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An introduction to the soils of the Moora advisory district

T C. Stoneman

National Soil Conservation Program (Australia)

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AN INTRODUCTION TO THE SOILS OF THE MOORA ADVISORY DISTRICT
- descriptions, illustrations and notes on eight common soils

COMPILED BY T.C. STONEMAN

DEPARTMENT OF AGRICULTURE-WESTERN AUSTRALIA
Foreword

Descriptions, 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 Western Australian 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 land capability.

Particular points to note with respect to the terminology and descriptions used in this 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 soil colour in comparison with the adjacent dry soil colour.

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

pH values - all pH values recorded in the text are from a 1:5 soil/water extract. Values in 0.01 M calcium chloride (CaCl₂) are also given in the soil profile descriptions.

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).

Particular acknowledgement is made for funds provided by the National Soil Conservation Program to assist the Department of Agriculture undertake this project.

*T.C. Stoneman - formerly Principal Officer, Soil Conservation Branch, Department of Agriculture. Present address 112 Rosedale Street, Floreat 6014
The Moora advisory district

The Moora Office of the Department of Agriculture services an advisory district embracing the shires of Moora, Victoria Plains, Wongan-Ballidu, Dalwallinu, Dandaragan, and parts of Chittering and Gingin, within the agricultural zone. The district has an area of approximately 2.6 million hectares and has about 1200 farms.

Geologically, the district can be divided into two major areas; that east of the Darling Fault (which runs approximately north-south through Moora) is primarily granites of Precambrian Age (i.e. older than about 2500 million years), while the lands to the west are underlain by a variety of marine and continental deposits of limestone, sandstone, shale and siltstones, some calcareous, some not. Most are younger than 150 million years and some near coastal areas are less than 10 million years old.

Topographically, most of the country east of the Darling Fault has a mature landscape with little relief between the valley floors and the divides. External drainage of this area consists of low gradient salt lake channel systems which only flow in periods of exceptionally high rainfall. Closer to the Darling Fault, but still to the east of it, is an area with appreciably more dissection and effective external drainage due to uplift on the eastern side of the Darling Fault and resultant eating back of the water courses. These generally westerly flowing streams enter the Coonderoo and Moore River, which eventually exits to the Indian Ocean at Guilderton.

The western part of the advisory district is drained by the Hill River in the north and the Moore River in the south, with the Nambung River system including Cadda and Bibby Springs, Minyolo Brook and Mullering Brook dissecting the intervening sandplains.

The soils of the area west of the Darling Fault are mainly sandplains dominated by grey leached sands (Soil 1), lateritic gravel soils (Soil 2) and yellow sands (Soil 4). In the vicinity of Dandaragan, appreciable areas of red earthy sands (Soil 3) are present. East of the Darling Fault in the rejuvenated drainage zones, red brown earths (Soils 5 and 6) occur, while further inland are extensive areas of yellow earthy sands (Soil 7) with intervening broad valleys including solonized brown soils (Soil 8).

Agricultural land use is dominated by wheat and sheep farming, with lupin cropping of considerable significance. In western areas, commercial wildflower production is a new enterprise.

References to soils of the Moora advisory district

Anon (1961-68). Reports 1-5 of the Midlands Light Lands Development Advisory Committee (responsible to the Minister for Lands).


Sawkins, D.N. (1981). The agriculture and land description of the Midlands, Wongan Hills and Dalwallinu districts of Western Australia. Moora District Office, Western Australian Department of Agriculture.


Further Reading


**Classification**  Australian Great Soil Group: Siliceous sand over indurated ironstone gravel  Northcote: Uc 2.12  Local name: Banksia sand

**Soil profile description**  
(See Fig. 1, colour photograph inside back cover)

0-10 cm grey sand,  
\[\text{pH 6.3 (4.8 CaCl}_2\text{)}\]

10-130 cm light grey sand,  
\[\text{pH 6.4 (5.1 CaCl}_2\text{)}\]

130-140+ cm indurated laterite

**Distinguishing features**
- The profile is a deep, grey sand to over a metre depth onto an indurated lateritic layer. This particular site is in a hollow, but on rising country between the hollows, the grey sands extend to considerably greater depth.
- The soil is slightly acidic in reaction throughout the profile.
- The soil occurs on extensive undulating sandplains.
- The native vegetation is coastal blackbutt (*Eucalyptus todtiana*), woolly bush (*Adenanthes signorum*), *Banksia* spp. and *Dryandra* spp.
- Map 1 provides an indication of the area within which this soil most commonly occurs in the Moora advisory district.
Agricultural use and management

Soil characteristics

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

Limitations
Nutrient status - very low (especially phosphorus and potassium) and applied nutrients leach quickly.
Water holding capacity - very low and non-wetting can be a problem.

Agronomic considerations
Crops - if ironstone gravels occur at greater than 80 cm depth cereal crops can not be grown profitably on this infertile, rapidly drained 'droughty' soil. Western Australian blue lupins can be grown to provide summer-autumn feed for sheep, but managers must be wary of lupinosis.

Pastures - if depth to ironstone gravel is greater than 60 cm, annual pastures can not be grown successfully. Tagasaste shows promise as a perennial leguminous fodder tree.

Soil conservation
Wind erosion is a common problem because of poor crop and pasture growth and the loose nature of the surface sand, particularly after cultivation or disturbance by grazing stock.

Uncleared areas of this soil should not be developed for agriculture. Areas where Western Australia blue lupins will not grow may be suitable for tagasaste or should be retired from agriculture.

Water conservation
The soil is unsuitable for dams or for catchment areas.
Classification
Australian Great Soil Group: Lateritic podzolic Northcote:Dy5.81 Local name: Sand over gravel

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

0-10 cm grey loamy sand with very few ferruginous nodules, pH 6.3 (5.0 CaCl₂)

10-35 cm light brownish grey sand, conspicuously bleached with many ferruginous nodules, pH 6.4 (4.9 CaCl₂)

35-50 cm yellow with few orange mottles, sandy clay with very few ferruginous nodules, pH 6.4 (5.2 CaCl₂)

50-110 cm yellow with orange mottles common, medium clay, pH 6.0 (5.4 CaCl₂)

110-135+ cm yellow with many orange mottles, medium clay with few soft ferruginous segregations, pH 6.0

Distinguishing features
• The profile is grey sand to 35 cm over yellow mottled sandy clay to medium clay. The subsurface contains appreciable quantities of ironstone nodules.
• The soil is slightly acidic in reaction throughout.
• The soil occurs on hill crests, ridges and upper slopes, usually with valleys of deeper sands over gravel (e.g. Soil 1) and deep sands (e.g. Soil 4).
• The native vegetation is low mallee (Eucalyptus spp.) and sandplain heath.
• Map 2 provides an indication of the area within which this soil most commonly occurs in the Moora advisory district.
Agricultural use and management

Soil characteristics
Favourable attributes
Water entry - good.
Soil workability - good, except where massive laterite is close to the soil surface.
Water availability - moderate.

Limitations
Nutrient status - low especially for phosphorus.
Waterlogging - waterlogging can occur in areas of low gradient.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, all cereal crops can be grown satisfactorily. Lupins grow well unless depth to dense gravel is less than 30 cm.
Pastures - subterranean clovers are the appropriate pasture legume, unless depth to clay exceeds 60 cm. Serradella can be grown on sites where the clay is deeper than 60 cm but not exceeding one metre.
Mosaics of this soil with soil types 1 and 4 can make land management difficult.

Soil conservation
Water availability - moderate. Water erosion can be a problem, particularly where breakaways and exposed massive ironstone shed water from upslope. Contour earthworks are often necessary.

Water conservation
Water conservation can be a problem, particularly where breakaways and exposed massive ironstone shed water from upslope. Contour earthworks are often necessary.

The soil is suitable for water catchments on sloping sites where subsoils occur at shallow depths, i.e. less than 30 cm, but suitability of the soil for farm dams is variable. Test borings are required to determine if the subsoil material will hold water.
### Soil profile description

(See Fig. 3, colour photograph inside back cover)

- **0-10 cm reddish brown medium to coarse sand, pH 6.0 (4.9 CaCl₂)**
- **10-40 cm yellowish red, clayey sand, pH 6.9 (4.8 CaCl₂)**
- **40-125 cm yellowish red clayey sand, with some quartz grit, pH 6.9 (6.1 CaCl₂)**
- **125-200+ cm strong brown clayey sand, with some quartz grit, pH 6.5 (6.0 CaCl₂)**

### Distinguishing features

- The profile is a deep sand to clayey sand, mainly yellowish red. It is derived from weathering of ferruginous sandstone.
- The soil is slightly acidic to neutral in reaction.
- The soil mainly occurs on mid and upper slopes flanking main trunk valleys.
- The vegetation is dominated by *Banksia* spp., *Dryandra* spp. and small eucalypts, particularly marri (*E. calophylla*).
- Map 3 provides an indication of the area within which this soil most commonly occurs in the Moora advisory district.
**Agricultural use and management**

**Soil characteristics**

*Favourable attributes*

Water entry and drainage - good.

Soil workability - good.

Nutrient status - reasonable, although phosphorus levels can vary widely.

**Limitations**

Water availability - low.

**Agronomic considerations**

Crops - given appropriate fertilizer and rotation practices, all cereal crops and lupins can be grown satisfactorily.

Pastures - subterranean clover is the appropriate pasture legume.

**Soil conservation**

Water erosion in the form of severe gullying can occur on slopes of the main valleys where soaks and springs overflow. Special techniques are needed to stabilize gully heads.

**Water conservation**

The soil is unsuitable for water catchments or for farm dams.
Soil profile description
(See Fig. 5, colour photograph inside back cover)

- 0-7 cm light grey with faint orange mottles common. Loamy sand, pH 6.7 (4.9 CaCl₂)
- 7-12 cm reddish brown sand, pH 7.6 (5.6 CaCl₂)
- 12-30 cm dark brown with brown mottles common, sandy clay with few manganiferous segregations, pH 9.1 (7.6 CaCl₂)
- 30-50 cm pale brown, with brown mottles common, sandy clay, with few manganiferous segregations, pH 9.5 (8.1 CaCl₂)
- 50-75 cm pale brown with orange mottles common, light medium clay with manganiferous segregations common and very few calcareous segregations, pH 9.6 (8.1 CaCl₂)
- 75-100 cm pale brown with faint brown mottles common, medium clay with manganiferous segregations common, pH 9.6 (8.1 CaCl₂)
- 100-135+ cm pale red with faint orange mottles common, medium clay with manganiferous segregations common and few calcareous segregations, pH 9.5

NOTE: Saline groundwater present at bottom of pit

Distinguishing features
- The profile is a very shallow sand over sandy clay at 12 cm depth. Soil colours are mostly brown throughout with mottling present in most horizons. Fine manganiferous nodules occur throughout the subsoil and calcium carbonate segregations are present at about half a metre and below one metre depth. The site is underlain by a shallow saline groundwater.
- The soil is slightly acidic in reaction at the surface but becomes strongly alkaline in the subsoil.
- The soil occurs on extensive low gradient valley floors.
- The native vegetation is dominated by salmon gums (Eucalyptus salmonophloia) and ti-tree (Melaleuca sp.).
- Map 5 provides an indication of the area within which this soil most commonly occurs in the Moora advisory district.
**Agricultural use and management**

**Soil characteristics**

*Favourable attributes*
Nutrient status - good, apart from phosphorus.

*Limitations*
Soil workability - reasonable, but soil structure deterioration can be a problem.

Water entry and drainage - limited by shallow, slowly permeable subsoil, low gradient, and frequently, by shallow saline watertables.

Water availability - usually limited by osmotic effects of high soluble salt concentrations in the subsoil.

*Agronomic considerations*

Crops - where salinity and waterlogging are not problems, good cereal crops can be grown. The soil is not suitable for lupins, but peas can be grown satisfactorily.

Pastures - medics are the appropriate legumes for non-saline areas with pH above 7.0. Puccinellia and halophytic shrubs are alternative fodder plants on salt affected areas.

**Soil conservation**

Salinity and waterlogging are the two main conservation problems on this soil. Treatments are site specific, but could include fencing out, surface drainage and use of salt tolerant species.

**Water conservation**

The soil is usually unsuitable for surface water catchments due to low gradients. The soil is suitable for farm dams, but particular care is needed to ensure that shallow saline groundwaters are not present.
**Classification**

Australian Great Soil Group: Red brown earth  
Northcote: Dr 2.13  
Local name: York gum

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**Soil profile description**

(See Fig. 6, colour photograph inside back cover)

- **0-10 cm** dark reddish grey loam with few coarse fragments of granite,  
  pH 6.7 (5.4 CaCl₂)

- **10-25 cm** dark reddish brown sandy clay with very few coarse fragments of granite,  
  pH 7.0 (5.4 CaCl₂)

- **25-45 cm** dark yellowish brown medium clay with very few coarse fragments of granite,  
  pH 8.3 (7.3 CaCl₂)

- **45-100 cm** dark brown heavy clay, slightly calcareous, with very few calcareous segregations and few coarse fragments of granite,  
  pH 8.6 (8.0 CaCl₂)

- **100+ cm** weathering coarse grained granite

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**Distinguishing features**

- The profile is a shallow loam overlying sandy clay at 10 cm. The subsoil increases in texture with depth from sandy clay at 10 cm to heavy clay by 45 cm. The soil mass includes fragments of granite and weathering coarse grained granite is present below about one metre depth. A few calcium carbonate segregations are present in the deepest horizon. Soil colours are generally brown throughout.

- The soil is slightly acidic in reaction at the surface and pH increases gradually with depth to become alkaline below 25 cm.

- The soil occurs on valley slopes of moderately dissected country (e.g. Berkshire Valley) usually in relatively small areas as part of a mosaic of soil types influenced by geology and topography.

- The native vegetation is dominated by York gum (*Eucalyptus loxophleba)*.

- Map 6 provides an indication of the area within which the soil most commonly occurs in the Moora advisory district.
Agricultural use and management

Soil characteristics
Favourable attributes
Nutrient status - good apart from phosphorus.
Soil workability - good, except where frequent rock outcrops interfere with cultivation patterns.
Water entry and drainage - good.

Limitations
Water availability - usually good, but shallow rock can limit rooting depth and hence water supply.

Agronomic considerations
Crops - the soil is suitable for cereal and pea-cropping, but not for lupins.
Pastures - subterranean clovers are the appropriate pasture legume, but medics can also be grown.

Soil conservation
Water erosion of cultivated sloping land and waterlogging are common problems, frequently requiring contour earthworks. Erosion of grazed pea stubbles also occurs.

Water conservation
The soil provides good surface water catchments, but dam sites require careful selection to avoid shallow rock.
**Soil profile description**
(See Fig. 7, colour photograph inside back cover)

0-10 cm yellow sand,
pH 5.3 (4.3 CaCl₂)

10-50 cm yellow clayey sand,
pH 5.1 (4.4 CaCl₂)

50-100 cm yellow clayey sand,
pH 5.1 (4.4 CaCl₂)

100-200 cm yellow clayey sand,
pH 5.0 (4.3 CaCl₂)

**Distinguishing features**

- The profile is a deep yellow clayey sand.
- The soil is acidic in reaction throughout the profile, commonly much more acidic than this profile, e.g. down to pH 4.
- The soil occurs extensively on undulating plateau areas.
- The native vegetation is low and medium height sandplain heath.
- Map 7 provides an indication of the areas within which this soil most commonly occurs in the Moora advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Water entry and drainage - good.
Soil workability - good.
Water holding capacity - adequate.

Limitations
Nutrient status - low inherent fertility, especially phosphorus. In areas where pH is very low, plant growth is inhibited by aluminium toxicity.
Soil workability - subsurface compaction due to tractor and machinery traffic can limit root growth but is responsive to deep ripping. Care is needed to ensure that acidic subsoils are not mixed with topsoils during ripping.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, cereals and lupins grow well.
Pastures - subterranean clovers are the appropriate pasture legumes, although continuous cereal/lupin or 2 cereal/lupin rotations are commonly practiced. Tagasaste has performed well on these soils where crops and pastures are limited by acidity.

Soil conservation
Wind erosion following summer grazing and during crop establishment can occur under poor management. Minimum cultivation techniques with good stubble management are required.
Water erosion, as sheet or rill erosion, can occur in cultivated areas. Contour working and contour earthworks are frequently necessary.
Saline sandplain seeps occur frequently on these soils. Trees can be used to transpire excess water to dry out the seepage area.

Water conservation
The soil is unsuitable for farm dams or for natural surface water catchments. Roaded catchments usually perform well.

Map 7
Classification
Australian Great Soil Group: Solonized brown soil
Northcote: Dy 3.13
Local name: Salmon gum

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

0-5 cm dark reddish brown sandy loam, pH 7.8 (6.9 CaCl₂)
5-12 cm dark reddish brown sandy clay loam, pH 6.8 (5.9 CaCl₂)
12-40 cm yellowish red with black mottles common, light clay with few coarse rock fragment, pH 8.7 (7.8 CaCl₂)
40-70 cm very pale brown with many brown mottles, light clay, highly calcareous with much soft calcium carbonate and very few calcium carbonate segregations, pH 8.7 (8.0 CaCl₂)
70-130 cm light grey with few faint orange mottles, medium clay, highly calcareous and with many calcium carbonate segregations, pH 8.8 (8.0 CaCl₂)

Distinguishing features
• The profile is very shallow sandy loam and sandy clay loam over light clay at 12 cm. Colour is generally brown throughout with mottling in the subsoil. The soil has appreciable quantities of soft calcium carbonate below 40 cm.
• The soil is alkaline to highly alkaline in reaction.
• The soil occurs on valley floors and gently undulating plains.
• The native vegetation is dominated by salmon gum (Eucalyptus salmonophloia).
• Map 8 provides an indication of the area within which this soil most commonly occurs in the Moora advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Nutrient status - good, apart from phosphorus.
Water availability - good, unless restricted by presence of soluble salts.

Limitations
Soil workability - soil structure deterioration frequently causes problems. These soils sometimes respond to gypsum applications, but success can not be predicted with confidence.

Water entry and drainage - reasonable, but the low gradient leads to waterlogging in wet periods and if shallow groundwaters are present, drainage is impeded.

Agronomic considerations
Crops - cereal crops grow well except where salinity problems have developed.

Pastures - medics are the appropriate pasture legumes. Where salinity has developed halophytic shrubs provide valuable sheep fodder.

Soil conservation
Soil salinity due to shallow saline groundwater is the major problem.

Water conservation
The soil is suitable for surface water catchments if sufficient slope is available. It is also suitable for farm dams, but care is needed to ensure that shallow saline groundwaters are not present.