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An introduction to the soils of the Geraldton advisory district

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National Soil Conservation Program (Australia)
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AN INTRODUCTION TO THE

OF THE

GERALDTON

ADVISORY DISTRICT

- descriptions, illustrations and notes on eight common soils

COMPILED BY T.C. STONEMAN

WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE
Foreword

*Description, illustrations and notes on eight common soils*

This publication is one of a series dealing with soils commonly occurring, or of particular significance, in the wheatbelt advisory districts of the Department of Agriculture. The districts regarded as 'wheatbelt' are Geraldton, Three Springs, Moora, Northam, Merredin, Narrogin, Katanning, Lake Grace, Jerramungup, Albany and Esperance (see map below). Most of the publications will be in this format, but those for Merredin and Northam will be rather more comprehensive in coverage of the soils, landscapes and agriculture of their respective districts.

The publications have the objective of encouraging and aiding recognition by advisory staff and farmers of different wheatbelt soils and the development of a greater appreciation of the influence that soil characteristics have on agricultural productivity and land capability.

Particular points to note with respect to the terminology and descriptions used in the publication follow:

Australian Great Soil Groups - the names used follow the identifications discussed by Stace et al. (1968) 'A handbook of Australian soils'.

Northcote Soil Classification - as described in Northcote, K.H. (1979) 'A factual key for the recognition of Australian soils'.

Soil profile sketches - these line drawings interpret the profiles presented in the matching colour photographs.

Colour photographs - many of the colour photographs show a darker coloured vertical band of soil on either side of the depth tape. This strip has been moistened and is intended to indicate moist and dry soil colours.

Soil colours - the common names used in soil descriptions are standard names derived from Munsell soil colour charts.

pH values - all pH values recorded in the text are in 1:5 soil:water. Values in 0.01 M CaCl₂ are also given in the descriptions of soil profiles.

Soil maps - the maps indicating where each soil most commonly occurs are derived from interpretations of Sheet 5 of the Atlas of Australian Soils (Northcote et al. 1967).

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The Geraldton advisory district

The Geraldton office of the Department of Agriculture services an advisory district embracing the shires of Greenough, Irwin, Mingenew, as well as those parts of the shires of Chapman Valley, Morowa, Mullewa and Northampton within the agricultural zone. The district has an area of approximately 2.2 million hectares and has about 1300 farms.

Geologically, the district can be divided into two major areas: that east of the Darling Fault (running in a line extending through Mullewa and Three Springs), is primarily granites of Precambrian Age (i.e. older than about 2,500 million years), while the country to the west is underlain by a variety of younger marine and continental deposits, mainly sandstones and siltstones.

The eastern part of the district has a mature landscape drained by very low gradient salt lake channels. In the Geraldton - Northampton area, erosion of the sedimentary rocks has produced a distinctive landscape of flat topped hills with extensive areas of gently sloping land with mature valleys. Extensive areas of yellow sandplain blanket large areas west of the Darling Fault. The western half of the district is drained by a number of rivers, the main ones being the Hutt, Bowes, Chapman, Greenough, Irwin and Lockier.

The soils east of the Darling Fault are dominated by extensive areas of red earths (Soil 4) and acidic yellow earths (Soil 5). West of the Fault very extensive areas of undulating sandplains occur, e.g. the so-called Eradu sandplain. Soils 2, 3 and 8 provide examples of the range of sandy soils which are present. More dissected country occurs associated with the active river systems and provides a variety of duplex soils and red earths on the valley sides and river flats (Soil 1 and Soil 6). On the Greenough Front Flats, fine textured alluvia have been deposited (Soil 7).

Agricultural land use in the advisory district is almost entirely wheat and sheep farming, with lupin cropping of considerable significance.

References to soils in the Geraldton District


Further reading


Soil profile description
(See Figure 1, colour photograph inside back cover)

- 0-10 cm reddish brown loamy sand, pH 6.4 (5.3 CaCl₂)
- 10-50 cm yellowish red sandy clay loam, pH 6.3 (5.9 CaCl₂)
- 50-100 cm yellowish red sandy clay, pH 6.4 (5.8 CaCl₂)
- 100 cm + decomposing granulite

Distinguishing features
- The profile is mainly yellowish red and consists of a loamy sand over sandy clay loam at about 10 cm depth on sandy clay at about 50 cm. Decomposing granulite appears at approximately one metre.
- The soil is slightly acidic in reaction throughout the profile.
- The soil occurs on valley slopes of dissected country associated with active river systems.
- The native vegetation was probably mainly *Acacia acuminata*, *A. nostellifera*, *Hakea preissii* and *Eucalyptus loxophleba*.
- Map 1 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry and drainage - good.

Soil workability - good, but rock outcrops create problems for cultivation and land management.

Water holding capacity - good, except where limited by shallow rock.

Nutrient status - reasonable, apart from phosphorus.

Agronomic considerations

Crops - given appropriate fertilizer and rotation practices, cereals and lupins grow well.

Pastures - subterranean clovers are the appropriate pasture legumes.

Soil conservation

Water erosion can occur in cultivated paddocks, particularly where rock outcrops or very shallow rock initiate run-off. Contour working and contour earthworks are frequently necessary.

Water conservation

The soil is suitable for natural surface water catchments, but sites for farm dams are usually severely limited by shallow rock.
Classification
Australian Great Soil Group: Earthy sand
Northcote: Uc 5.22 Local name: Eradu sandplain

Soil profile description
(See Figure 2, colour photograph inside back cover)

0-15 cm very pale brown loamy sand,
pH 6.4 (5.3 CaCl₂)

15-200 cm+ yellow clayey sand, pH 6.5 (5.6 CaCl₂)

Distinguishing features
- The profile is yellow clayey sand to two metres depth.
- The soil is slightly acidic in reaction.
- The soil occurs on extensive undulating plains.
- The native vegetation is low and medium height heath.
- Map 2 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry and drainage - good.
Soil workability - good.

Limitations
Water holding capacity - low.
Nutrient status - low.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, cereals and lupins grow well - lupins are particularly suited to this soil.
Pastures - lupins and medics are the appropriate legumes.

Soil conservation
Wind erosion can be a problem following overgrazing in the summer - autumn period and during crop establishment. Vegetative cover must be retained at all times.

Water conservation
The soil is unsuitable for dams or for water catchments.
Soil profile description

(See Figure 3, colour photograph inside back cover)

- **0-10 cm grey sand, pH 6.3 (5.6 CaCl₂)**

- **10-50 cm light grey sand, with very few ferruginous nodules, pH 6.5 (5.6 CaCl₂)**

- **50-100 cm pale yellow sand, with very many ferruginous nodules, pH 6.4 (6.1 CaCl₂)**

- **100-180+ cm red with many yellow mottles, sandy loam, with very many soft ferruginous nodules and pockets of pale yellow sand, pH 6.0**

**Distinguishing features**

- The profile is approximately half a metre of pale yellow sand, over a second half metre of very gravelly sand, over a red and yellow mottled sandy loam with much soft gravel.

- The soil is slightly acidic in reaction throughout the profile.

- The soil is distributed as variable sized occurrences on extensive undulating sandplains. The associated soils are mainly earthy sands (Soil 2).

- The native vegetation is low to medium height sandplain heath.

- Map 3 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

*Favourable attributes*

- Soil workability - good.
- Water entry and drainage - good.

*Limitations*

- Nutrient status - low, especially for phosphorus and potassium.
- Water holding capacity - low.

*Agronomic considerations*

- Crops - lupins are a more profitable crop than cereals on this soil.
- Pastures - lupins are much more reliable as a pasture than subterranean clovers or medics.

Soil conservation

Because of the sparse groundcover common with pastures and grazed cereal stubbles, wind erosion is common. Minimum cultivation, careful stubble management and grazing control are essential.

Water conservation

The soil is unsuitable for water catchments or for dam construction.

Map 3
Soil 4. Geraldton advisory district

**Classification**

Australian Great Soil Group: Terra rossa

Northcote: Gn 2.12

Local name: Heavy land

**Soil profile description**
(See Figure 4, colour photograph inside backcover)

- 0-8 cm reddish brown loamy sand, pH 6.6 (5.6 CaCl₂)
- 8-30 cm red sandy loam, pH 6.4 (5.5 CaCl₂)
- 30-80+ cm calcrete

**Distinguishing features**

- The profile is red, loamy sand to sandy loam texture and overlies a calcareous hardpan (calcrete) at shallow depth (30-60 cm).
- The shallow soil is slightly acidic in reaction, but overlies a highly calcareous hardpan.
- The soil occurs extensively on plains and gentle flanking slopes.
- The native vegetation is dominated by York gum (*E. loxophleba*).
- Map 4 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Nutrient status - reasonably good, apart from phosphorus.
Soil workability - good.
Water entry and drainage - good, but drainage limited in wet periods by shallow hardpan.

Limitations
Water holding capacity - limited by shallow soil depth.

Agronomic considerations
Crops - in reasonable rainfall years wheat grows well, but yields are limited by shallow rooting depths because of the presence of hardpan.
Pastures - medics are the appropriate pasture legume.

Soil conservation
Sheet erosion by water, local flooding in wet periods, and soil salinity where shallow groundwaters are present are the main problems. Surface water control is frequently required, and the adoption of minimum cultivation systems and good stubble management is necessary.

Water conservation
The soil provides good natural water catchments, but is unsuitable for dam construction.
**Classification**
Australian Great Soil Group: Earthy sand
Northcote: Uc 5.22
Local name: Wodjil sand

**Soil profile description**
(See Figure 5, colour photograph inside back cover)

- 0-10 cm yellowish brown sand, pH 5.0 (4.2 CaCl₂)
- 10-30 cm strong brown sand, pH 5.0 (4.1 CaCl₂)
- 30-60 cm brownish yellow sand
- 60-120+ cm yellow clayey sand, pH 4.5 (4.1 CaCl₂)

**Distinguishing features**
- The profile is generally dull yellow throughout, with a slight increase in texture from sand at the surface to clayey sand below 60 cm.
- The soil is acidic to strongly acidic in reaction throughout.
- The soil occurs extensively on undulating plateau areas.
- The native vegetation is a medium height heath, including *Acacia* sp. (wodjil), *Eucalyptus* spp. (mallee) and *Melaleuca* spp.
- Map 5 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry and drainage - good.
Soil workability - good.

Limitations
Nutrient status - low inherent fertility and very acidic soil conditions severely restrict agricultural productivity.
Water holding capacity - low.

Agronomic considerations
Crops - cereal rye, triticale and oats are the most tolerant of the cereals to acidic soil conditions. Lupins grow well provided soil depth is adequate.
Pastures - subterranean clovers can be grown if acidity is not severe. Medics are not suitable.

Soil conservation
Crops and pastures are usually sparse, and wind erosion following summer grazing and during crop establishment can be severe under poor management. Minimum cultivation systems with good stubble management are required.

Water conservation
The soils are unsuitable for dams and for catchment areas.
Soil 6. Geraldton advisory district

**Classification**
Australian Great Soil Group:
Red brown earth (truncated profile)  
Northcote: Dr 2.13  
Local name: Red heavy land

**Soil profile description**
(See Figure 6, colour photograph inside back cover)

- 0-15 cm dark red loam, pH 6.8 (5.0 CaCl₂)
- 15-60 cm reddish brown medium clay, pH 7.5 (6.1 CaCl₂)
- 60-120+ cm reddish brown medium clay with calcareous nodules common, pH 9.0 (7.8 CaCl₂)

**Distinguishing features**
- The profile is red throughout, and consists of a shallow loam horizon overlying medium clay which contains calcium carbonate below 60 cm depth.
- The soil is neutral in reaction at the surface, but is strongly alkaline below 60 cm.
- The soil occurs mainly on undulating valley plains and terraces.
- The native vegetation is dominated by York gum (*E. loxophleba*).
- Map 6 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water holding capacity - good.
Nutrient status - good, apart from phosphorus.

Limitations
Water entry and drainage - limited by shallow clay horizon and sometimes by soil structure deterioration.
Soil workability - reasonable, except where surface soil structure deterioration has produced a very hardsetting soil surface.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, all cereal crops can be grown satisfactorily.
Pastures - medics are the appropriate pasture legume.

Soil conservation
Sheet water erosion occurs on cultivated land and soil salinity problems are present in limited areas where shallow groundwaters occur.
Minimum tillage systems, good stubble management and adoption of contouring are desirable to minimize land degradation.

Water conservation
The soil provides good surface water catchments and dam sites.
Soil profile description
(See Figure 7, colour photograph inside back cover)

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Description</th>
<th>pH</th>
<th>CaCl₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>Dark greyish brown with orange mottles common, silty clay loam</td>
<td>6.8 (5.6 CaCl₂)</td>
<td></td>
</tr>
<tr>
<td>15-30</td>
<td>Brown silty clay</td>
<td>7.2 (5.4 CaCl₂)</td>
<td></td>
</tr>
<tr>
<td>30-75</td>
<td>Yellowish brown medium clay</td>
<td>7.6 (6.4 CaCl₂)</td>
<td></td>
</tr>
<tr>
<td>75-100</td>
<td>Dark yellowish brown medium clay</td>
<td>8.3 (7.1 CaCl₂)</td>
<td></td>
</tr>
<tr>
<td>100-145</td>
<td>Brown medium clay with few calcareous nodules</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>145-165+</td>
<td>Brown sandy clay loam with very few calcareous nodules</td>
<td>8.7 (7.7 CaCl₂)</td>
<td></td>
</tr>
</tbody>
</table>

Distinguishing features
- The profile is brown and yellowish brown, and increases in texture gradually with depth from a silty clay loam at the surface through silty clay to medium clay by 30 cm. Below 1.5 m a lighter textured sandy clay loam horizon occurs, presumably reflecting the alluvial origins of the soil.
- The soil is neutral in reaction at the surface, becoming strongly alkaline below one metre.
- The soil occurs mainly on a riverine plain (the Greenough Front Flats) in association with areas of gilgai soils.
- The remnant native vegetation is mainly Acacia rostellifera.
- Map 7 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

*Favourable attributes*

- Water holding capacity - high.
- Nutrient status - very good.

*Limitations*

- Water entry and drainage - slow.
- Soil workability - successful cultivation limited to a narrow range of soil water content; soil very hard when dry, slippery and unworkable when wet.

*Agronomic considerations*

- Crops - cereal crops grow well. This soil is particularly favoured for hay crops.
- Pastures - medics are the appropriate pasture legume.

Soil conservation

*Waterlogging in wet periods is common due to poor internal and external drainage.*

*Water conservation*

The soil is suitable for surface water catchments if enough slope is present to allow run-off. Potential dam sites require test boring to ensure the clay soil is not underlain by more permeable layers.
Classification
Australian Great Soil Group: Siliceous sand
Northcote: Uc 2.21
Local name: Pale yellow sands

Soil profile description
(See Figure 8, colour photograph inside back cover)

0-15 cm grey sand, pH 6.8 (5.9 CaCl₂)

15-75 cm pale yellow sand, pH 6.6 (5.3 CaCl₂)

75-110 cm yellow sand, pH 6.3 (5.6 CaCl₂)

110-175+ cm yellow clayey sand, pH 6.5 (5.7 CaCl₂)

Distinguishing features
- The profile is a deep sand, pale yellow becoming yellow with depth and increasing slightly in texture to clayey sand.
- The soil is slightly acidic in reaction throughout the profile.
- The soil occurs over extensive areas of gently undulating plateaus, often associated with areas of earthy sands (Soil 2) and lateritic podzolics (Soil 3).
- The native vegetation is low to medium height sandplain heath.
- Map 8 provides an indication of the area within which this soil most commonly occurs in the Geraldton advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry and drainage - good.
Soil workability - good.

Limitations
Water holding capacity - low.
Nutrient status - low, especially phosphorus and potassium.

Agronomic considerations
Crops - lupins are well suited to this soil. Given appropriate fertilizer and rotation practices cereals can be grown, but have relatively low yield potential.

Pastures - subterranean clover is the appropriate pasture legume.

Soil conservation
Wind erosion following summer grazing and during crop establishment can be severe under poor management. Minimum cultivation systems with good stubble management are required.

Water conservation
The soil is unsuitable for water catchments or for farm dams.
FIGURE 1. Yellow earth (Red loams)

FIGURE 2. Earthy sand (Eradu sandplain)

FIGURE 3. Siliceous sand with colluvial gravel (Sand over gravel)

FIGURE 4. Terra rossa (Heavy land)

FIGURE 5. Earthy sand (Wodjil sand)

FIGURE 6. Red brown earth (Red heavy land)

FIGURE 7. Wiesenboden (Greenough flats)

FIGURE 8. Siliceous sand (Pale yellow sands)