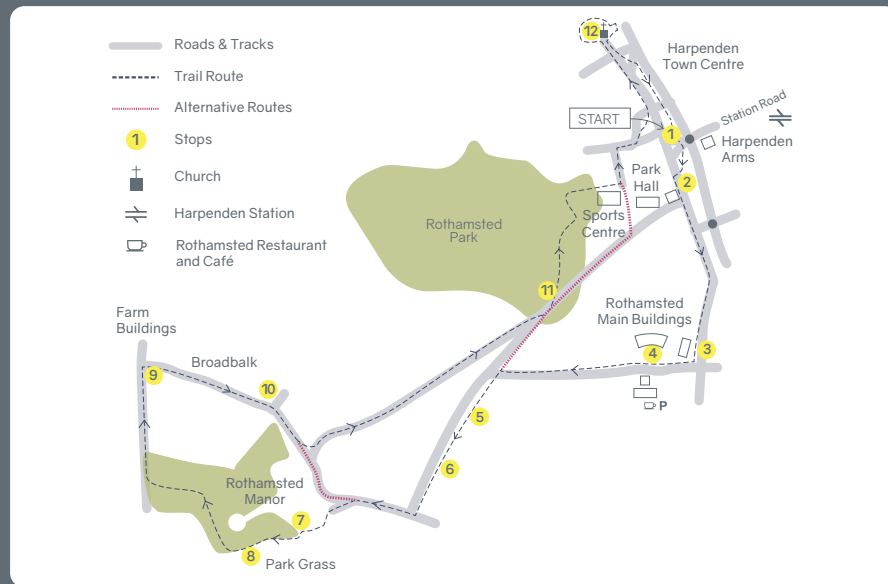


Answers to questions:

1. British Women's Temperance Association. (Now known as the 'White Ribbon Association').
2. Sharpening slate pencils which were used by Victorian schoolchildren.
3. Rothamsted's 100th anniversary was in 1943, during World War 2 when there were other priorities.
4. Synthetic pyrethroids are more stable in sunlight so their effectiveness is longer-lasting than natural pyrethrum.
5. About 600 species. Of these, no less than 347 different aphid species have been recorded in the suction traps at Rothamsted.
6. 'Phenotyping' refers to the observable physical properties of an organism; these include its appearance, development and behaviour.
7. A military intelligence centre involved in intercepting German messages.
8. 1690.
9. Four years – by then they were stunted and barely recognisable as cultivated wheat.
10. Phosphorus (P) and Potassium (K).
11. To commemorate the golden jubilee of Queen Victoria.
12. About £43 million, according to: www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator

Walk devised and photographed by Stephen Moss. Additional input: John Jenkyn and Roger Plumb (all former Rothamsted Research scientists). Thanks to Richard Harrington for route checking.



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Rothamsted Walking Trail

Rothamsted, a short distance south of Harpenden town centre, is the world's oldest agricultural research institution. It dates its foundation to 1843 when John Bennet Lawes, the owner of the Rothamsted Estate, appointed Dr Joseph Henry Gilbert, a chemist, as his scientific collaborator. Their scientific partnership lasted 57 years, and they established the principles of crop nutrition and laid the foundations of modern scientific agriculture.



Distance:

This **4.8 km (3.0 mile)** walking trail takes you through Harpenden and the Rothamsted Estate and highlights important historical features as well as newer facilities contributing to ongoing research.

Duration:

Allow at least **two hours**. The trail is mainly along surfaced or gravel paths and in dry conditions, can easily be walked in ordinary shoes. Wellington or other waterproof boots are preferable in wet conditions as parts of the trail can be muddy.

Welcome to the Rothamsted Walking Trail


Our trail starts from 'the old drinking fountain', outside Pizza Express, at the south end of Harpenden High Street, opposite the Harpenden Arms pub. Public toilets are adjacent. However, it can be started at stops 3 or 4, at Rothamsted, if preferred.



1 Drinking Fountain

This was presented to the people of Harpenden in 1890 by Sir John Bennet Lawes who, besides founding the Rothamsted Research Station, was also Lord of the Manor. It was restored by public subscriptions collected by the BWTA (Harpenden Branch) in 1914, and again by the Town Council in 2003.

Q1. Look at plaque on the fountain base - what do you think BWTA stands for? (Answers at end).

 Walk directly away from the fountain and Pizza Express towards Harpenden Common and cross the road onto the path opposite. Walk straight on for 12m then turn half right and follow the diagonal path. Note Bennet's to the right (at one time the home of Lawes' elder sister, Marianne Warde). Cross Leyton Road by the zebra crossing and turn left. After 35m stop at Park Hall.





2 Park Hall

John Lawes provided the site and partly paid for the construction of this building for use as the Harpenden British Schools, one for boys and one for girls, which opened in 1850. These were the first local schools to provide education for children of working-class families. The schools continued until 1897 when Park Hall became the offices and Public Hall for the newly formed Harpenden Urban District Council. Harpenden Town Council redeveloped the rear part of the schools as the new Town Hall in 1994. The original part is now maintained as a community facility with the Harpenden Town Hall in the newer building at the rear.



Q2. What do you think made the deep scratches in the north-facing wall (best seen in the bricks to the left of the green door, on the wall facing 'Busy Bees')?

 Continue on the footpath alongside the road, walking away from the town centre. Pass the entrance to Rothamsted Park - the gates and railings were removed as part of the WWII war-effort. Continue on the footpath alongside the road, passing the fire station on right, then the Silver Cup pub on the left, and then, by the post box, observe Pirie Cottage, named after Bill Pirie, an eminent Rothamsted scientist who, with Fred Bawden and others, discovered that plant viruses contain protein and nucleic acid. Continue past Sir Joseph's Walk (named after Joseph Henry Gilbert, although he was always known as 'Henry') and, immediately after, note the former Rothamsted Directors' House on the right. Continue, passing The Red Gables (once the home of the artist Frank Salisbury) and then stop at the front of Rothamsted, by the large boulder.

 From oak tree, walk past Harpenden Town Football Club buildings to entrance of overflow car park, then turn right along access road towards main Amenbury Lane car park. Continuing in same direction, walk across to the far side where you turn left along an access road with double yellow lines both sides. Continue along the access road*, with the car park on the left, until you reach a road where you turn right downhill towards the Oddfellows Arms pub.

Just past the pub turn left, cross the road and walk across Leyton Green space. When you reach Leyton Road turn left and follow the path past Waitrose and M&S Food Hall while heading towards St Nicholas's Church tower. Cross Rothamsted Avenue with care and walk towards the church. Pass through the entrance gateway (black gate posts) and immediately turn half left towards some black railings which you follow to the first gap on the right. Stop just inside the churchyard.



Lawes' grave
Gilbert's grave

Warington's grave


12 Graves of Gilbert, Lawes and Warington:

Immediately on your left is the grave of Sir Joseph Henry Gilbert (1817 - 1901) and his second wife, Maria. Gilbert started working at Rothamsted in 1843, as a chemist and scientific collaborator of Lawes and was knighted in 1893 in recognition of his contribution to agricultural research.

 From Gilbert's gravestone walk nine paces directly towards the church and you will be beside the grave of Sir John Lawes.


Sir John Bennet Lawes lived from 1814 to 1900 and, with Gilbert, established

Rothamsted Experimental Station in 1843. Lawes was created a baronet by Queen Victoria in 1882. Sir John Lawes secondary school in Harpenden is named after him. His wife, Caroline, is commemorated here too. The adjacent grave is that of Marianne, John Lawes' mother, who died in 1876. (Confusingly, Lawes and his father had identical names).

 From a point midway between Lawes' and Gilbert's graves, walk along the broad grass track across the churchyard. At the far side of churchyard you reach a leaning Cupressus tree where you turn right along another broad grass track. After about 40m you will see, on the left, a memorial with a Celtic cross (cross within a circle).

This is the grave of Katherine Warington (1897 - 1993). She was a botanist and worked at Rothamsted for 36 years. One of her most significant discoveries was that boron is an essential plant nutrient. The Katherine Warington School, which opened in September 2019, is Harpenden's fourth secondary school and is named after her. The name was one of over 700 suggestions from pupils at primary schools in and around Harpenden. The name was suggested by Elizabeth Gilardo, an 8 year old pupil from St Dominic Catholic Primary School, who was "...surprised that Katherine had not been fully recognised for her achievements so her name becoming the school name would help that."

Q12. When he died in 1900, Sir John Lawes' estate was valued at about £500,000? What is the equivalent value today?

 Turn right and walk through the churchyard towards the church. When you reach an asphalt path, turn left and pass the Garden of Remembrance. Then turn right along a path by a brick-topped flint wall and follow the path around the church and back to the entrance gateway. From the church entrance, walk towards the war memorial, crossing the road with care. The war memorial bears the names of three people who worked at Rothamsted and died in WWI (K R Lewin) or WWII (J Olver & J R Williams) while serving with H.M. Forces. You are now back in the High Street - turn right and walk back to your starting point.

the field receive different fertilizer treatments, which have a considerable impact on crop yields. The field is divided crossways into 10 sections, which test different cropping treatments. For example, some sections have been sown with no crops other than wheat since 1843. In other sections, beans and oats are grown in rotation with wheat. The second section from this end of the field receives no herbicides, so is full of weeds, including some which are nationally rare or declining (e.g. corn buttercup (*Ranunculus arvensis*), shepherd's needle (*Scandix pecten-veneris*)). Broadbalk is the last site in the UK where corn cleavers (*Galium tricornutum*) occurs.

Q10. Apart from nitrogen, what are the other two most important major nutrients essential for plant growth?

Warning: The next section can be muddy with many large puddles in winter, so you may want to avoid this section. If so, continue on the farm road, passing the back of the Manor and follow the road as it bends left. You will come to the black metal gates on the right where you entered the Manor grounds. Retrace your outward route by turning left at the next road junction and continue down the avenue of lime trees. Don't turn right back toward the main Rothamsted site but continue down the avenue of lime trees along the gravel track until you reach the gate mentioned below* in Rothamsted Park. Follow directions from there.

Main route: Continue along the main farm road towards the brick outbuildings of the Manor but after only 60m leave the road and bear left on a footpath. After 93m, where the path meets an asphalt access road, turn left past a pair of brick cottages following the bridleway signposted to Rothampstead (sic, sic) Park. Follow the gravel track, which can be wet and muddy in winter, until it meets another track at the avenue of lime trees. Turn left down the avenue of lime trees, ignoring a path off to the right, and after 25m reach a metal gate. Stop just beyond the gate*.



11 Rothamsted Park

This was formerly a private part of the Rothamsted estate owned by Sir John Lawes but was bought by Harpenden Urban District Council in 1938 and subsequently opened to the public. The avenue of lime trees was planted by Lawes around 1880.

Warning: The next part of the route cuts across the grass of Rothamsted Park but, if you want to avoid this in wet weather, simply continue on the track down the avenue of lime trees and turn left on the footpath passing between buildings of the new Leisure Centre and continue straight on along the access road* mentioned below, where you re-join the main route.

Main route: Turn half left across the grass of Rothamsted Park. Head for a hedge corner half way between the mobile phone mast, just visible above the trees, and the skateboard area next to the Leisure Centre. At the hedge corner, bear right following hedge to end, then cross new car park to reach the prominent oak tree planted by St John Lawes on 20th June 1887, which is close to the mobile phone mast.

Stop by the tree to read the plaque.

Q11. Why was this oak tree planted by Sir John Lawes?



3 Rothamsted – Russell Building (built 1911–1918), facing the Common

Note the large Shap granite boulder commemorating the 50th anniversary (1893) of the start of Rothamsted's famous long-term field experiments. Across the lawn to the left is an oak tree (red oak, *Quercus rubra*) commemorating the 150th anniversary in 1993. The plaque on the base of the boulder, commemorating this anniversary, was unveiled by Queen Elizabeth II, who was the patron of Rothamsted Research.

Q3. Why is there nothing commemorating Rothamsted's 100th anniversary? (This was asked, quite innocently, by a German visitor!)

Main route: Walk up to Rothamsted's main access road (by the commemorative oak tree) and turn right into the main site. Walk up the path noting the new (2018) De Ramsey & Anova Courts visitor accommodation buildings, then the new (2015) conference centre buildings on the left with the curved Centenary Building (2003) on the right, with grass in front and an old cider-apple mill. Stop here.



Rothamsted Research studies the interactions between wild vegetation and farming practices in order to enhance biodiversity and make agriculture more sustainable. Over 450 plant species have been recorded on the estate.



4 Rothamsted Research

Does cutting-edge research in an extensive range of modern laboratories and on experimental farmland extending to over 400 hectares. In total, up to 1000 staff of 35 nationalities are based here and at three other locations in southern England. Current research themes include: sustainable agriculture to improve productivity and resilience; plant science relevant to improving crop performance and quality; innovative crop protection practices that minimise environmental impact; and analytical and computational science. For further information see: www.rothamsted.ac.uk

Q4. What was the major advantage of the synthetic pyrethroid insecticides first synthesised at Rothamsted in the 1970s within 50m of this spot, over natural compounds derived from the pyrethrum daisy (*Tanacetum cinerariifolium*), as growing here around the old cider-apple mill?

Opposite the cider-apple mill are the older conference centre buildings (pyramid shaped roof) with staff restaurant behind. This is open to the general public Mon to Fri, 09.00 - 15.00.

Main route: Continue up through the main site noting the Lawes Open Innovation Hub (2015) on the right, two thatched cottages (built in 1861 by John Lawes, close to extensive allotment gardens which then existed here) and then, on the left, the Pavilion and sports field. Continue until you reach the avenue of lime trees, planted around 1880, where you turn left. Walk along the grass verge of the farm road and, after 117m, stop at the display board on the left.



5 Rothamsted Insect Survey

Look across the sports field where you will see two chimney-like insect suction traps and, just to the right, a pylon-like structure, of similar height, which is part of the meteorological station. Rothamsted has been recording rainfall continuously since 1853 and temperature since 1873. The suction traps have been providing daily samples of insects, including pests such as aphids, since 1964. Traps of this Rothamsted design are used worldwide. You will see a moth trap further along the trail. The traps have now generated the longest continuous set of insect data in the world.

Q5. How many different species of aphid occur in the UK? Is it about 100, 300, 600 or 1000?

Continue on the verge for another 135m and stop at the next display board.



6 Field Phenotyping Platform

This is clearly visible in the adjacent field. Built in 2015, it is the world's first in-field automated measuring facility for crop growth and health. Crops can be monitored continuously by an array of sensors with the overall aim of improving crop yield and quality.

Q6. What does 'phenotyping' actually mean?

Continue walking on the verge up to the road T junction. Turn right here and then, after 105m, bear left and pass through the black metal gates and onto the permissive route into the grounds of Rothamsted Manor. Follow the drive, bearing left after 50m, and walk to the far end of the lawn where, under five lime trees, there is a display board about Rothamsted Manor.



7 Rothamsted Manor

John Bennet Lawes, the founder of Rothamsted, was born here in 1814. He was educated at Eton and Oxford and when he returned from university had one of the best bedrooms fitted out as a laboratory, much to his mother's dismay. Here he developed a process for producing phosphate fertilizers by treating bones and other phosphatic materials with sulphuric acid. He established a business based on his patented (in 1842) method for manufacturing superphosphate fertilizers and owned factories in London. He married Caroline Fountaine in 1842 and took his new bride on a boat trip on the Thames looking for a site for his first factory. Lawes wrote, with masterly understatement, "the loss of the (planned) Foreign tour was a great disappointment to my wife". They had two children – Charles (b. 1843) and Caroline (b. 1844). The income from the very successful fertilizer business enabled him to fund the research at Rothamsted. He sold his fertilizer business in 1872 and, with some of the proceeds, established the Lawes Agricultural Trust, the owners of the Rothamsted Estate.

Q7. What was the Manor used for during World War II?

Turn left, past the wooden gate, and follow the path until you see the display boards for the Park Grass experiment on the left, just before a metal field-gate.



8 Park Grass

This grassland experiment, started in 1856, is the oldest ecological experiment in the world. It is one of the seven Classical experiments started by Lawes and Gilbert between 1843 and 1856 still continuing today. The field is particularly impressive in May/early June, prior to being cut for hay, when the differences in the flora between plots is striking. Some plots contain 35 – 45 different plant species whereas others, especially some very acid plots, are dominated by a single species (e.g. sweet vernal grass, *Anthoxanthum odoratum*). This is entirely a consequence of different fertilizer (N, P, K mainly) and liming treatments as no seeds have been sown or herbicides used. Park Grass continues to provide important information on the impact of environmental and climatic changes on plant population dynamics and biodiversity.

Q8. Park Grass has been a grassland meadow since about when?

Warning: The next section of the trail passes through two kissing gates, which are not wide enough for buggies or wheelchairs. An alternative route is to retrace your steps to the black metal entrance gates to Rothamsted Manor, where you turn left and follow the farm road or new gravel path for about 700m, passing the back of the Manor and continuing all the way to where the road bends sharply to the right at stop 9.

Main route: Just beyond the Park Grass display boards turn right, following the gravel path into the woods. At a path junction, bear left and continue through the woods towards a metal gate. Note the disused moth trap just before reaching the gate. Go through the kissing gate and turn right down the track. Pass through another kissing gate and continue in the same direction until you reach a farm road at a bend. **Stop here.**



9 Broadbalk Wilderness

The narrow band of woodland immediately ahead, on the other side of the road, is Broadbalk Wilderness (yes, it is quite small for a wilderness!). It was part of the main Broadbalk wheat field until 1882 when it was fenced off and left. It is now an area of deciduous woodland (mainly ash, sycamore and hawthorn). Most of this part of Hertfordshire would probably come to look like this if all humans suddenly disappeared.

Q9. Wheat plants (derived from self-sown seed) continued to be found on this area after it was fenced off. For how many years do you think wheat plants could be found – one, four, ten or twenty years?

Turn right and follow the farm road or new gravel path to the end of the field on the left, which is Broadbalk. Where the hedge ends, by a large oak tree, stop at the main display boards, which are on the left.



10 Broadbalk field experiment

This was started in 1843 and is the oldest continuous arable experiment in the world. It is another of the Rothamsted Classical experiments. It was one of the first experiments to show conclusively that wheat, like most plants, obtains nitrogen from compounds in the soil, rather than from the atmosphere. The different strips running up