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An introduction to the soils of the Three Springs advisory district

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AN INTRODUCTION TO THE

SOILS

OF THE

THREE SPRINGS

ADVISORY DISTRICT

- descriptions, illustrations and notes on seven common soils

COMPILED BY T.C. STONEMAN

DEPARTMENT OF AGRICULTURE - WESTERN AUSTRALIA
The Three Springs advisory district

The Three Springs office of the Department of Agriculture services an advisory district embracing the shires of Carnamah, Coorow and Three Springs, as well as that part of the Perenjori Shire within the agricultural zone. The district has an area of about 1.36 million hectares and has about 400 farms.

Geologically, the district can be divided into two major areas; that east of the Darling Fault (and Three Springs) is primarily granites of Precambrian age (i.e. older than 2,500 million years), while the lands to the west of a line approximately north-north-west through Three Springs are underlain by a variety of marine and continental deposits of sandstone, shale and siltstones, some calcareous, some not. Most are younger than 150 million years and some less than 10 million years old.

The district has a mature landscape with little relief between the valley floors and the divides between major drainage lines. The only hills of note are three small ranges, Yandanooka Hills, Billeranga Hills and Koolanooka Hills. External drainage of the eastern part of the district consists of very low gradient salt lake channels which arise in the pastoral lands to the east and drain eventually (and occasionally) into the Yarra Yarra Lakes south of Three Springs. A similar, but less extensive, system drains the south-eastern part of the district into the upper reaches of the Coonderoo River leading eventually past Moora into the Moore River. The eastern portion of the advisory district has no external drainage system, apart from the Arrowsmith River in the north which almost reaches the coast before dissipating into the coastal sands.

The soils to the west of the Darling Fault are mainly sand plains dominated by deep grey leached siliceous sands (Soil 1) and earthy sands (Soil 2). East of the Darling Fault the most extensive areas are of red brown earths (Soil 3) and sandy yellow earths and earthy sands (Soil 6), while in the valley floors of the more defined drainage systems, solodic soils with hard setting loamy top soils and mottled yellow clayey subsoils occur (Soil 7). Further to the east, terra rossa soils occur, frequently underlain by a calcrete hardpan (Soil 4), as do the acid yellow earths (Soil 5).

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

References to soils in the Three Springs district


Further reading


## Classification


## Soil profile description

(See Figure 1, colour photograph inside back cover)

<table>
<thead>
<tr>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8 cm</td>
<td>Light grey sand, pH 6.3 (4.6 CaCl₂)</td>
</tr>
<tr>
<td>8-110 cm</td>
<td>Very pale brown sand, conspicuously bleached, pH 5.8 (4.9 CaCl₂)</td>
</tr>
<tr>
<td>110-140+ cm</td>
<td>Yellow clayey sand with orange mottles and very soft ferruginous nodules, common, pH 6.0 (5.5 CaCl₂)</td>
</tr>
</tbody>
</table>

## Distinguishing features

- The profile is a deep grey sand to one metre depth over a yellow clayey sand with very soft ferruginous nodules.
- The soil is slightly acidic in reaction throughout the profile.
- The soils often occur in valley floors between lateritic rises and frequently within a mosaic of varying deep sands and lateritic soils. In the west, this soil type also occurs as extensive undulating plateaus.

- The native vegetation is a heath of Banksia, Dryandra, and small Eucalyptus spp.
- Map 1 provides an indication of the area within which this soil most commonly occurs in the Three Springs advisory district.
Agricultural use and management

Soil characteristics
Favourable attributes
Water entry - good.
Soil workability - good.

Limitations
Nutrient status - very low and applied nutrients leach quickly.
Water availability - very low, and non-wetting can be a problem.

Agronomic considerations
Crops - if ironstone nodules occur at depths greater than 80 cm, cereal crops can not be grown profitably on this infertile, excessively drained 'droughty' soil.
Pastures - Western Australian blue lupins can be grown to provide summer-autumn feed for sheep, but care is needed to avoid lupinosis.

Early maturing varieties of serradella can be grown if depth to gravel is less than 60 cm.
If depth to ironstone nodules is greater than 60 cm, annual pastures can not be grown successfully. Tagasaste shows promise as a perennial leguminous fodder tree.
Mosaics of soil types make land management difficult.

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 treading by stock.
Uncleared areas of this soil should not be developed for agriculture. Areas where blue lupins will not grow should be retired from agriculture.

Water conservation
The soil is unsuitable for dams or for catchment areas.
Soil 2. Three Springs advisory district

Classification

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

0-10 cm yellowish brown sand,
  pH 5.8 (5.5 CaCl₂)

10-50 cm yellow sand,
  pH 5.5

50-200 cm+ yellow clayey sand,
  pH 5.4 (5.1 CaCl₂)

Distinguishing features
- The soil consists of half a metre of yellow sand, over yellow clayey sand to greater than two metres depth. It is similar to Soil 6 which has clayey sand below 10 cm depth. This soil is often paler in colour than the profile described.
- The soil is acidic in reaction throughout the profile.
- The soil occurs over extensive areas of gently undulating plateaus.
- The native vegetation is commonly Banksia spp. and Christmas tree (Nuytsia floribunda).
- Map 2 provides an indication of the area within which this soil most commonly occurs in the Three Springs 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 nutrients leach quickly.
Water holding capacity - low, and non-wetting can be a problem.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, reasonable cereal crops can be grown. Narrow leaf lupins are probably the most profitable crops for these soils.

Pastures - W.A. Blue lupins are the most suitable fodder plant, but early maturing varieties of serradella also grow well. Subterranean clover is reasonably persistent.

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 dams or for catchment areas.
Classification

Soil profile description
(See Figure 3, colour photograph inside back cover)

0-10 cm dark reddish brown sandy loam,
pH 6.5 (5.7 CaCl₂)

10-20 cm dark red sandy clay,
sporadic bleach at 20 cm, pH 6.7 (5.5 CaCl₂)

20-50 cm dark red sandy clay, with fine
manganiferous segregations common,
pH 7.0 (6.1 CaCl₂)

50-75 cm red with a very few coarse distinct grey
mottles, heavy clay with few calcareous and
manganiferous segregations, pH 8.5 (7.4 CaCl₂)

75-100 cm red with faint yellow mottles common,
heavy clay, with few calcareous and
manganiferous segregations, pH 8.5

100-130+ cm yellowish red with faint yellow
mottles common, medium clay, with
manganiferous segregations common and
very few calcareous segregations, pH 8.5

Distinguishing features
- The soil profile is red throughout, and consists of
a shallow sandy loam over sandy clay becoming
mottled heavy clay at 50 cm depth.
- The upper half metre is neutral in reaction but the
profile is alkaline below that depth. Calcareous
concretions are present in small quantities below
half a metre.
- The soil usually occurs on broad flat valleys or
gently undulating terrain.
- The native vegetation is York gum (*E. loxo-
phleba*) woodland.
- Map 3 provides an indication of the area within
which this soil most frequently occurs in the Three
Springs advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Nutrient status - reasonable, apart from phosphorus.
Water availability - good.

Limitations
Soil workability - fair, except where soil structure deterioration has resulted in a very hard setting soil surface.
Water entry and drainage - often restricted due to deterioration of surface soil structure. As a consequence, waterlogging can occur in wet periods.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, all cereal crops can be grown satisfactorily. Wheat is the most profitable.

Pastures - medics, especially the burr medics are the most appropriate pasture legumes, but persistence can be adversely affected by emergence problems resulting from poor soil structure, and by consecutive low rainfall years. Medics are more drought tolerant than subterranean clover.

Soil conservation
Soil structure problems are common and are often associated with local waterlogging and flooding. Structural improvement in response to gypsum applications is variable, and can not, as yet, be predicted reliably.

Soil salinity problems are evident in valley situations where shallow saline groundwaters are present.

Water conservation
The soils are suitable for farm dams and for water catchments, but shallow saline groundwaters frequently prevent excavation of dams.

Structural deterioration is reduced by minimum tillage crop establishment techniques.
**Classification**  
Australian Great Soil Group: Terra rossa.  
Northcote: Dr 2.13.  
Local name: Salmon gum-gimlet.

### Soil profile description

(See Figure 4, colour photograph inside back cover)

- **0-7 cm** dark reddish brown sandy loam,  
  pH 7.4 (6.6 CaCl₂)
- **7-20 cm** dark red sandy clay loam,  
  pH 7.3 (6.8 CaCl₂)
- **20-50 cm** dark red light clay with very few  
  calcareous concretions,  
  pH 8.2 (7.6 CaCl₂)
- **50-75 cm** red light clay with very many  
  calcareous concretions,  
  pH 8.3 (8.0 CaCl₂)
- **75-140 cm** reddish yellow sand with many  
  calcareous concretions,  
  pH 8.5
- **140-170+ cm** red light clay with few calcareous  
  concretions,  
  pH 8.5

### Distinguishing features

- The profile is essentially a red soil consisting of  
  sandy loam to sandy clay loam overlying a light  
  clay at 50 cm containing large quantities of cal-
  careous nodules/concretions. The calcareous  
  horizon is commonly cemented to form a red-
  brown hardpan. In this profile layer of sand is  
  present between 75 cm and 140 cm.
- The soil is near neutral in reaction at the surface,  
  but is alkaline at depth.
- The soil occurs on flat to gently undulating plains.
- The native vegetation is salmon gum (*Eucalyptus*  
  *salmonophloia*) - York gum (*E. loxophleba*) wood-
  land.
- Map 4 provides an indication of the area within  
  which this soil most frequently occurs in the Three  
  Springs advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Nutrient status - reasonable, apart from phosphorus.
Water availability - good.
Water entry and drainage - reasonably good.

Limitations
Surface soil structure can be degraded by excessive cultivation and can adversely affect soil workability.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, cereal crops can be grown successfully. Wheat is the most profitable. The soil is not suitable for lupins.
Pastures - medics are the most appropriate pasture legumes. Both barrel medics and burr medics are suitable.

Soil conservation
Flooding, waterlogging and salinity are the main problems. Soil structure improvement due to gypsum applications is variable, and can not, as yet, be predicted reliably.
Minimum cultivation systems with good stubble management can improve soil structure.

Water conservation
This soil provides good surface water catchments, but farm dams frequently leak.

Map 4
Classification

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

0-10 cm brown loamy sand,
\[ \text{pH } 7.0 \ (5.5 \text{ CaCl}_2) \]

10-30 cm brownish yellow clayey sand,
\[ \text{pH } 5.5 \]

30-100 cm brownish yellow with very few distinct red mottles, sandy loam,
\[ \text{pH } 4.0 \ (3.9 \text{ CaCl}_2) \]

100-200+ cm reddish yellow with few distinct red mottles, sandy clay loam,
\[ \text{pH } 3.8 \ (3.8 \text{ CaCl}_2) \]

Distinguishing features
- The profile is generally a dull yellow throughout, increasing gradually in texture with depth, from a loamy sand at the surface to a sandy clay loam below one metre. The general appearance of an exposed profile of the soil is very similar to Soil 2 and Soil 6. However, colour is duller, texture increases with depth, and the native vegetation, wodjil, in particular identifies the soil.
- The soil is neutral in reaction at the surface, but rapidly becomes strongly acidic by 30 cm depth (pH 4.0 and less).
- The soil occurs extensively on undulating plateau areas.
- The native vegetation is a medium height heath, including Acacia sp. (wodjil), Eucalyptus spp. (mallees) and Melaleuca spp.
- Map 5 provides an indication of the area within which this is most frequently occurs in the Three Springs advisory district.
Agricultural use and management

Soil characteristics

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

Limitations
Nutrient status - low inherent fertility and very acidic subsoil conditions severely restrict agricultural use because of toxic levels of aluminium in the soil solution.

Agronomic considerations
Crops - cereal rye, triticale, lupins and oats are the most tolerant of acid soil conditions, with barley the most sensitive.

Pastures - medics cannot be grown on these acid soils. Subterranean clover growth is dependent on the degree of acidity and persistence is often poor. Serradella is well suited provided appropriate varieties are used.

Soil conservation
Because crops and pastures often provide sparse ground cover, wind erosion after summer grazing and during crop establishment can be severe under poor management. Minimum cultivation systems with good stubble management are required.

If soil acidity is severe, the developed areas may have to be retired from agriculture.

Water conservation
The soils are unsuitable for dams or for catchment areas.

Map 5
Soil 6. Three Springs advisory district

**Classification**

Australian Great Soil Group: Earthy sand.  
Northcote: Uc 5.22.  
Local name: Clayey yellow sand plain.

**Soil profile description**

(See Figure 6, colour photograph inside back cover)

- 0-10 cm brown loamy sand, pH 6.0 (5.3 CaCl₂)
- 10-75 cm brownish yellow clayey sand, pH 5.5 (5.1 CaCl₂)
- 75-150+ cm yellow clayey sand, pH 5.8 (5.8 CaCl₂)

**Distinguishing features**

- The profile is yellow apart from the surface 10 cm, and is sandy throughout, varying only slightly in texture from loamy sand in the surface, to clayey sand below. It is similar to Soil 2 which has a sand texture to 50 cm, before increasing to a clayey sand.
- The soil is slightly acidic in reaction.
- The soil occurs extensively on undulating plateau areas.
- The native vegetation is low and medium height sandplain heath.
- Map 6 provides an indication of the area within which this soil most frequently occurs in the Three Springs 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, and applied nutrients leach readily.
Subsurface soil compaction due to tractor and machinery traffic can limit root growth, but is responsive to deep ripping.

Agronomic considerations
Crops - given appropriate fertilizer and rotation practices, cereals and lupins grow well.
Pastures - subterranean clovers are the appropriate pasture legumes but harbinger “strand” medic and the burr medics can also be grown.

Soil conservation
Wind erosion following summer grazing and during crop establishment can occur under poor management. Minimum cultivation systems 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.

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

Soil profile description
(See Figure 7, colour photograph inside back cover)

- 0-10 cm reddish brown loamy sand, pH 6.0 (5.1 CaCl₂)
- 10-30 cm yellowish red loamy sand
- 30-35 cm reddish yellow conspicuously bleached sand
- 35-75 cm brown medium clay with manganiferous segregations common, pH 6.1 (5.9 CaCl₂)
- 75-150 cm light brown light clay with few manganiferous segregations and many calcareous concretions, pH 8.2 (7.4 CaCl₂)

Distinguishing features
- The profile is dominantly brown, with an abrupt change in texture at about 35 cm from surface loamy sand and sand to a medium clay, which is calcareous below 75 cm.
- The upper part of the profile down to 75 cm is slightly acidic in reaction, but becomes alkaline below 75 cm.
- The soil occurs on broad flat valleys, and valley plains and terraces.
- The native vegetation is York gum (*Eucalyptus loxophleba*) woodland.
- Map 7 provides an indication of the area within which this soil most frequently occurs in the Three Springs advisory district.
Agricultural use and management

Soil characteristics

Favourable attributes
Nutrient status - good apart from phosphorus.
Water availability - good.
Soil workability - good.

Limitations
Water entry and drainage - the strong texture contrast of sand over clay can lead to surface waterlogging and local flooding in wet periods.

Agronomic considerations
Crops - cereal crops grow well, but lupins give a variable performance.
Pastures - subterranean clovers and burr medic are the appropriate pasture legumes.

Soil conservation
Soil salinity occurs along creek lines and on valley floors where shallow saline groundwaters have developed.
Sheet erosion by water can be a problem where the soil occurs on valley side slopes.

Water conservation
The soil is suitable for farm dams and as natural catchments. Care is needed to ensure shallow saline groundwater is not present at proposed dam sites.