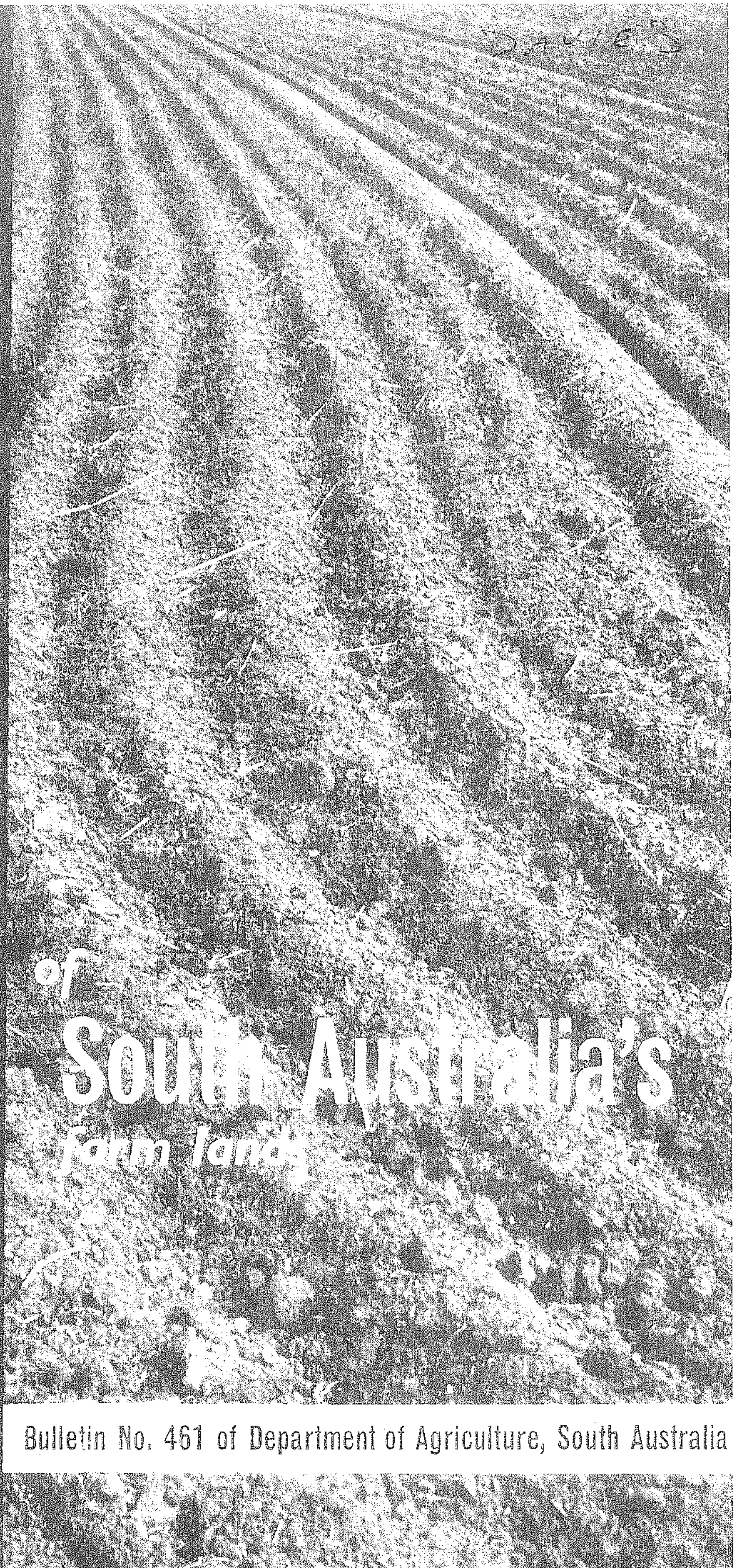
SOILS of South Australia's farm lands



Bulletin No. 461 of Department of Agriculture, South Australia

SOILS

of

South Australia's Farm Lands

A reprint of a series of articles by officers of the Soil Conservation Branch appearing in the Journal of Agriculture, South Australia

August, 1959 - November, 1960

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THIS BULLETIN . . .

This bulletin brings together a series of articles by officers of the Soil Conservation Branch describing the main soils of South Australia's farm lands.

There are, of course, a huge number of different types of soil. On almost any farm it is possible to find half a dozen quite different soils, each with numerous minor variations. It would be impossible to map and describe all these.

Nevertheless, soils with similar characteristics can be grouped; and, provided we make the groupings on the basis of the right characteristics, these can be of great value in guiding field research and advisory work.

In this bulletin we have been mainly concerned with grouping together the soils with similar agricultural characteristics and in stressing the similarities and differences within each group which bear on their use as farm lands.

The groupings are generally into "Great Soils Groups" as used in orthodox soil maps; but where such groupings do not suit this purpose they have been modified. The article on deep sands, for example, includes more than one group; and the podsols and solonetz soils are not separated strictly at "Great Soil Group" level.

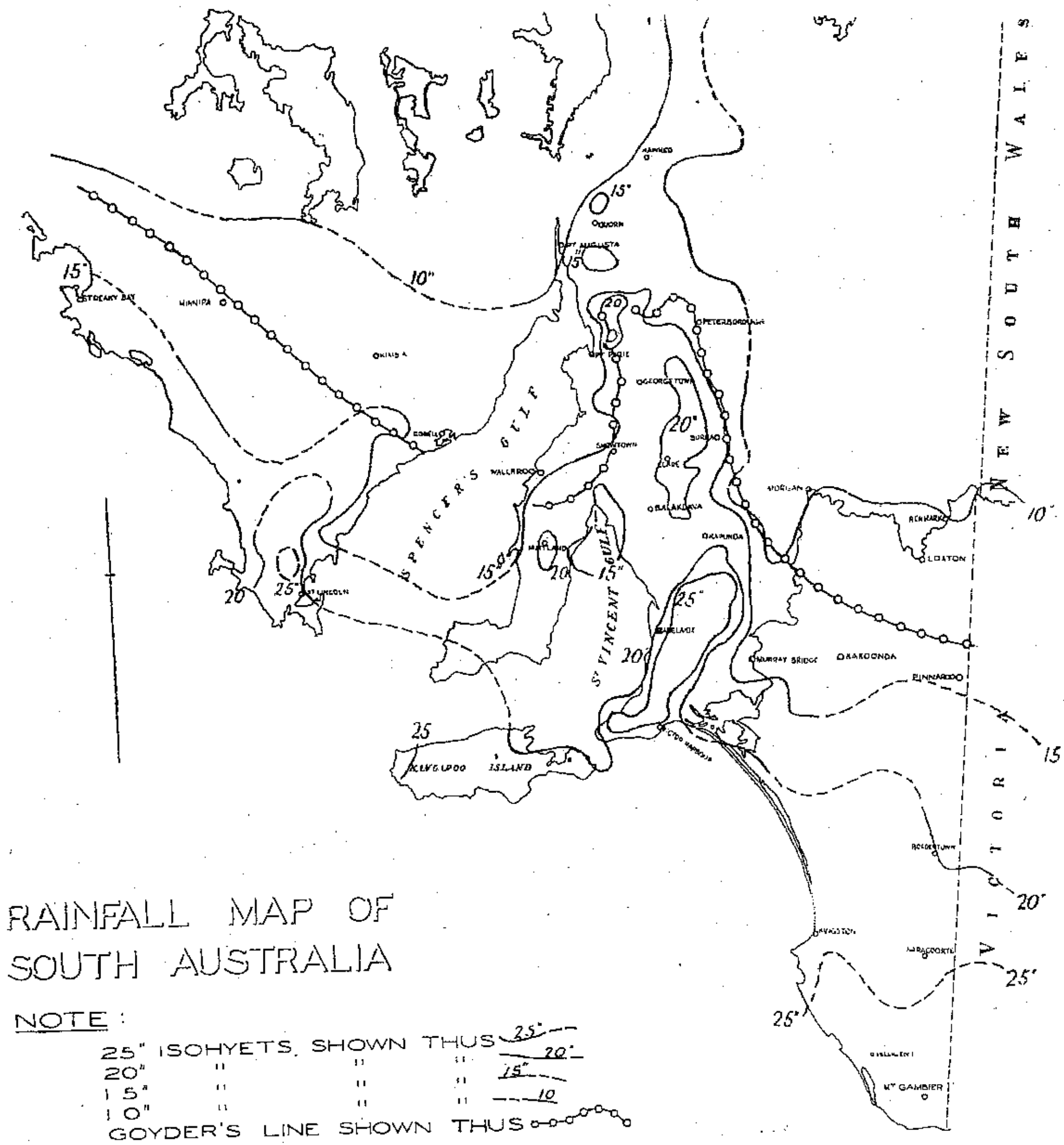
Amount of Organic Matter.

All soils contain organic matter, which is the decayed residue of plants and animals which have lived on it or in it. The amount varies enormously, from less than 1 per cent in desert sandhills to over 50 per cent in peat soils.

Organic matter is important in soils because it can form a reserve of plant foods becoming gradually available to plants, and also because of its effect on water holding capacity and soil structure.

Amount of Salt.

Normally the amount of salt in soils is very small, too small to affect plant growth. However, in some places salt tends to accumulate in the soil, due to a salt water table or some other agency. If the content is high enough, this will prevent many plants from growing. In severe cases only salt tolerant species such as samphires can survive, or all plant growth is destroyed.



THE MALLEE SOIL GROUP

The widespread group of brown solonised soils of the drier half of the wheat belt are commonly referred to as "Mallee" soils because the original vegetation was mainly mallee scrub.

While it is true that most of the soils of this region are "mallee" soils, there are exceptions. Some of the soils carrying mallee vegetation belong to other groups. We need to look at other characteristics before deciding whether a soil belongs to the "mallee" group or not.

The main features distinguishing mallee soils are:—

1. *Light texture of surface soil*—usually sand, sandy loam, or loam, and brown, reddish brown or grey brown in colour.

2. *Very high lime content.* There is always a conspicuous lime horizon. This may consist of a continuous limestone sheet, of limestone rubble, or occasionally of a high proportion of powdery lime.

Except in the case of mallee sandhills, the lime is less than 2ft., and often only a few inches, below the surface. Frequently pieces of limestone or limestone nodules are scattered over the surface.

3. Where the lime is deep *the sub-surface horizon is seldom heavier than a clay loam* or light clay; and the transition from the surface soil to this heavier horizon is fairly gradual.

THREE TYPES OF MALLEE COUNTRY.

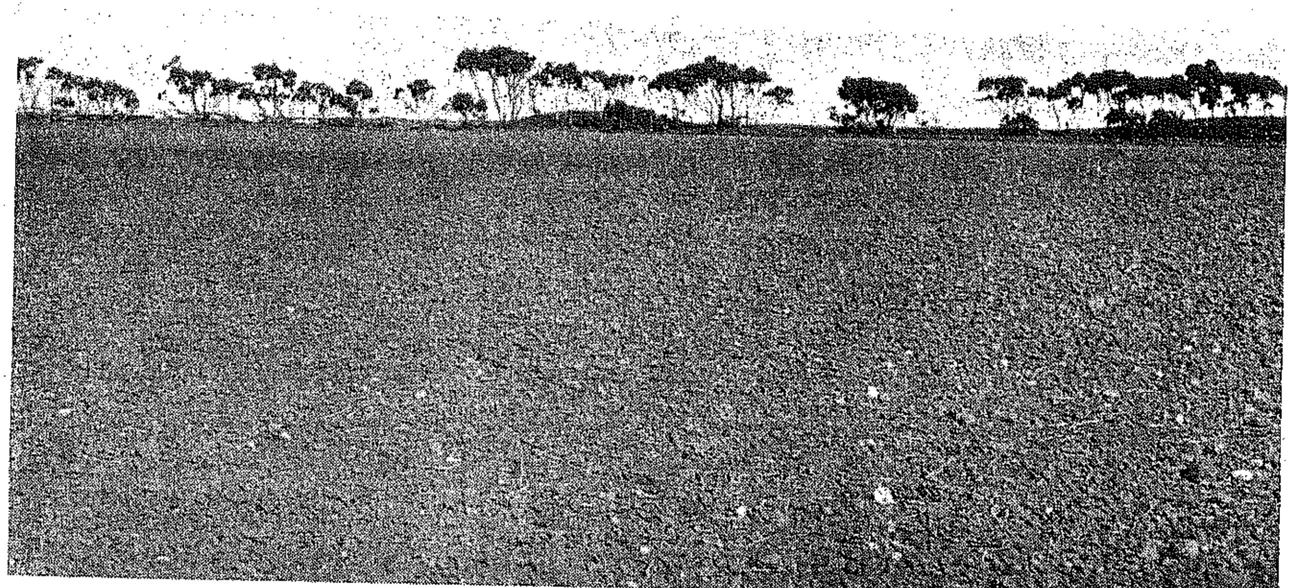
The mallee soil areas can be divided into three groups:—

Loamy Mallee.—Flat or gently undulating country with friable, loamy surface soils, often comparatively shallow and with the usual clay and lime layers in the subsoil. There are usually pieces of limestone scattered on the surface. These soils are mostly in the 10-16in. rainfall zone and are very fertile.

Stony Mallee.—Generally flat areas with very shallow surface soil over large amounts of limestone. The surface is always stony. In much of this country there is very little soil over the limestone, and in places the sheet limestone is actually exposed.

Stony mallee areas are mainly in the 8-15in. rainfall zone, and because of stoniness are difficult or impossible to work.

Sandy Mallee—These are mallee soils in which the surface is loamy sand or sand. Mostly they occur as long sand ridges with firmer soils such as loamy or stony mallee on the flats between.



Typical loamy mallee farm land with the characteristic pieces of limestone scattered ever the surface.

By J. A. Beare, B.Ag.Sc., Soil Conservator.

LOAMY MALLEE SOILS

As shown in the accompanying map (Fig. 1) the loamy mallee soils are mostly in the 10-16in. rainfall zone, with a few areas in higher rainfall country such as Yorke Peninsula, Adelaide Plains and scattered parts of the Lower North.* Land is mostly flat or with comparatively gentle arable slopes, with only occasional very steep slopes.

LAND USE PROPERTIES OF LOAMY MALLEES.

Ease of Working.

Loamy mallee soils are comparatively easy to cultivate. They do not become sticky or boggy unless very wet, nor set hard when dry. Drainage is usually good, and the soils dry out enough to cultivate very soon after rain.

The commonest drawback is that pieces of limestone of various sizes are scattered over and through the soil and interfere with mowing, small seed harvesting and the like.

Water Holding Capacity.

This depends very much on the nature of the limestone layer. Where there is an almost continuous limestone sheet at shallow depth (Fig. 2) then only a small reserve of water is available after the rains cease. Only those plants whose roots find their way through cracks in the limestone will continue to make growth for some time without further rain. On the other hand, where lime exists as a rubble (Fig. 3) moisture reserves are much higher and crops will hold on much better over dry periods.

The nature of the limestone layer is also very important in the growth of lucerne. Only scattered plants will grow on a soil like that in Fig. 2, whereas the soil in Fig. 3 is excellent for lucerne. These two types often occur together; and this will explain some of the patchiness of lucerne stands after the first summer.

Apart from this, some of the grey types of loamy mallee soils appear to make inefficient use of light rainfall. Crops "burn off" in dry years. These soils apparently have a high wilting point. The reason for this is not clear, but may be due to fine carbonate or dissolved salts.

Fertility.

As a result of their high lime content mallee soils are alkaline, the pH ranging from 7.8-8.5 in the surface and 8-9 in the subsoil.

In common with most South Australian soils, the mallee soils are initially deficient in phosphate. Further, the lime in these soils tends to cause superphosphate to revert to a less soluble form. Repeated dressings of water soluble phosphate are therefore necessary. Fertilizers containing phosphate in acid soluble forms, although they may be of use on acid soils, have little value for mallee types.

Where phosphate deficiency is made good, loamy mallee soils can be highly productive.

Organic matter is generally low, especially in the drier districts; and if cropped heavily to cereals it is not many years before there are signs of nitrogen deficiency.

It is fortunate that these soils are particularly suited to burr and barrel medics, which have come in naturally over most of them. Where these legumes are encouraged by reasonable phosphate dressings and good management, the available nitrogen remains adequate and quite close crop rotations are feasible without loss in fertility.

Deficiencies of elements other than nitrogen and phosphorus do not occur extensively on loamy mallee soils. Copper may sometimes be slightly deficient, leading to "steeliness" in wool.

Structure.

Loamy mallee soils usually have good crumb structure, which is important to ease of working and resistance to erosion. When over-cultivated without adequate return of organic matter, they tend to become powdery or "fluffy" rather than hard-setting, as occurs with some other soils. Poor soil structure seldom hinders seed germination or plant growth on mallee soils.

* Within the areas designated as containing mallee soils there are calcareous soils which may not be accepted by pedologists as belonging to this group but rather as terra rossas, rendzinas, or brown calcareous soils. However, except where their texture is much heavier, these soils have similar agricultural characteristics to the mallee types, so the distinction is unimportant for the purpose of this article.

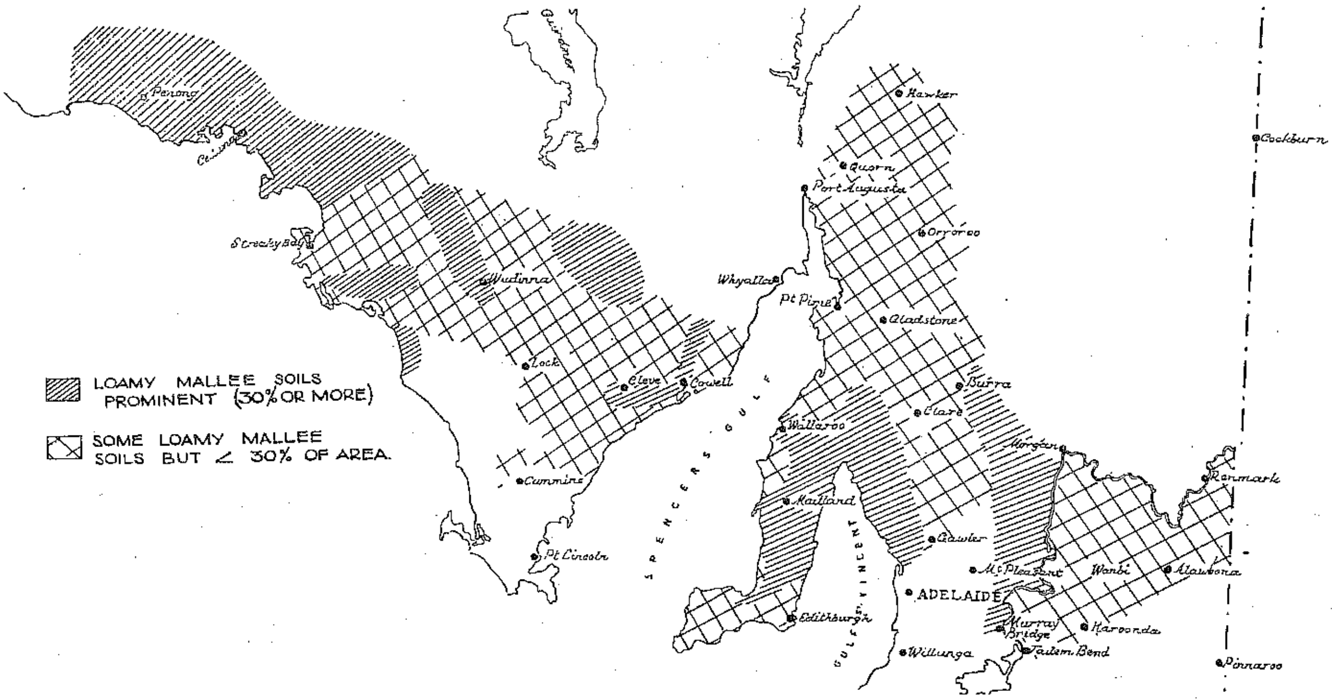
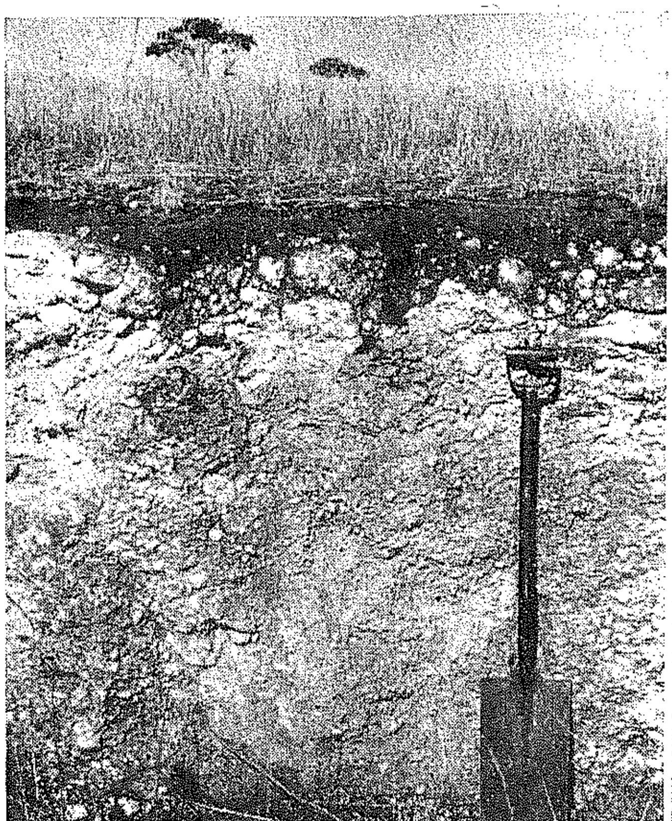
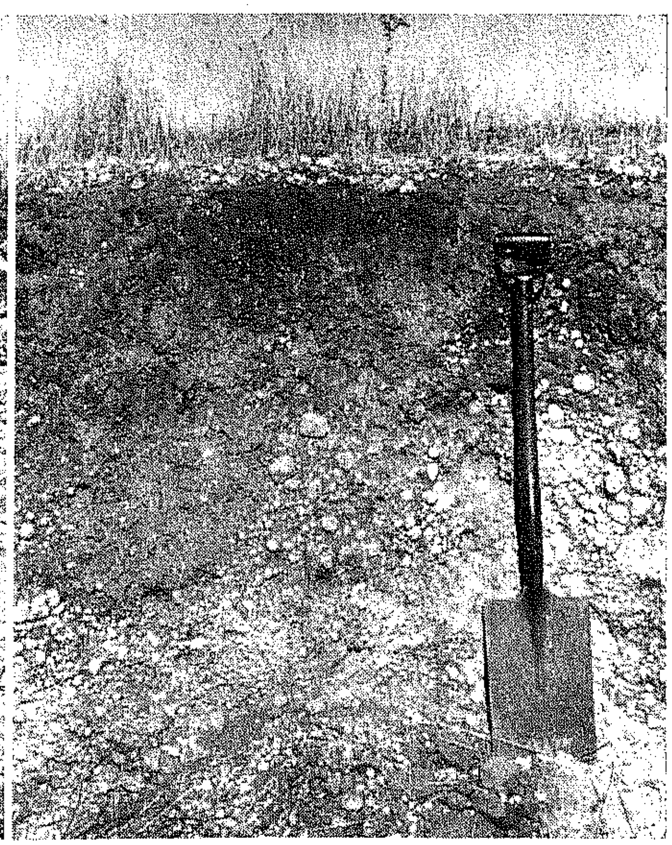


Fig. 1.—Distribution of loamy mallee soils in the agricultural areas of South Australia. Heavy hatchings show areas where 30 per cent or more of soils are loamy mallee. Cross-hatched areas have less than 30 per cent of loamy mallee soils.





(*Left*) Fig. 2. Loamy mallee profile with shallow surface soil and sheet limestone beneath.
(*Right*) Fig. 3. In this loamy mallee profile the surface soil is much deeper and the limestone occurs as a rubble. These two types often occur together. These two profiles, photographed in the Crystal Brook area, were in the same quarry about 30ft. apart.

Salinity.

Mallee soils often contain appreciable amounts of soluble salt. The range is mostly from 0.05 to 0.5 per cent, with the higher figures recorded for subsoils.

While this salt remains distributed throughout the soil it does not hinder crop or pasture growth; but once the salt becomes concentrated at the surface, through seepage or from other causes, then plants may be damaged. Bare areas, often known as "magnesia patches" but actually due mostly to common salt, are widespread in the loamy mallee areas but are seldom extensive enough on any one property to be a very serious problem.

Erodibility.

Under the cropping rotations usually followed, loamy mallee soils are not readily eroded. Although comparatively light in texture, their crumb structure is usually good, and the soils do not set hard or "seal" readily under heavy rain.

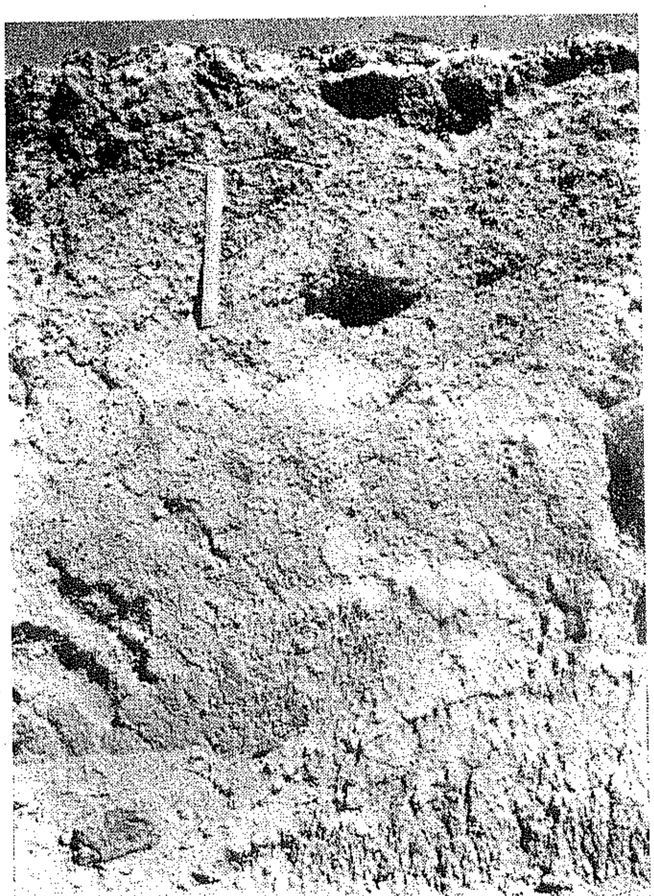


Fig. 4. A third type of loamy mallee from Ceduna in which there is a high proportion of powdery limestone throughout the profile instead of a layer of rubble or sheet limestone.

As a result they absorb water readily, and this reduces the amount of run-off.

Severe water erosion, therefore, is comparatively rare. In the past it has usually occurred only after intensive cropping or over-grazing, combined with fine working of the soil. On shallow types with sheet limestone the loss of only an inch or two of topsoil is very serious. Sometimes all the topsoil has been lost. Most water erosion, however, is confined to sheet or minor gully erosion on the lower parts of long slopes.

Erosion by wind, also, is not as serious a problem on these soils as it is on the sandy mallee soils. Nevertheless it will occur on the sandier types if they are over-grazed or worked too fine.

FARMING ON LOAMY MALLEE SOILS.

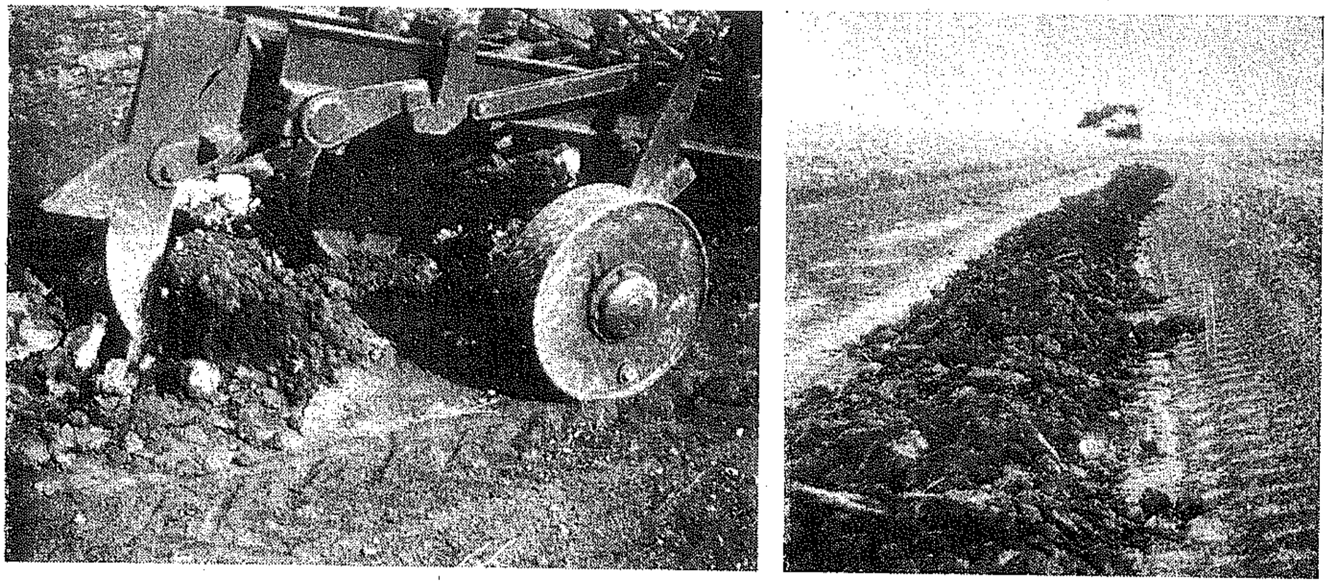
The main areas of loamy mallee soils east of Spencers Gulf were opened up for wheat farming by 1890, and there was also some very early development on the far west coast. Other areas, such as Minnipa, Kimba and Buckleboo, were not developed until after World War I.

In the country developed before the general use of superphosphate yields fell off very quickly and reached extremely low levels. When phosphate came into use yields rose sharply. On Yorke Peninsula, for example, yields trebled between 1901 and 1908.

From then on the productivity of loamy mallee soils of more than 13in. rainfall continued to rise, though more slowly, until the late 1930's. Higher wheat yields were doubtless due to such factors as improved farm machinery, better varieties and so on.

At the same time there was an apparent drop in fertility, due to the exploitive cropping systems of fallow-wheat or fallow-wheat-barley, combined with stubble burning. By 1941 yields were stationary or actually falling in some districts.

In the last 10 to 15 years fallowing has been reduced and is usually done much later. Barley has become relatively more important and many more crops are grown on ley land. The use of medics has greatly increased, both by encouragement of the naturally occurring burr medic and by seeding of barrel medic.



Two stages in the building of contour banks to protect a loamy mallee soil against water erosion.

The result has been a rise in soil fertility and a new upward trend in productivity.

Loamy Mallee Soils in Drier Districts.

In districts of less than adequate seasonal rainfall, such as the eastern half of County Eyre, or Counties Kintore or Way, wheat yields reached their peak 10-15 years after development and then began to decline. The failure of these soils to maintain their fertility in the same way as similar soils in higher rainfall is probably due to a combination of:—

1. An initially lower nitrogen and organic matter content.
2. Very much lower phosphate dressings. Over the period of very intensive cropping in the late 1920's and early 1930's the average dressing was only 40-50 lb. superphosphate per acre in marginal country, and up to 50 per cent of crops were sown without fertilizer. This low phosphate level, together with unreliable rainfall, would result in too little natural medic growth to maintain fertility.

PRESENT LAND USE.

At present the loamy mallee soils in districts with 13in. or more rainfall probably present less problems in land use than any of the other major soil groups.

Providing phosphate dressings are kept up and medics encouraged, these soils are capable of maintaining fertility under intensive cereal growing with crops as often as one year in three—or even every other year where alternating with clover/ley.

Fallowing appears desirable on these soils for best wheat yields, but barley yields are excellent on a two year rotation of barley-medic pasture. This barley-pasture rotation appears to result in increasing fertility and a drop in quality of barley for malting. One hesitates, however, to suggest that cropping might be even more frequent.

Barrel medic is superior to the burr and woolly burr medics which come in naturally where phosphate is applied. Where clover has to be sown, therefore, barrel medic is the best to use; but it is often difficult to get it to supplant the natural medics.

Erosion Control.

Because loamy mallee soils withstand erosion comparatively well, contour banks are needed only on the steeper slopes (5 per cent or more) when fallowing is carried out.

Contour working has proved worth while on long but comparatively gentle slopes.

Pasture Species.

Where pastures of longer than two years duration are required, lucerne appears to be the most satisfactory plant. The annual medics thin out after one or two years. Wimmera rye-grass, likewise, soon gives way to barley grass and brome grass, which can only be regarded as second rate pastures because of their objectionable seed heads.

Marginal Areas.

The low rainfall areas of loamy mallee soils have seen a steady reduction in cropping and a reversion to grazing on natural pasture. In the driest parts cropping has gone right out; and in some places the native bluebush is regenerating, with pastures otherwise becoming dominated by speargrass and annual grasses.

In the slightly better parts, with 10-12in. rainfall, some cropping is still carried on, with benefit both from the crops as grain for sale or stock feed reserves and from the subsequent pastures.

Problems of Future Use.

In the present economic situation no marked changes in use of loamy mallee soils seem likely. Experimental work within the Department of Agriculture aimed at increasing efficiency includes:—

1. A search for better annual legumes, especially for the lower rainfall districts.
2. A search for better pasture grasses, especially drought resistant perennials.
3. Fertility studies in relation to yield and quality of cereals.
4. A study of the importance of time of fallowing on moisture storage and crop response.

STONY MALLEE SOILS

The dominant feature of stony mallee soils is the presence of surface limestone to the extent that it interferes seriously with cultivation.

The surface is always very rough, with exposed sheet limestome as well as loose stones of various sizes. Where stone is not actually exposed, the surface soil is brown or grey brown loam, sandy loam or loamy sand, and only a few inches deep.

Extensive stone picking sometimes makes it possible to grow crops on stony mallee soils; but usually where cropping is carried out the soils are loamy mallee rather than stony mallee.

DISTRIBUTION OF STONY MALLEE SOILS.

The map (Fig. 5) shows that there are stony mallee soils throughout the mallee areas, especially in the vicinity of Tailem Bend, north of Swan Reach, in the Tooligie region of Eyre Peninsula and near Melton on Yorke Peninsula.

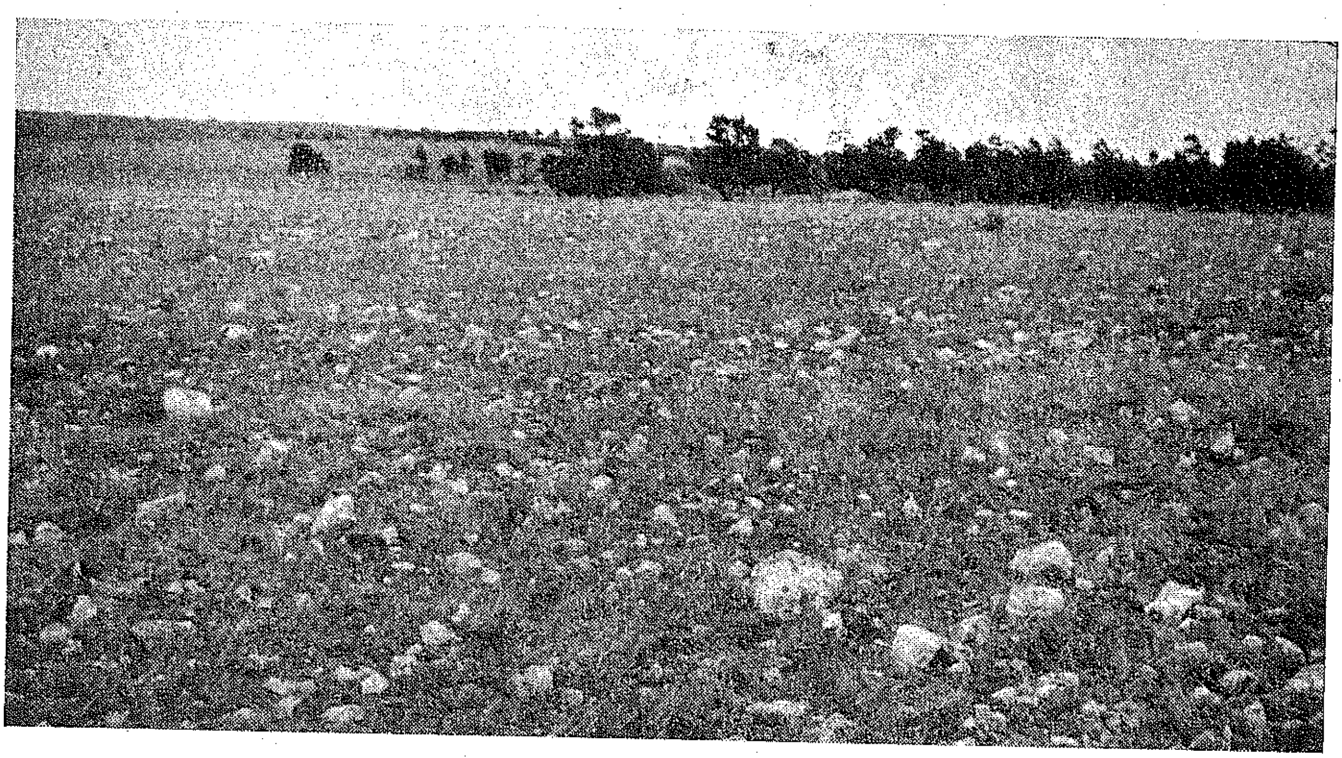
In addition, there are extensive areas of shallow soils with outcropping limestone which are not strictly mallee soils. These occur along the west coast of Eyre Peninsula south of Streaky Bay, and in southern Yorke Peninsula.

USED CHIEFLY FOR GRAZING.

Most of these stony mallee and similar shallow soils are used only for grazing or are left uncleared. The pastures are usually annual grasses such as barley grass or bromegrasses, together with woolly burr clover. They have been found to respond to superphosphate, but topdressing to improve pastures is rarely attempted.

The stony soil areas on western Eyre Peninsula and southern Yorke Peninsula are deficient in cobalt and copper; and unless these are supplied, sheep suffer from "Coast" disease.

Small areas of stony mallee on farms of predominantly sandy or loamy soils make useful sites for watering points or for hand feeding sheep.



Stony mallee country near Murray Bridge. Frequently the surface limestone is even denser than this.

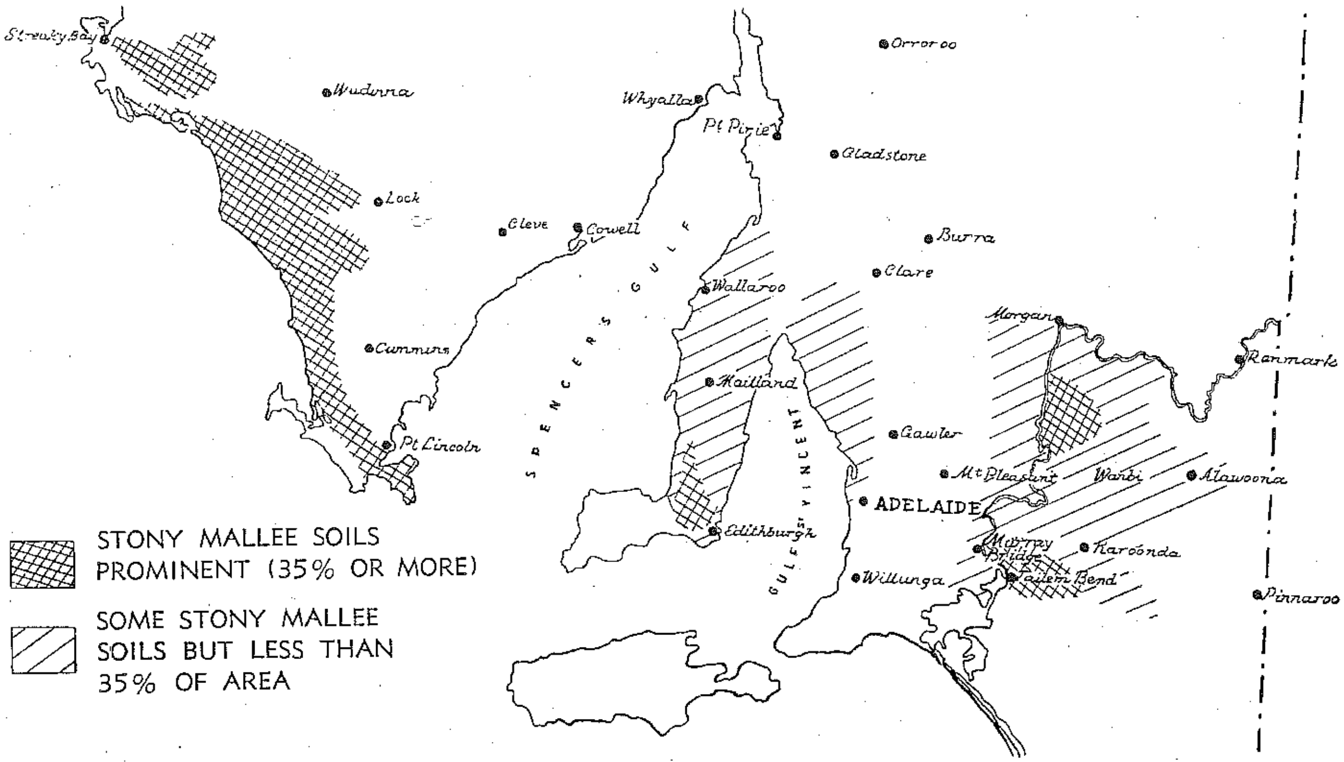


Fig. 5.—Distribution of stony mallee soils in the agricultural areas. Cross-hatchings indicate main regions of stony mallee and similar shallow stony soils.

SANDY MALLEE SOILS

The sandy mallee soil regions of South Australia form a very characteristic landscape pattern of alternating sand ridges and flats between. The ridges are roughly parallel and follow the direction of the prevailing winds.

In very sandy areas the ridges or dunes are close together, with very little flat land between. Elsewhere the dunes are isolated or separated by ¼ mile or so of flats.

SOILS OF THE FLATS.

The flats between the dunes are very variable in type. The surface is generally loamy sand or sandy loam. The texture may become finer with depth and increase to loam or sandy clay loam before reaching lime rubble at depths of two feet or so. In other cases there is little change in texture until sheet limestone or limestone rubble is encountered at shallow depths.

These soils of the interdune flats may generally be regarded as loamy mallee or stony mallee.

THE SAND RIDGES.

In their natural state the ridges consist of brown or reddish brown sand of considerable depth, becoming deeper towards the crest.

On the lower slopes there is generally a sandy clay loam horizon about a foot below the surface, and beneath this again a horizon of soft lime. Nearer the crest the sand may be 4ft. to 6ft. deep.

A section through a typical sand ridge is illustrated in Fig. 6.

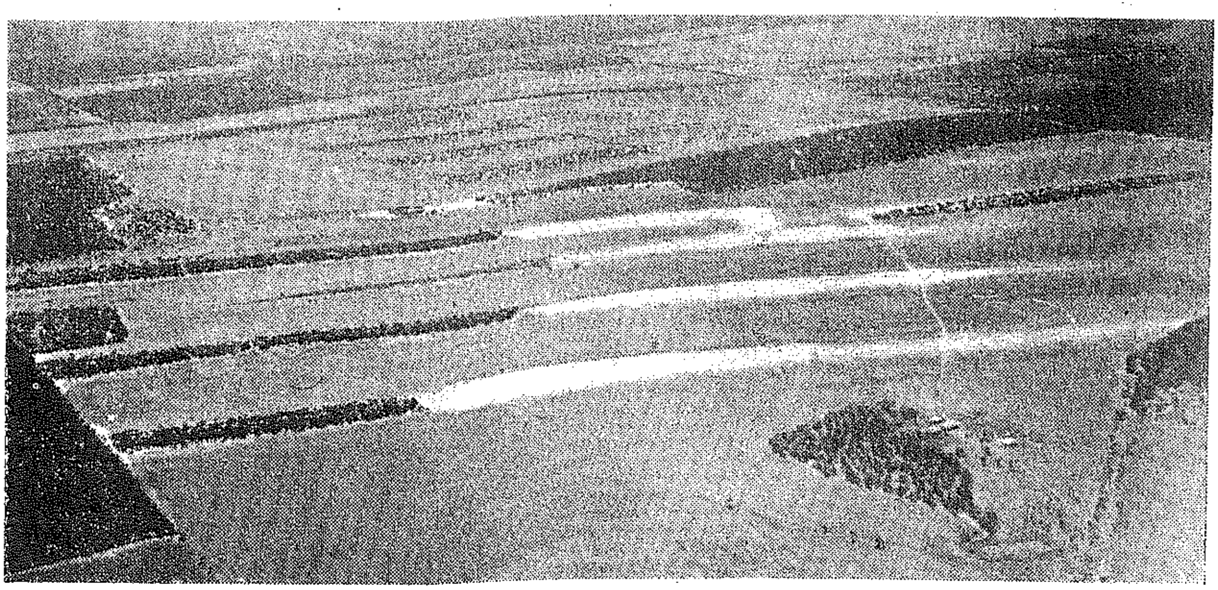
Sometimes the sandy clay loam is absent and there is little change in texture above the lime.

DISTRIBUTION OF SANDY MALLEE SOILS.

Fig. 7 shows the distribution of sandy mallee soils in the agricultural areas. These soils are almost entirely in the 10in. to 15in. rainfall zone. The land is nearly flat except for the sand ridges, and there is no defined drainage system.

PROPERTIES AFFECTING LAND USE.

A feature of sandy mallee regions is the wide range of soil types thoughout the landscape. Except in irrigated areas it is not economically possible to subdivide farms so that sandhills and flats are separated. This often makes it necessary to handle a complexity of soils in the one paddock.



An aerial view of parallel sand ridges on Eyre Peninsula. Scrub has been left on most of the larger hills, but where these have been cleared, drift has occurred.

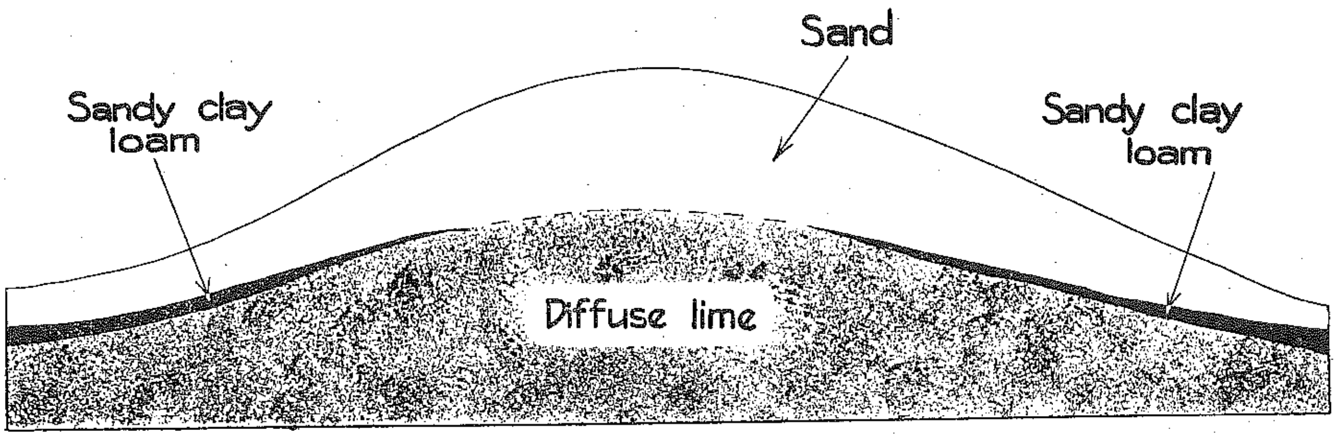


Fig. 6.—**Diagrammatic cross-section of an eroded mallee sand ridge. The depth and thickness of the sandy clay loam varies considerably, as also does the density of the lime beneath.**

Fertility.

The initial phosphate level is very low—even lower than with loamy mallee soils—making phosphate fertilizers essential.

Nitrogen reserves are also low, and deficiency soon shows up in cereal crops.

In irrigated areas deficiencies of zinc, manganese and copper have been recorded on fruit trees and vines. Applications of these elements, especially zinc, have given marked increases in growth. Non-irrigated areas, on the other hand, have shown little or no response to these elements.

There are signs that potash may also be lacking. Although potash fertilizers have not given economic returns, there has been some response in trials both with cereals and with irrigated horticultural crops. The results suggest that supplies of potash are marginal and that potash fertilizers may be needed eventually.

In their virgin state all the soils of the sandy mallee regions are alkaline. The deep sands of the ridges eventually become acid if regularly fertilized with heavy dressings of sulphate of ammonia such as are applied to irrigated orchards. However, no case has come to notice where soil acidity has become serious enough to

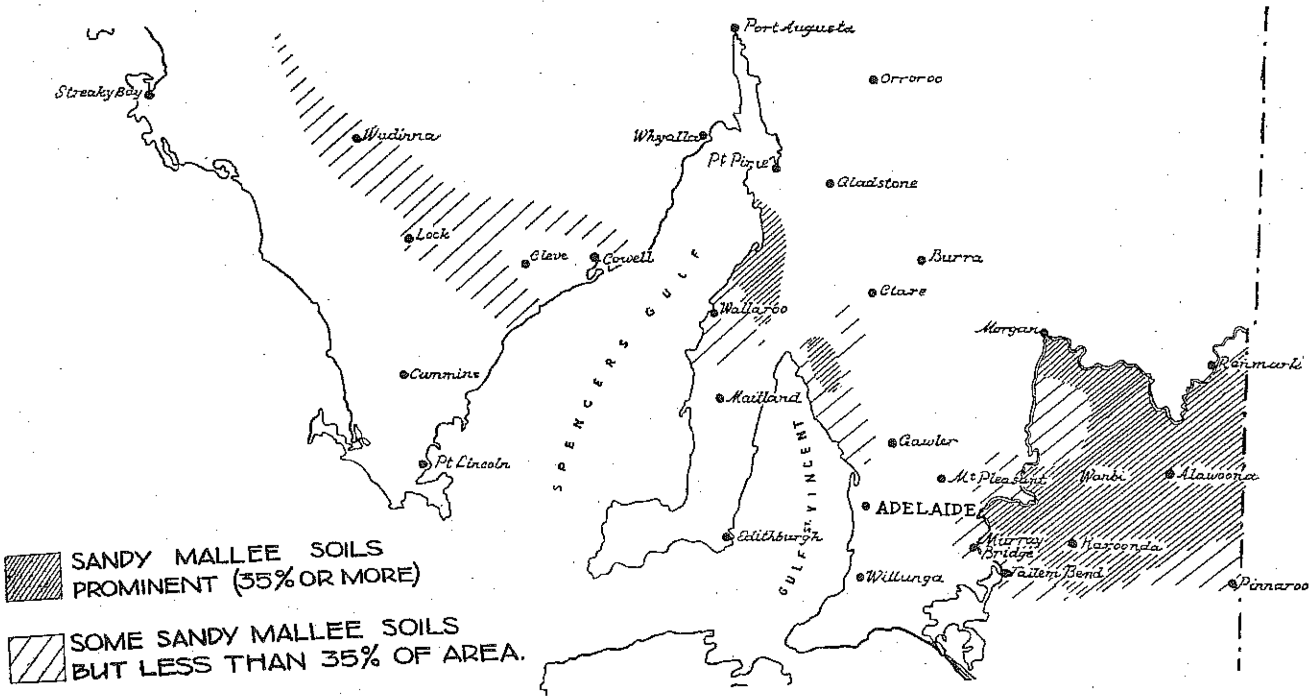


Fig. 7.—**Distribution of sandy mallee soils in the agricultural areas. Heavy hatchings show regions where 35 per cent or more of soils are sandy mallee.**

be injurious. The amounts of sulphate of ammonia used for rye or other cereal crops are unlikely to affect the alkaline reaction of the soil.

Erodibility.

The tendency of mallee sand ridges to drift very readily if cultivated or grazed bare in summer is well known. There are very few cleared sandhills in the mallee which have not drifted at some time since clearing.

In extreme cases 4ft. to 6ft. of sand at the western end of long dunes is blown away right down to the sandy clay or soft limestone. Further along, a new dune of loose sand is piled up, usually along one edge of the original sand rise.

Drift has a serious effect on fertility. Areas which have lost only a few inches of sand are very infertile and need ample fertilizer to re-establish plant cover.

On the other hand the areas covered by sand drift become much more fertile but are very unstable and often difficult to travel over with implements.

DEVELOPMENT OF SANDY MALLEE SOILS FOR FARMING.

Most of the sandy mallee has only been opened up for farming since 1910, and until the 1930's was chiefly used for wheatgrowing.

Under intensive cropping the fertility of the sandy mallee soils declined rapidly, especially as clovers and medics do not come in naturally to the same extent as on the loamy mallee.

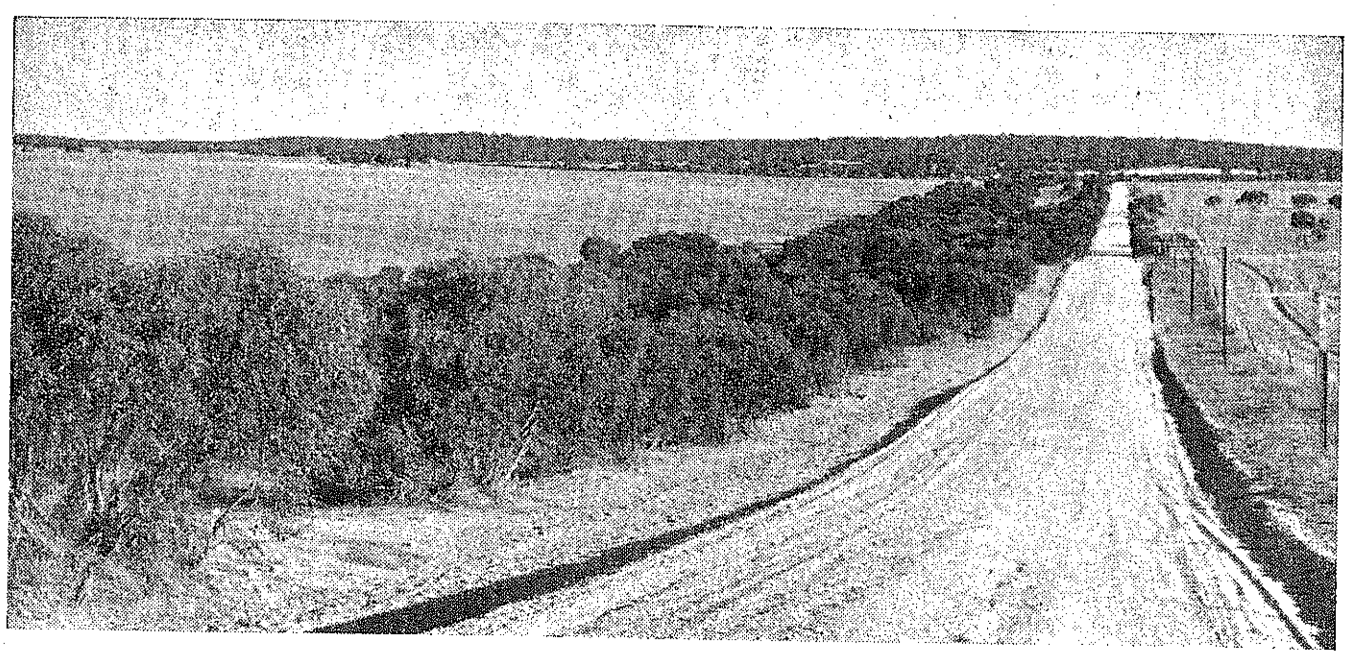
The fallowing of sandhills inevitably led to the drift problems which have been the bugbear of the sandy mallee ever since it was opened up. The problem, naturally, is worst in the driest parts of the mallee; but during the intensive wheatgrowing phase bad drifts were common even in reliable rainfall areas such as Bute, Wynarka and Pinnaroo.

Since the last 1930's however, there have been marked changes in the farming of the sandy mallee:—

- Farm size has increased, especially in the marginal country by the joining of farms together.
- Cropping is far less intensive, and more attention is given to sheep raising.
- Barley has replaced wheat as the main crop.
- Fallowing is now comparatively rare and is generally confined to the firm soils of the flats.
- The use of cereal rye to stabilize sandhills is now general.

PROBLEMS OF THE SANDY MALLEE.

A major problem in sandy mallee areas is the management of the easily eroded sandhill soils in the same paddocks as more stable flats. Although it is quite practicable to cultivate and crop differently on different soil types, they



Farm land in a sandy mallee area. The road crosses low sand rises in the foreground. Scrub has been left on the very large sand ridges in the background.

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A mallee sand ridge near Wanbi. The crest of the ridge has been blown off, and loose sand is piled along the north side of the dune (*foreground*).

cannot be grazed differently. Thus it is seldom possible to make full use of the flats without overgrazing the sandhills.

Clover or medic growth in natural pastures in the mallee is generally very poor. This may be partly due to lack of phosphate. Some farmers who have applied ample phosphate have obtained good volunteer growths of burr medic.

Barrel medic has been the most successful of the species which have been sown.

Research in Progress.

Research work in progress in the mallee includes the following investigations:—

1. A search for species, especially perennials, to give more effective long term protection of the hills.
2. A search for better pasture species, especially clovers.
3. Studies of soil fertility and fertilizer requirements for crops and pastures.

Further problems are those associated with livestock management including the economics of subdivision and the relative merits of a permanent breeding flock or fluctuating numbers of dry sheep.

Use of Sandy Mallee Soils for Irrigation.

The horticultural settlements along the River Murray are all on sandy mallee soils, and these have been surveyed in detail by the C.S.I.R.O. Division of Soils.

The main problem in management of irrigation water has been due to the very high infiltration rate. With furrow irrigation it is very difficult to achieve uniform watering. Excess water has often resulted in the development of water tables and saline seepage of lower slopes, necessitating the installation of drainage schemes.

The use of sprinkler irrigation on newer settlements is expected to reduce this problem.

THE RED-BROWN EARTHS

Extending through the Lower, Mid and Upper North cereal areas, the red-brown earths are the most important wheatgrowing soils in South Australia.

One of the outstanding features of these soils is their red-brown colour, which is very prominent in the subsoil. Another is the distinct contrast between topsoil and subsoil, both in colour and texture. The topsoil is always lighter in colour than the subsoil and it is also lighter in texture.

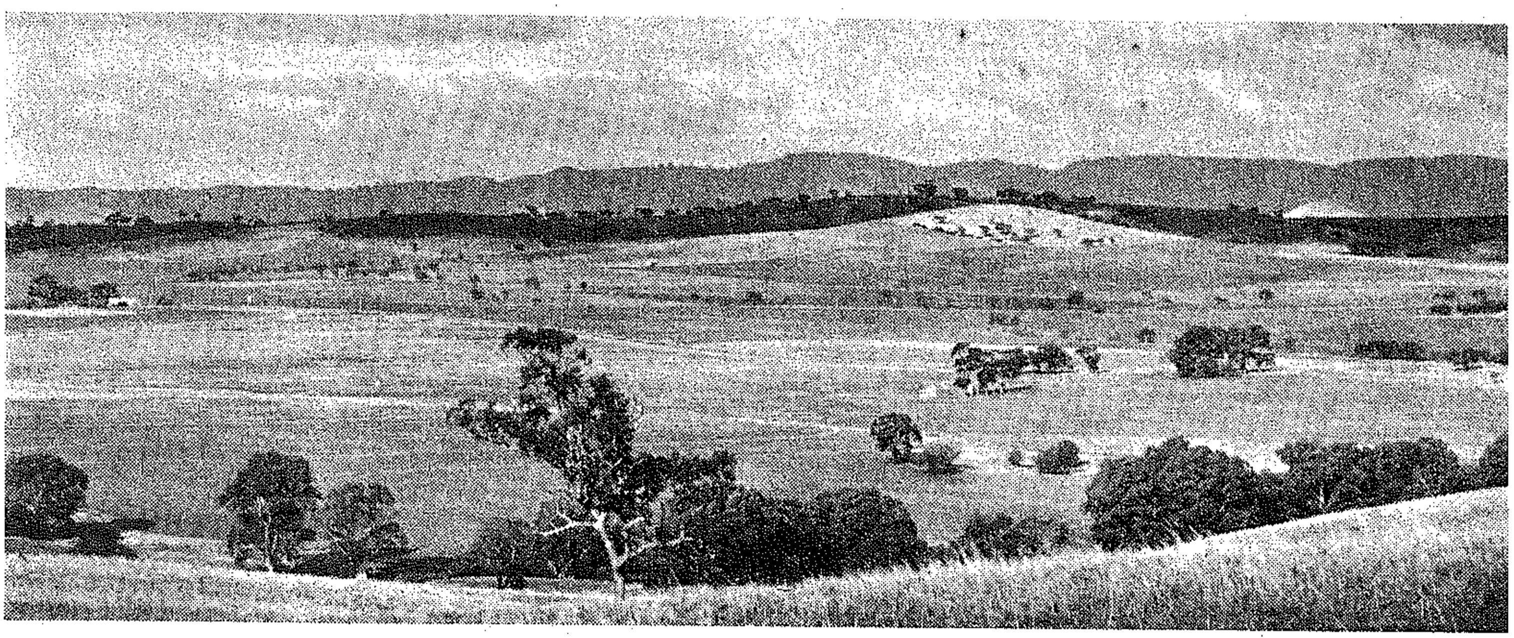
Colour of the surface soil ranges from light brown to reddish-brown while the subsoil is usually red, dark red or reddish-brown.

The subsoil colour becomes lighter with depth, chiefly because of the high lime content.

Texture of the topsoil is usually loamy, and the subsoil is always a clay.

Main differences between the various horizons in red-brown earths are set out below:

Horizon	Colour	Texture	Structure	Average Thickness	Lime Content	pH
Topsoil	Light brown to reddish-brown	Sandy loam–clay loam	Poor, breaks down with cultivation	6in.-12in.	None	6-7·5
Subsoil	Red to red-brown	Clay	Very good, friable	12in.-24in.	None or a little	7·5-8
Lower subsoil.	Brown to whitish-brown	Clay	Crumbly and friable	Variable	High	8-8·5



This rolling hill country in the Lower North is typical of northern farmlands where red-brown earth soils predominate.

By W. E. Matheson, B.Ag.Sc., Soil Conservation Adviser.

DISTRIBUTION OF THE RED-BROWN EARTHS.

The map (Fig. 8) shows that as well as the red-brown earth zone extending from Adelaide to Quorn, there are smaller areas on Eyre Peninsula.

The red-brown earths are mainly found in hilly country of 13in. to 20in. rainfall, with a few areas in higher rainfall. They occur both on steep slopes and on the comparatively level valley floors. Those on steep slopes and on hill-tops are often shallow, whereas in valleys the soils are many feet deep.

The red-brown earth areas include other soils, the type depending on the nature of the parent rock and on drainage and rainfall.

In higher rainfall areas of red-brown earths these other types are mainly podzolic, solodic and solonetzic soils. They differ from the red-brown earths chiefly because of their greyish colour, their sandy surface and their lack of lime. Their light textured topsoils are usually sands or sandy loams, and the subsoil is grey, brown, red or yellow.

In areas under 16in. of rainfall the red-brown earths are often associated with loamy and sandy mallee soils and, in the drier northern marginal lands, with desert loams. Like loamy mallee soils, desert loams show little change in texture between topsoil and subsoil. They are heavy textured and have a clay loam surface and a clay subsoil. There is much lime in these desert loams and also gypsum in the subsoil.

Besides this, there are some red-brown earth areas which include other soil types such as black earths, rendzinas, terra rossas and brown and grey soils of heavy texture. These occur extensively in districts such as Tarlee, Freeling and Merildin, and often form a complex soil pattern with the red brown-earths. This may cause cultivation difficulties because of the more rapid drying of the red-brown earths after heavy rain.

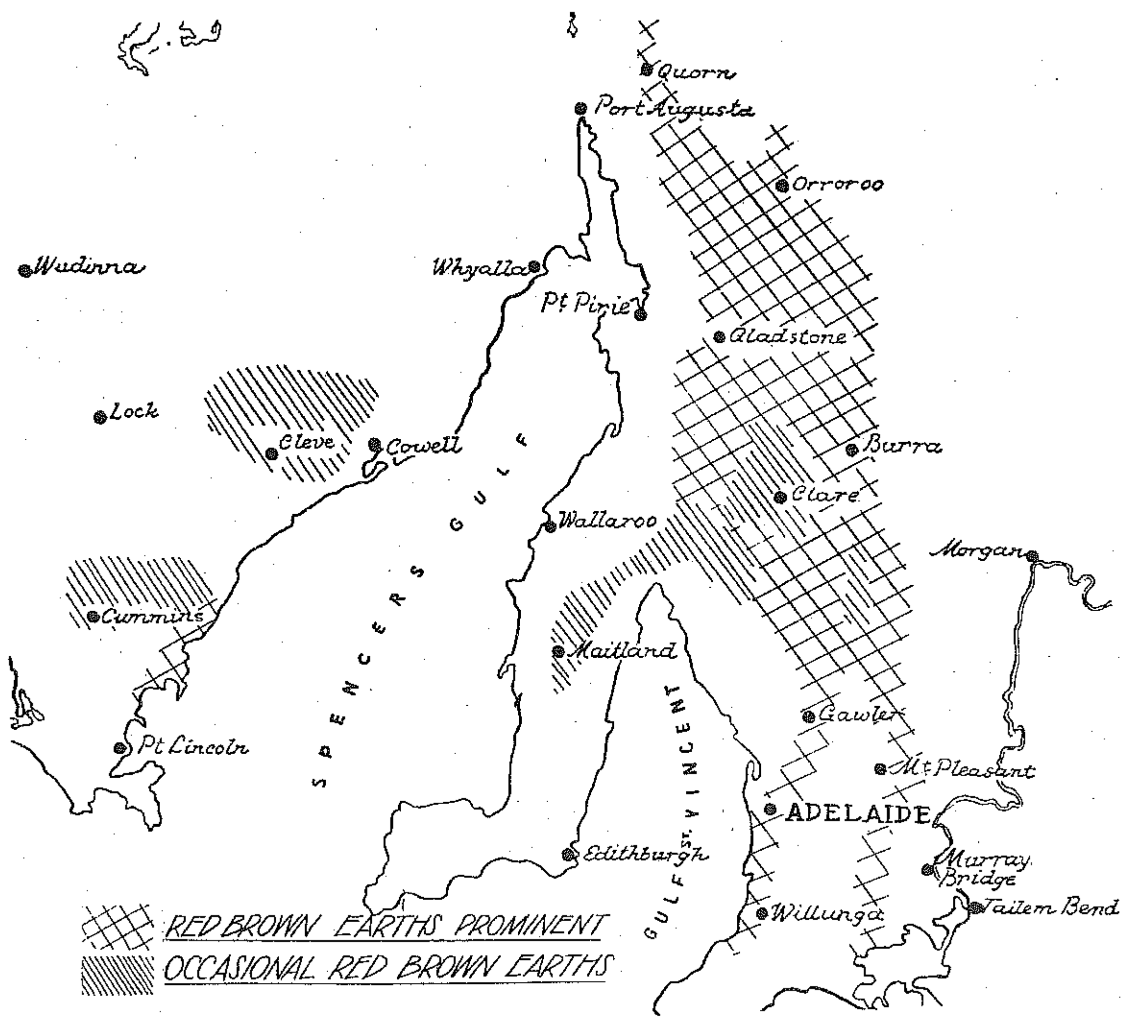
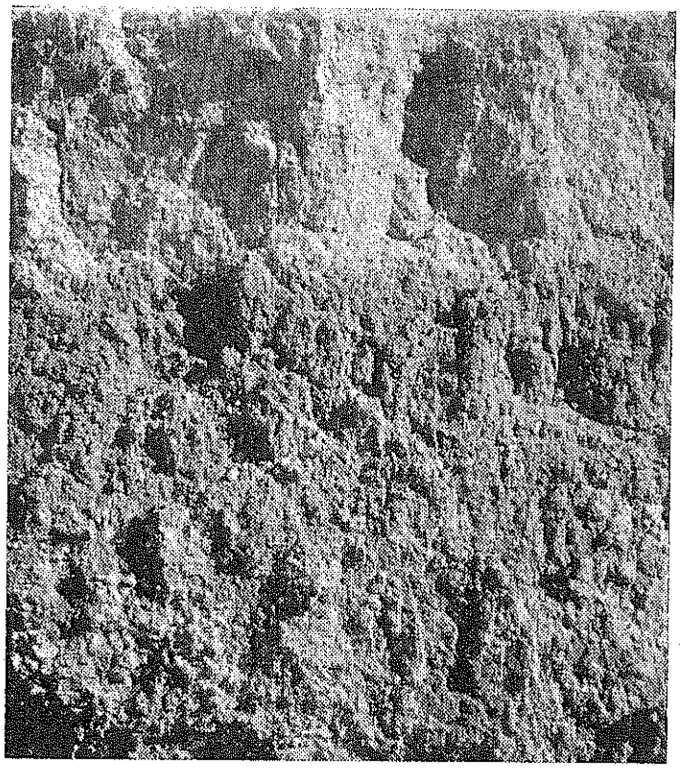


Fig. 8. Distribution of red-brown earth soils in the agricultural areas. Cross hatching indicates areas where red-brown earths are most prominent.



Upper part of a red-brown earth profile. This photo. shows the sharp contrast between surface loam and subsoil clay.

PROPERTIES AFFECTING LAND USE.

Organic Matter.

Red-brown earths are low in organic matter, and under cultivation the level falls rapidly, with a serious decline in structure. A good supply of organic matter is essential to keep soils friable and prevent loss of structure. Most organic matter is added to the soil while it is under pasture; and at least one year of good pasture is needed for each year of fallow.

Water Holding Ability.

Because they have deep clay subsoils, red-brown earths can store large amounts of water. Experimental work by the Waite Institute and the Department of Agriculture has shown that as much as 9in. of water can be stored in fallows over summer.

This ability to store moisture, combined with good internal drainage, makes the red-brown earths excellent soils for lucerne. The better lucerne stands of the northern agricultural areas such as those around Booborowie, Canowie Belt and Jamestown, are on red-brown earths.

Profile of a red-brown earth, showing the structure and vertical cracking of the subsoil clay and the lighter colour of the deep subsoil due to the presence of lime.

Go to Part 2 of this report