ROTHAMSTED RESEARCH

Rothamsted Experimental Station Guide

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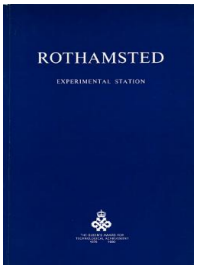

Soil

Rothamsted Research

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ROTHAMSTED FARM AND THE FIELD EXPERIMENTS

THE SOIL (see Map on p. 42) Numbers in brackets refer to fields marked on accompanying soil map.

The soils are in various superficial or drift deposits, including Clay-with-flints, valley Head deposits and river gravel, over Upper Chalk with nodules and layers of flint.

The Clay-with-flints, containing angular flints and flint pebbles in a clayey matrix, is more than 6 m thick in places. It is weathered debris of older sediments (chiefly Reading Beds) irregularly mixed with variable amounts of Chalk residue (chiefly angular flints) under periglacial conditions. On lower ground it is replaced or covered by younger drift deposits containing flint and other material from the older formations, together with wind-borne silt (loess), mixed and re-arranged by down-slope creep (Head) or by stream action. Thin spreads of loess-like drift ('brickearth') also occur on the higher ground, partly mixed with the Clay-with-flints below and modifying the texture of the soil.

Beneath the Ver valley floor are layers of flint gravel and silty alluvium laid down by the river in recent times.

The soils in these variable deposits have been classified by the Soil Survey of England and Wales, and the accompanying map indicates the approximate distribution of the soil series and other units identified.

Leached brown soils (Paleo-argillic and argillic brown earths). The main soils, on Clay-with-flints and flinty valley deposits, contain no naturally-occurring calcium carbonate, any originally present having been removed by leaching. They have brownish weathered subsurface horizons, with evidence of downward movement of clay-size particles.

Soils of the Batcombe series, which have a silty surface layer over Clay-with-flints, occupy most of the plateau east of the Ver valley. The topsoil is a greyish brown flinty silty clay loam with some 20–28% clay. This usually overlies a brown friable horizon of similar texture, which passes into stiff, brighter brown or yellowish red clay with scattered flints at 30–60 cm below the surface, but in places the clay is just below plough depth. Drainage is somewhat impeded by the clay, as shown by varicoloured mottling, black manganiferous deposits and grey-coated cleavage faces at depths below 45–60 cm, but neither ditches nor field drains are necessary for ordinary arable cropping. Where the Clay-with-flints thins on valley sides and spurs, the Batcombe soils are often replaced by those of the Winchester series, which have a subsoil layer of unmottled reddish plastic clay with large black-coated flints, resting irregularly on chalk at depths of 30–120 cm. These soils, which occur irregularly in and around Knott Wood (1), are grouped on the map with shallow (eroded) Batcombe soils in which the clay subsoil starts within 30 cm depth. Those of the latter kind are well represented in Barnfield (2) and Agdell (3), and in Summerdells (4), Claycroft (5) and Dell Piece (6). Smaller

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patches, each with some topsoil containing more than 30% clay, are in Broadbalk (7), Great Harpenden (8) and Hoosfield (9).

Especially in the northern part of the farm, the Clay-with-flints includes discontinuous sandy layers or pockets. The subsoils there are correspondingly variable, patches of red or yellowish sandy loam to sandy clay alternating with stiff flinty clay, and the topsoils commonly contain much more sand and less silt than elsewhere, giving clay loam or sandy loam rather than silty clay loam textures.

The Batcombe soils apparently incorporate a thin spread of silty loess-like material, mixed with the underlying Clay-with-flints. Thicker silty accumulations occur sporadically on the plateau, especially in shallow depressions at valley heads, and give deeper 'brickearth' soils like the Hook series. Typical profiles have brown subsurface horizons of friable silty clay loam with few flints, passing into a firmer, mottled subsoil. The largest and most homogeneous area of this variant extends from Whittlocks (10) through West Barnfield (11) into Long Hoos (12).

The remaining originally acid soils, grouped as the Charity complex, are in valley drift. Like those on Clay-with-flints, they usually have distinct finer-textured subsoil horizons at various depths, but are all well-drained, and have friable, more or less flinty surface and subsurface horizons of silt loam or silty clay loam texture. The largest area occupies the gentle footslope on the western side of the Ver valley. In Flint (13), Scout (14) and Osier (15) fields, the soil is locally so gravelly that augering is impossible below about 30 cm. Elsewhere, sometimes within a few metres, the drift contains few stones in the upper 80 cm, giving deep brown silty soils of the Hamble series. East of the Ver, Charity soils occur in the minor valley extending through Drapers (16) and Stubbings (17) fields into Knott Wood (1). Here the brown flinty subsoil rests on chalky drift. In the minor valleys that head on the plateau, the soils incorporate 'field-wash', accumulated since the land was first cultivated.

Calcareous soils (Brown calcareous earths and rendzinas). These are well-drained soils, on chalky drift or directly on solid chalk, that retain residual calcium carbonate and are consequently alkaline. They occupy slopes in Drapers (16), Webbs (18) and White Horse (19) fields and in Knott Wood (1). Texture, flintiness and calcium carbonate content change considerably over short distances. Most have a brownish subsurface horizon, but in others (rendzinas) the topsoil rests directly on fragmented chalk.

Alluvial and terrace soils (Alluvial gley soils, humic-alluvial gley soils and argillic brown earths). The alluvial soils in Ver (20) and Flint (13) fields have dark, friable, surface horizons with up to 15% organic matter. Sharp lateral variations in subsoil character can be related to small variations in ground-surface level and in turn to depositional history. Slightly raised terrace-like areas have loose flint gravel directly below the topsoil. In depressions, including former water-courses and ponds, nearly black surface horizons pass into greyish silt loam with rusty mottling, which is locally calcareous and overlies gravel.

Soil analysis. In its natural condition most of the soil on the plateau is acid. No area of the farm has soil that has not been influenced by management; probably the most nearly 'natural' soil is that of the unmanured and unlimed

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plots of Park Grass (21), with pH of 5·0–5·5. The old practice of excavating the underlying chalk and spreading it on the surface of arable fields gave them small reserves of calcium carbonate, Fields that follow our usual rotation of crops are limed once in 7 years to maintain an average pH value of 7·0. A few areas are deliberately kept acid.

The Classical experiments (see below) provide extremes of depletion and enrichment of P and K. Typical amounts are:

Field	Treatment since about 1850*	In soil now (mg kg^{-1}) P	K
Agdell	Nil	2	90
	PK	10	170
Barnfield	Nil	23	180
	PK	64	640
Broadbalk	Nil	8	100
	PK	80	360
Hoos Barley	Nil	5	90
	PK	130	430
Park Grass	Nil	5	60
	PK	130	670

* Amounts applied and periods differ from experiment to experiment.
Note: P is $NaHCO_3$-soluble; K is exchangeable.

WEATHER RECORDS

The meterological enclosure is in Great Field. In addition to the measurements returned to the Meteorological Office, others are made that are specially needed for agriculture or for use with the field experiments.

The observations cover a long period: rainfall (since 1852), drainage through bare soil, 20, 40 and 60 in. deep (50, 100 and 150 cm) (since 1870), air temperature (since 1878), and sunshine (since 1891). Rain, drainage, temperature, sunshine and radiation are continuously recorded. Daily observations include temperature measurements in the soil, under bare soil and turf, at

TABLE 1

Rothamsted weather: 10-year averages 1970–79 (and 1976 temperatures and rainfall in brackets)

	Mean air temperature °C	Rain (mm) (1)	Drainage (mm) (2)	Evaporation (mm) (3)	Sunshine (hours)	Daily solar radiation MJm^{-2}d^{-1} (4)
January	3·4 (4·9)	74 (27)	64	8	42	1·9
February	3·6 (3·9)	59 (26)	48	10	63	3·9
March	5·1 (4·5)	62 (18)	38	27	106	7·5
April	7·3 (7·6)	51 (22)	20	49	129	11·2
May	11·0 (12·1)	52 (22)	18	83	196	16·2
June	13·9 (17·2)	57 (17)	16	99	201	17·4
July	16·0 (18·5)	34 (42)	3	103	190	16·0
August	16·0 (17·5)	55 (9)	14	91	180	13·4
September	13·5 (13·5)	58 (106)	20	69	148	10·1
October	10·2 (10·5)	56 (123)	31	34	103	5·7
November	6·1 (5·7)	75 (83)	53	16	74	3·0
December	4·6 (1·5)	71 (87)	58	8	45	1·7
Total or mean	9·2 (9·8)	704 (582)	383	597	1477	9·0
Equivalent to	49°F (50°F)	27·7 in. (22·9 in.)	15·1 in.	23·5 in.		

Notes—(1) 1/1000th acre (0·0004 ha) gauge.
(2) Through 20 in. (50 cm) bare soil.
(3) Open water. 6×6 ft (1·8×1·8 m) sunken tank.
(4) Total (Kipp).

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