ROTHAMSTED RESEARCH

The Soil at Rothamsted

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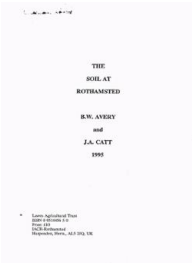

Salient Soil Properties

Rothamsted Research

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The map legend (Table 3) includes 13 units identified in all but one case by names of the dominant soil series as now defined. 'Typical' and 'heavy' phases of the Batcombe series are set apart on a textural basis and the locally variable soils on the Ver valley floor are grouped as the Ver complex. A further unit comprises unsurveyed and/or disturbed (made) ground, including pits and 'dell-holes'.

It is now generally recognized that soil-series mapping based on field examination of the soil profile at sampling sites is subject to errors arising firstly from short-range lateral variability and secondly from the limited precision of field estimates of differentiating properties defined in quantitative terms. Thus the bodies of soil represented by mapping delineations normally include profiles conforming to more than one soil series. A map unit is conventionally identified by a single series name when it is predicted that most of the soil in every delineation conforms to it and that unconforming inclusions are similar for practical purposes or occupy negligible proportionate areas. Undifferentiated units, estimated to include substantial but variable proportions of two or more closely related series, are identified by the names of the two most extensive (e.g. Batcombe-Carstens); units comprising significant proportions of contrasting series in each delineation are distinguished as complexes.

Salient Soil Properties

General profile characteristics

As indicated in earlier accounts, the undisturbed soils are readily divisible into three broad classes as follows:

1. Well drained calcareous soils (rendzinas and brown calcareous earths) on Chalk or chalky drift.
2. Well drained to moderately well drained, originally acid soils (nearly all paleo-argillic or argillic brown earths) on Clay-with-flints and in other non-calcareous or superficially decalcified drift over Chalk.
3. Low lying soils (groundwater gley soils, including argillic, humic and humic-alluvial gley soils) over river gravel, that show signs of periodic saturation by groundwater in the recent past.

Soils of the first class, confined to sloping land on the eastern side of the Ver valley, have relatively simple profiles in which the topsoil rests more or less directly on fragmented chalk (rendzinas) or overlies a brown subsurface (B) horizon of similar texture (brown calcareous earths).

Soils of the second class, which are by far the most extensive, nearly all have brown to yellowish-red subsoil horizons of noticeably finer texture (argillic Bt horizons), either directly below the topsoil or at greater depths beneath a less strongly coloured and more friable subsurface (Eb) horizon. In both cases the increase in clay content with depth is at least partly attributable to downward translocation of clay-size particles, though on the Clay-with-flints, as mentioned above, it is accentuated by the presence of a more silty superficial layer rich in loess-derived material. Soils in the thicker loess-containing deposits of Devensian age (argillic brown earths) have B horizons that are less brightly coloured than the Clay-with-flint subsoils, which are normally strong brown

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(7.5YR5/6) to yellowish red (5YR5/6-8) and show additional micromorphological features (Avery & Bullock 1969; Avery *et al.* 1972) attributed to soil development in one or more earlier interglacial stages of the Quaternary. Soils with B horizons of this kind have been grouped as paleo-argillic brown earths in England and Wales, and are typically more strongly leached and weathered than younger soils in parent materials of originally similar composition. Those on Clay-with-flints include typical paleo-argillic brown earths (Carstens and Winchester series) with uniformly coloured B horizons, and stagnogleyic paleo-argillic brown earths (Batcombe and Hornbeam series) in which the B horizons show varicoloured mottling within 60 cm depth, indicative of reduction/mobilization and redeposition of iron (gleying) under periodically water-saturated conditions.

Following construction of the Redbourn by-pass, soils of the third class are of very limited extent, occurring only in Flint Field and the adjoining Ver Spinney (Fig. 1). They have very dark coloured topsoils rich in organic matter and greyish gleyed subsurface horizons with ochreous mottles and streaks.

Texture and stoniness

As the topsoils generally contain substantial proportions of loess-derived material, they are predominantly silty in texture. Over at least 75 per cent of the area mapped, the estimated particle-size (textural) class is silty clay loam (Fig. 2b), or silt loam according to the U.S.D.A. system (Fig. 2a), with between 18 and 27 per cent clay and less than 20 per cent sand (60 μm - 2 mm). Topsoils of finer texture, mainly heavy silty clay loams with 27-35 per cent clay, occur chiefly on upper slopes susceptible to erosion, as in Barnfield (Avery *et al.* 1972) and Claycroft, and only sporadically on the plateau. Lighter soils, mainly silt loam or sandy silt loam containing less than 18 per cent clay, have been recorded only in parts of Flint, Scout, Ver and Osier fields (Fig. 1).

The topsoils nearly everywhere contain angular, or angular and rounded, flint stones in proportions which locally exceed 15 per cent by volume. Under old grass, as in Highfield (profile 13), they are concentrated in a layer some 10-20 cm below the surface as a result of earthworm activity. Of the predominant 'Clay-with-flint soils' (Batcombe, Carstens and Winchester Series), those on the nearly level plateau are generally less stony than on bordering slopes, and the subsoils contain fewer but larger flints. Average weights per acre of stones (> 6 mm) in successive 23 cm layers, quoted for the chief experimental fields by Hall (1917), exemplify these trends. Thus the surface layer of Barnfield is significantly more stony than those of Broadbalk and Hoosfield but not quite as stony as Agdell, and the topsoils of both Barnfield and Broadbalk are on average two to three times more stony than the subsoils at 46-69 cm. In the generally loamy soils at lower levels, however, the subsoils are in places much more stony than the topsoils, particularly alongside and west of the R. Ver in Flint, Osier and Scout fields (Fig. 1).

Mineralogy

The mineralogy of the fine earth < 2 mm has been studied only in Batcombe and associated soils in Broadbalk (Weir *et al.* 1969) and Barnfield (Avery *et al.* 1972). The results indicate that the Batcombe soils in both fields are developed in a relatively silty (loess-containing) superficial deposit overlying and mixed with the Clay-with-flints. The fine sand and more particularly the coarse silt fractions of the latter contain around 95

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