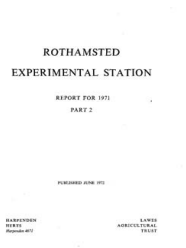
ROTHAMSTED RESEARCH

Rothamsted Experimental Station Report for 1971 Part 2



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The Soils at Saxmundham Experimental Station

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The Soils at Saxmundham Experimental Station

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Soil maps do not exist for the district around Saxmundham, and the nearest area that has been mapped by the Soil Survey is around Harleston (Sheet TM 28). However, from a general knowledge of the area acquired by examining sites of fertiliser trials, pipeline trenches and individual farms it seems probable that the soils at Saxmundham are typical of much larger areas of east Suffolk and south Norfolk where the soils are formed in Chalky Boulder Clay having surface layers containing much sand. Commonly, the surface within this district is a non-calcareous sandy loam, sandy clay loam, or sandy clay some 30–90 cm thick, which passes downwards into a calcareous, chalky, clay or silty clay. The junction between the layers often contain pockets of brown or grey loamy sand.

Dr. R. M. S. Perrin of Cambridge University (unpublished) has shown that the textural differences between these layers are consistent over many miles; the particle-sizes shown in Fig. 2 are selected from his analyses which are on a carbonate-free basis to bring out the differences between layers.

However, the thickness of the surface layer differs greatly over distances as short as one or two metres (Corbett & Tatler, 1970), because the interface with the chalky clay beneath is very contorted. When allowance is made for such contortions it seems that the surface layer is thickest on the high flat parts of the Boulder Clay 'plateau' distant from the main rivers, intermediate on gently sloping spurs flanking the high central sites, and thinnest on the steeper slope near the main valleys. The thickest deposits contain most sand and the most numerous sand pockets.

The origin of the sandy topsoil is debateable. Watt, Perrin and West (1966) suggested that the sands of the Breckland to the west are as likely as not windblown and Catt *et al.* (1971) indicated that topsoils in north-east Norfolk contain loessic material. Thus, a possible origin for the extensive surface layers of the Boulder Clay containing sand seems to be as windblown sand subsequently mixed with the clay till beneath.

The Saxmundham Field

The field is on a south facing valley side. The soil distribution fits the general pattern mentioned above; the thin sandier topsoils covering the clay subsoil are thicker on raised level ground near the road than on slopes. The sandier upper layers vary greatly in thickness. Fig. 1 shows the variation in midfield along the north side of the north-west section of Rotation I. The section was made from auger borings a yard apart. The thickness of the sandier topsoil ranges from 25 cm to 91 cm over a distance of 5 m. The sandy loam inclusion is conventionalised as a pocket, but examination of the pipeline section opened in 1969 some half mile to the south-east shows that the inclusions are usually thin veins or wedges. The curves of particle-size distribution in Fig. 2 are of samples from this trench.

The northern quarter of the Saxmundham field is gently sloping high ground (less than 1° slope) and mostly has sandy clay loam surface and sandy clay loam subsurface layers passing downwards to decalcified clay and then to clay with chalk stones. *On average* clay occurs below a depth of 60 cm. The soils are Surface Water Gleys of the Beccles series (Profile No. 1).

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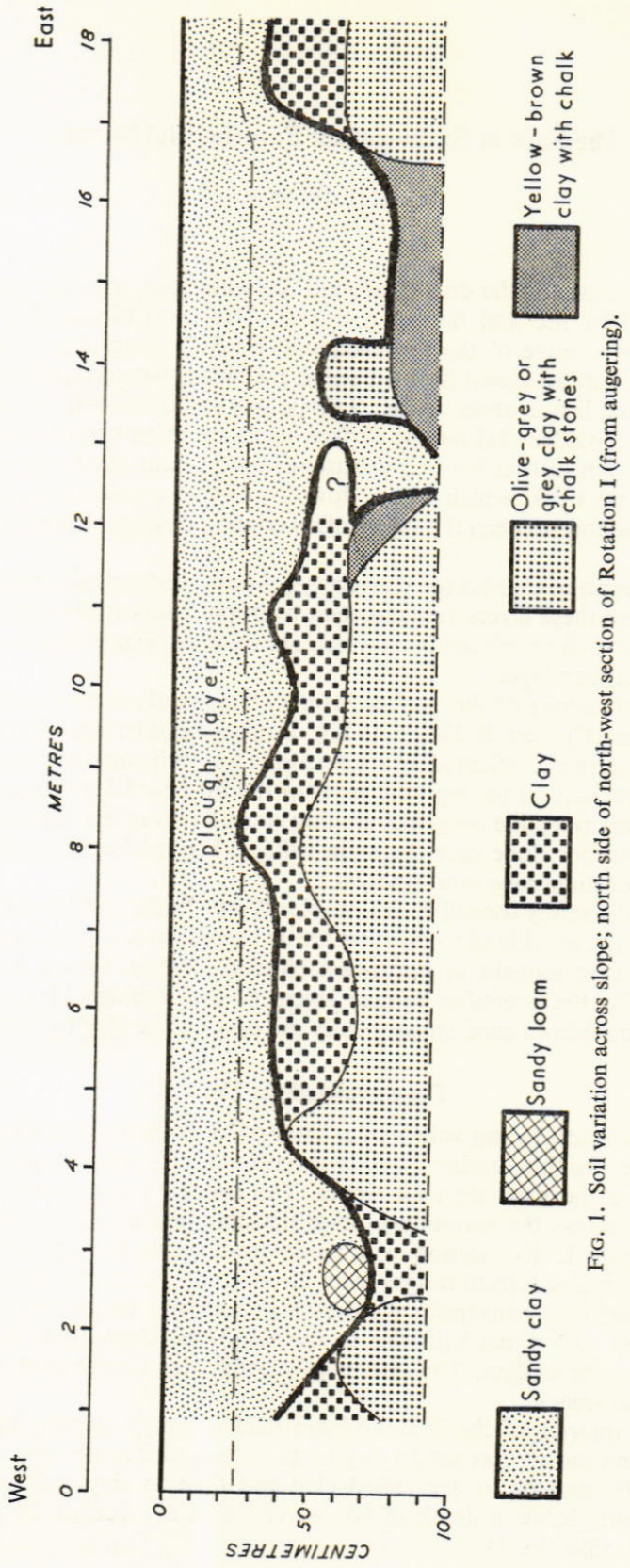

FIG. 1. Soil variation across slope; north side of north-west section of Rotation I (from augering).

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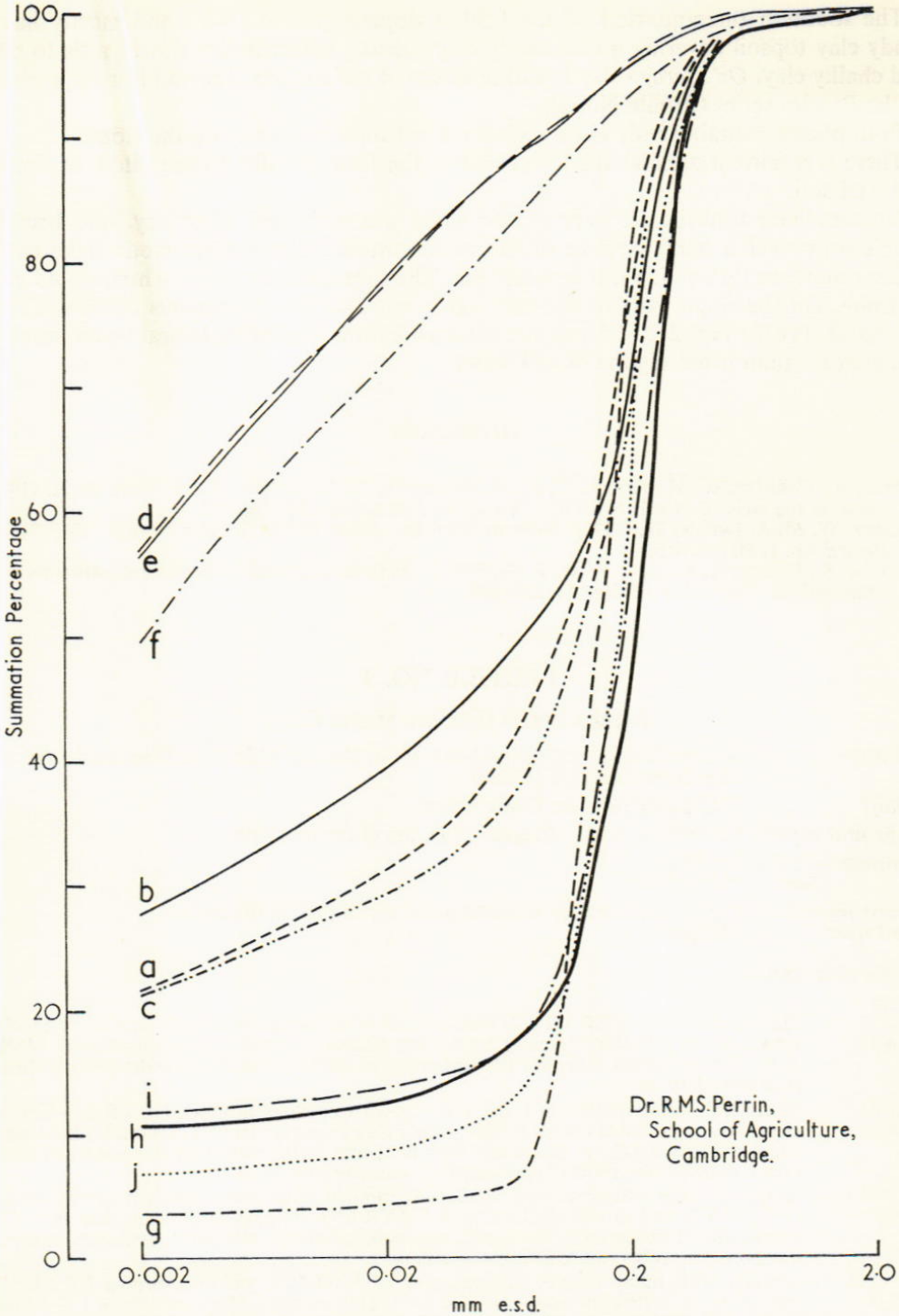

FIG. 2. Particle-size distribution, Suffolk Chalky Boulder Clay (carbonate free basis).

Topsoils
(a) Great Ashfield, Stowmarket 0–10 cm
(b) Saxmundham
(c) Yaxley, Diss 0–30 cm

Substrata
(d) Great Ashfield 2·6 m
(e) Saxmundham 1·15 m
(f) Yaxley 3·7 m

Sand pockets
(g) Great Ashfield 2 m
(h) Saxmundham 80 cm
(i) Yaxley 50 cm
(j) Haughley 78–90 cm

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The southern three-quarters of the field is sloping ground (1–3°) and mostly has a sandy clay topsoil covering a thin sandy clay subsoil, which passes downwards to clay and chalky clay. *On average* clay is within 60 cm of the surface. The soil is a slope phase of the Beccles series (Profile No. 2).

Both phases contain sandy loam inclusions but these are fewer on the slope.

There is a narrow zone at the lower end of the field, parallel to the ditch, of deeper colluvial soil.

Saxmundham topsoils are very plastic when wet and hard when dry, and become friable only over a narrow range of moisture contents. The surface clods slake easily under rain when the sand grains separate out. The subsoils have much ochreous and grey mottling. On the slope, part of the area has a more or less continuous ochreous, iron rich band (Profile No. 2 20–25 cm), an unusual feature suggesting lateral water seepage and a worse than usual regime of soil water.

References

Catt, J. A., Corbett, W. M., Hodge, C. A. H., Madgett, T. A., Tatler, W. & Weir, A. H. (1971) Loess in the soils of North Norfolk. *Journal of Soil Science* **22**, 444–452.

Corbett, W. M. & Tatler, W. (1970) Soils in Norfolk. Sheet TM 49 (Beccles North). *Soil Survey Record* No. 1, Harpenden.

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PROFILE NO. 1

Beccles Series (Surface Water Gley)

Locality: Saxmundham Experimental Field. Pit in Herbage plots 10 m from main road and 50 m from shed (TM 369638)

Relief: Undulating (Boulder Clay country)

Slope and aspect: Less than 1° to S. ***Height:*** 37 m, top of convex slope

Drainage—Profile: Imperfect
Site: Normal site

Parent material: Chalky Boulder Clay with additional coarse drift in the surface
Land use: Ploughed

Profile description

cm	
0–28 Ap	Dark greyish brown (10 YR 3/2) with patches of Bg horizon ploughed into it; sandy clay loam; stones 1%, flints greater than 1 cm diameter; weak coarse sub-angular blocky clods; friable (moist) to slightly plastic (wet); few visible pores; few fine dead roots, abrupt even boundary to:
28–53 Bg1	Many fine, faint mottles in range grey–brown to yellowish-brown (10 YR 5/2–5/5), no clearly distinguishable matrix colour; sandy clay loam; less than 1% stones, flints; weak angular blocky structure, coarse and very fine; firm to friable; many fine pores; no roots except decayed tree roots (3 cm diameter); merging even boundary to:
53–76 Bg2	Brown to light olive-brown (2·5 YR 5/4) mottled with many medium strong brown (7·5 YR 5/6) and coarse distinct, grey (10 YR 6/1) mottles; sandy clay, less than 1% stones, flints; moderately developed, medium, prismatic structure; moderate numbers fine pores; no roots; merging even boundary.
76–104 Bg3	Mottled with many coarse, distinct, grey (7·5 YR 6/0), yellowish-brown (10 YR 5/5) and olive to yellowish-brown (10 YR 2·5 Y 5/4) mottles; clay; less than 1% stones, flints; moderately developed, medium, prismatic structure; very firm; a few fine pores; no roots; merging uneven boundary; in some places this layer is missing, and Bg2 passes to Bg3.
104+ IIB/Cg	Grey (7·5 YR 6/0) with coarse distinct greyish brown (10 YR 5/2) and yellowish-brown (10 YR 5/4) mottles. Olive tinge and grey in fine root channels; clay but sandy loam in places; 5% stones, chalk and flints; moderately developed, medium prismatic structure; very firm; a few fine pores; no roots; secondary $CaCO_3$.

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Analytical Results

Horizon depth (cm)	0–28	30–50	56–71	81–99	107–117
Particle size distribution %					
2 mm–1 mm	0·7	1·1	0·5	0·7	1·8
1 mm–500 μ	1·8	1·7	1·2	1·2	1·7
500 μ–200 μ	24·3	22·5	24·3	10·6	9·9
200 μ–100 μ	19·8	18·2	17·0	8·4	7·2
100 μ–75 μ	3·5	3·4	2·4	2·0	1·9
75 μ–20 μ	12·7	11·8	9·6	10·0	9·3
20 μ–2 μ	11·8	13·5	10·1	16·6	25·9
<2 μ	25·3	27·8	34·9	50·6	42·3
$CaCO_3$ equivalent %	0·6	tr	tr	0·2	24·1
Chemical analyses					
Organic C %	1·8	0·6	0·3	—	—
N %	0·17	0·07	0·04	—	—
C/N ratio	11	9	8	—	—
pH in water (1 : 2·5)	7·8	7·9	8·2	8·2	8·3
pH in *M*/100 $CaCl_2$	7·4	7·4	7·5	7·5	7·8
Free iron (Deb) % Fe_2O_3	2·0	2·4	2·2	3·6	2·5
Exchangeable cations					
Cation exchange capacity me/100 g	20·5	17·8	19·6	26·5	20·2

PROFILE NO. 2

Beccles Series slope phase (Surface Water Gley)

Locality: Saxmundham Experimental Field. Pit to west of plot 10 in the north-west block of Rotation I midway between plot and ditch and halfway down plot (TM 368637)

Relief: Undulating (Boulder Clay country)

Slope and aspect: 2–3° slope to south, midpoint of convex slope. ***Height:*** 34 m

Drainage—Profile: Poor
Site: Slightly receiving site

Parent material: Chalky Boulder Clay; slight surface contamination

Land use: Winter wheat

Profile description

cm	
0–20 Ap	Dark greyish brown (10 YR 4/2 poor match) sandy clay loam; 2% stones, flints; clods breaking into sticky fragments; slightly plastic and sticky; no visible pores; some fine roots; abrupt slightly wavy boundary.
20–25 Bg1	Yellowish-brown (10 YR 5/6) with common fine faint yellowish-brown mottles (10 YR 5/4) with an olive tinge; sandy clay; 2% stones, flints; moderately developed, medium angular blocky structure; firm; a few fine pores; some fine roots; rare MnO_2 concretions; clear slightly wavy boundary to.
25–35 (48) Bg2	Grey (10 YR 6/1) clay with distinct, medium common mottles of yellowish-brown (10 YR 5/4) sandy clay in some patches; 1% stones, flints; moderate to strongly developed medium prismatic structure; firm; a few fine pores; roots rare; clear wavy boundary.
35(48)–91+ B/Cg	Grey (7·5 YR 5/0 and 6/0) with distinct, common, sharp edged mottles of yellowish-brown (10 YR 5/4); grey colours in fine root channels; clay; 5% stones mainly chalk with flints; moderately developed coarse angular blocky structure; very firm; some fine pores; roots rare.

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Analytical Results

Horizon depth (cm)	0–18	23–28	30–43	48–60
Particle size distribution %				
2 mm–1 mm	0·9	1·0	0·5	0·9
1 mm–500 μ	2·5	2·3	1·1	1·1
500 μ–200 μ	22·6	22·5	6·4	5·5
200 μ–100 μ	18·7	14·7	13·7	5·9
100 μ–75 μ	3·4	2·6	2·3	1·8
75 μ–20 μ	11·5	8·6	17·9	9·7
20 μ–2 μ	11·4	7·9	13·8	29·0
<2 μ	28·8	40·3	44·3	46·0
$CaCO_3$ equivalent %	1·3	0·4	tr	29·2
Chemical analyses				
Organic C %	1·2	0·5	0·5	0·6
N %	0·13	0·06	0·06	0·05
C/N ratio	9	8	8	12
pH in water (1 : 2·5)	8·2	8·3	8·3	8·4
pH in *M*/100 $CaCl_2$	7·7	7·7	7·7	7·7
Free iron (Deb) % Fe_2O_3	2·0	4·4	3·1	2·5
Exchangeable cations				
Cation exchange capacity me/100 g	20·0	22·1	24·4	18·9

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