mm

Elevation: 1102 m
N 38°31.31'
W 101°39.37'

Current contact: Dr. Alan Schlegel, Kansas State University (schlegel@ksu.edu)

Year established: 1962

Location: Wooster, Ohio, USA

Name: No-tillage Plots

Scientists with The Ohio State University/Ohio Agricultural Research and Development Center had a large role in the development of the no-tillage revolution in the late 1950s and early 1960s. Two early no-tillage pioneers were Dr. Glover Triplett and Dr. Dave VanDoren. They began to experiment with growing crops without tillage. Their initial objective was to determine how much tillage, if any, was necessary to obtain satisfactory crop yields. Their second objective was to determine how crop rotation and tillage interact during the production of corn.

Their work led the way in the development of no-tillage, and in 1962 they initiated a series of experiments in Ohio that investigated the interaction of tillage and rotation on not only corn (*Zea mays* L.) production but also soybean [*Glycine max* (L.) Merr.], oat (*Avena sativa* L.), and forage hay. These plots have been maintained to the present time and represent the longest continuously maintained no-tillage plots in the world. It has now been 45 years since the plots were tilled by any means other than the small slot created by the planter or fertilizer injector. Yet results have clearly shown that yields under no-tillage have not only kept pace with yields where soils are plowed, but in many cases have exceeded the plow-tillage yields.

Soil: Wooster silt loam (fine loamy Typic Fragiudalfs)

Annual rainfall: 940 mm

Elevation: 346 m
N 40°45.838', W 81°54.346'

Current investigators in charge: Dr. Warren Dick, Professor, Ohio State University (email: dick.5@osu.edu) and Dr. Robert Mullen, Asst. Professor, Ohio State University (mullen.91@osu.edu).

Year established: 1970

Location: Lexington, Kentucky, USA

Name: Blevins Long-Term Tillage Trial

One of the oldest tillage comparisons east of the Mississippi River, this experiment was initiated by Dr. Robert L. Blevins at the University of Kentucky's "Spindletop" Agricultural Experiment Station research farm in 1970. Two primary tillage systems (no-tillage and moldboard plowing) are compared at each of four rates of fertilizer nitrogen (0, 84, 168, and 336 kg N/ha), in a split-strip design with four replications. The cropping system is monoculture maize, for grain, with a winter annual cereal cover crop established each fall. The trial has been the source of much research information on the impact of tillage and nitrogen rate management on soil biological, chemical and physical properties and processes. Current and future work at the site contemplates issues in soil and water quality, and in carbon sequestration and greenhouse gas emissions. The experiment has been instrumental in demonstrating the value of no-tillage soil management to Kentucky growers. In 2004, no-tillage soil management was used on 55% of Kentucky's cropland, including 70% of all soybean and 60% of all corn.

Soil: Maury silt loam (fine, mixed, semiactive, mesic Typic Paleudalfs)

Annual rainfall: 1140 mm

Elevation: 320 m
N 38°07'
W 84°29'

Current contact: Dr. J.H. Grove, Plant and Soil Sciences Department, University of Kentucky (jgrove@uky.edu)

Year established: 1975

Location: INTA Experiment Station. Marcos Juárez, Córdoba, Argentina

This trial was initiated by Ing. Hugo Marelli in 1975: no-till soybean following wheat in a 33-year long-term trial with six treatments and four replications in a split plot design. Argentina leads the world in the adoption of no-tillage production systems with near 70% of all farmers using reduced tillage operations for moisture conservation.

Soil: silty loam, Typic Argiudolls

Annual rainfall: 900 mm

Elevation: 474 m
S 32°43'03.2"
W 62°06'23.9"

Current contact: Ing. Hugo Marelli and Ing. Juan Arce (hmarelli@mjuarez.inta.gov.ar)

Year established: 1989

Location: Hickory Corners, Michigan, USA

Name: Long-term Ecological Research (LTER) Plots

Initiated by G.P. Robertson, E.A. Paul, and M.J. Klug and established as the only agricultural site in the NSF Long-term Ecological Research (LTER) network in 1988, research is focused on understanding the ecology of row crop ecosystems. The experimental design includes A) four annual cropping systems in a corn–soybean–wheat rotation managed 1) conventionally, 2) with no-till, 3) with reduced chemical inputs, and 4) organically; B) three perennial cropping systems: 1) alfalfa, 2) poplar, and 3) planted conifers; and C) four successive systems: 1) early succession historically tilled, 2) mid-succession never tilled, 3) mid-succession historically tilled, and 4) undisturbed mature forest. This provides a wide range of replicated ecosystems with the same pedogenic history that differ in key management and ecological characteristics. More details, including publications, are available at (http://lter.kbs.msu.edu)

Soil: Kalamazoo loam (fine-loamy, mixed, mesic, typic Hapludalfs)

Annual rainfall: 890 mm

Elevation: 288 m
N 42º24'28.65", W 85º22'17.34"

Current contact: Dr. Phil Robertson; Professor and Director, KBS LTER Site (robertson@kbs.msu.edu) or Dr. Ron Gehl, Assistant Professor, Michigan State University (gehlr@msu.edu)