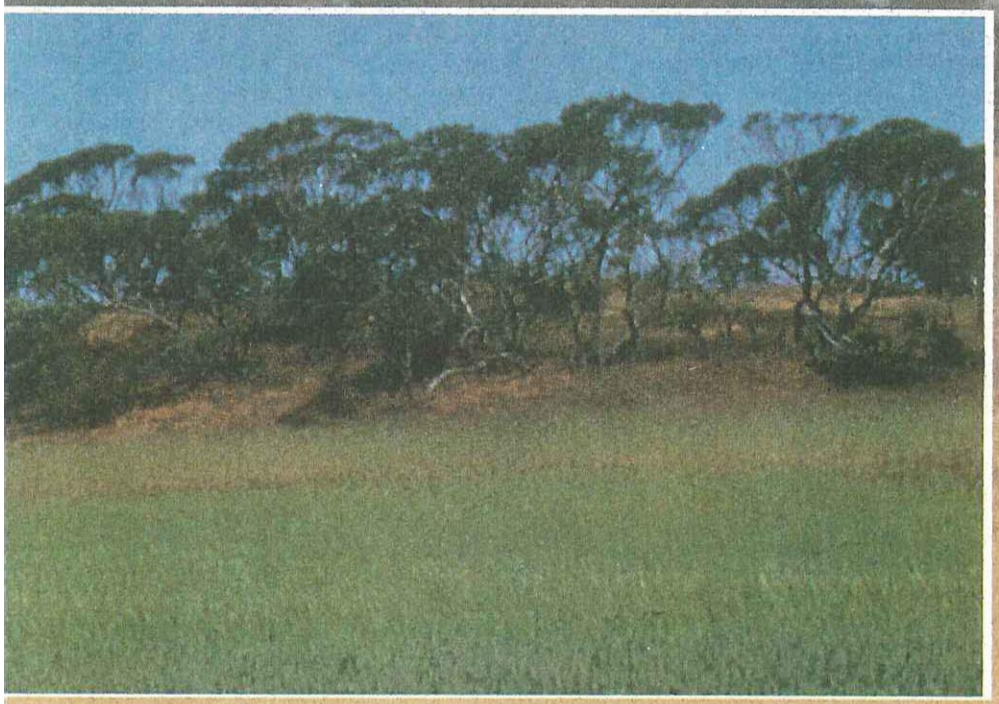
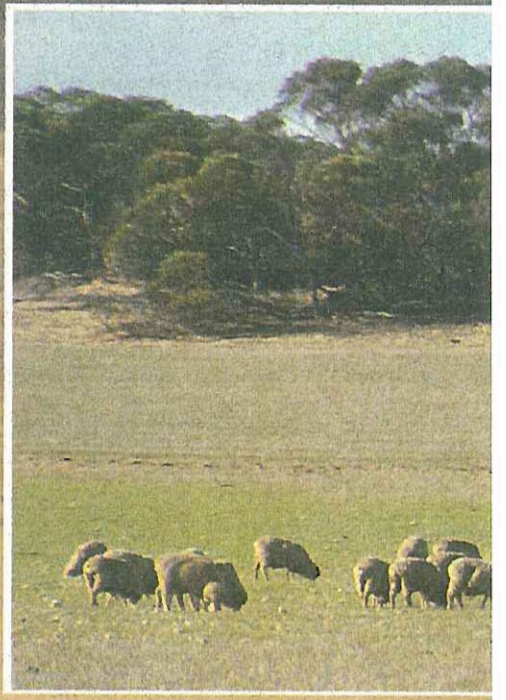
M. I. Hansen

Bulletin 7/92

Are you farming for the future?





THE MURRAY MALLEE DISTRICT

MURRAY MALLEE DISTRICT SOIL CONSERVATION BOARD

DEPARTMENT OF
PRIMARY INDUSTRIES (AGRICULTURE)

NATIONAL
SOIL
CONSERVATION
PROGRAM

Are you farming for the future?

THE MURRAY MALLEE DISTRICT

By Glenn Gale, senior soils officer

Bulletin 7/92

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Acknowledgment

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Are you farming for the future?

The increasing concern about the long-term condition of the land and the pressure to get more and more from it makes this one of the most important questions that farmers can ask. The answer lies in using the land within its capability. In other words, using the land without causing permanent damage or a reduction in its future productivity.

The Problems

To ensure that land in the Murray Mallee is used within its capability farmers must overcome several problems:

- wind erosion;
- decline in organic matter and fertility of the soil;
- rabbits;
- decline in native vegetation;
- saline ground water recharge.

Proven solutions to these problems exist and many farmers have put them into practice. The purpose of this booklet is to summarise these solutions and to encourage their use by farmers throughout the Murray Mallee.

▼ *The long-term future of farming depends on using the land within its capability.*

PROVEN SOLUTIONS

MAINTAIN GROUND COVER

Maintaining ground cover is the key factor in the prevention of wind erosion. Ground cover can be annual crops and pastures and their residues, perennial pastures, or native vegetation.

Retaining stubbles and pasture residues:

- ***helps to protect the soil from wind erosion;***
- ***returns organic matter to the soil;***
- ***recycles plant nutrients.***

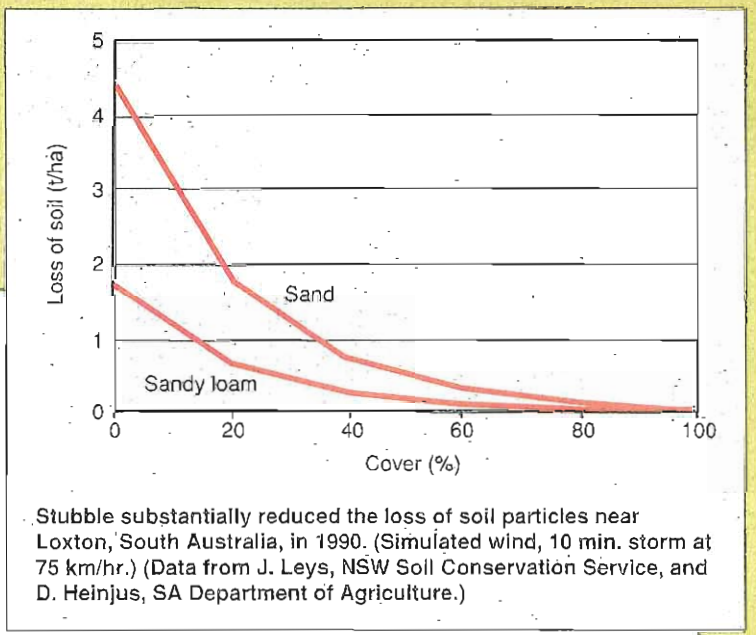
Protection from erosion

About 25 per cent ground cover provides adequate protection from wind erosion on productive, stable soils, such as loamy flats.

More stubble or pasture residue is required to protect sandier soils and sandhills from wind erosion. About 70 per cent ground cover is adequate.

▶ *About 25 per cent ground cover is adequate protection from wind erosion on stable soils.*

◀ *About 70 per cent ground cover, adequate protection from wind erosion on sandhills.*



Stubble substantially reduced the loss of soil particles near Loxton, South Australia, in 1990. (Simulated wind, 10 min. storm at 75 km/hr.) (Data from J. Leys, NSW Soil Conservation Service, and D. Heinjus, SA Department of Agriculture.)

Success with pasture residues

Pasture residues are brittle and are often well broken down before seeding. However, if they are managed well they can provide some surface protection through to March, or even later.

To successfully maintain ground cover with pasture residues:

- use chemical fallow or chemical topping instead of long cultivated fallow;
- replace cultivations with herbicides wherever possible;
- graze sparingly or not at all over summer;
- when cultivation is necessary, use low inversion implements and cultivate slowly.

PROVEN SOLUTIONS

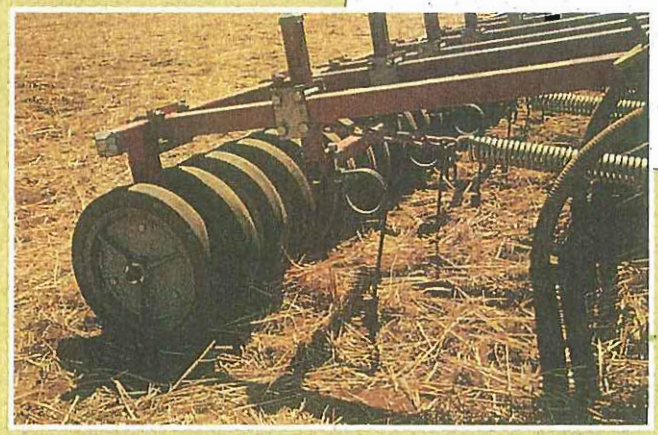
Success with stubble retention

With adequate planning, which begins at harvest, most stubbles can be successfully retained.

▲ *Chop and spread straw and chaff when harvesting.*

- For best results, begin stubble treatment at, or immediately after, harvest. This will allow the most time for the stubble to break down before seeding or pasture regeneration.
- Keep as much stubble as possible on the soil surface. Most of the problems experienced with stubble retention are caused by incorporating stubble into the seedbed.

Avoid repeated harrowing or working just to break up or bury stubble. The damage these extra cultivations do to the soil outweighs the benefits of keeping stubble.



▲ *Match stubble length with the capacity of tillage and seeding equipment.*

▼ *Stubble retention is especially important when lupins and other grain legumes are sown.*

- Break stubbles into manageable lengths (usually 15 cm or less). It is the length of the stubble, not the quantity, that causes blockages in machinery.
- Take care when grazing legume stubbles because the surface protection they provide is often inadequate, and grazing aggravates the erosion risk.
- Stubble is too valuable to burn. When stubbles are burnt all the nitrogen and sulphur are lost. Burn only as a last resort, using a cold burn.

FACT

When the stubble from a 1 t/ha wheat crop is burnt about 12 kg of nitrogen is lost per hectare. This is equivalent to the nitrogen contained in 25 kg of urea.

PROVEN SOLUTIONS

REDUCE TILLAGE

Of all farm practices, cultivation is the greatest destroyer of the soil. Reduced tillage systems limit cultivation by a reduction in the number and intensity of cultivations and as a consequence soil erosion and breakdown of organic matter are limited.

Reduced tillage:

- ***reduces wind erosion;***
- ***minimises organic matter decline;***
- ***maintains ground cover;***
- ***enables more timely sowing.***

▶ *Avoid working fast and working soil that is too dry.*

Cultivations can be reduced

- Use chemical topping, grazing, spray grazing or slashing to reduce weed populations before cropping.
- Cultivate only when weeds are present or when rhizoctonia is likely to be a problem.
- Instead of fallowing, control weeds and diseases in other phases of the rotation.
- Use chemical fallow instead of long cultivated fallow.
- Tolerate some summer weeds instead of cultivating fallowed paddocks.
- Have a planned approach to weed and disease control. Consider what weeds and diseases are likely to occur and plan tillage and herbicide options accordingly.

The degree to which cultivation can be reduced depends on getting other management factors right, particularly weed control throughout the rotation. In the light of increasing herbicide resistance, some cultivation for weed control may be necessary in the rotation.

▼ *Chemical fallows provide more protection from wind erosion than do cultivated fallows. However, chemical fallows need careful management to prevent erosion. The plant residues tend to break up readily and are very palatable to stock, and the soil works up finely when cultivated.*
Left: Chemical fallow.
Right: Wheat crop on chemical fallow.

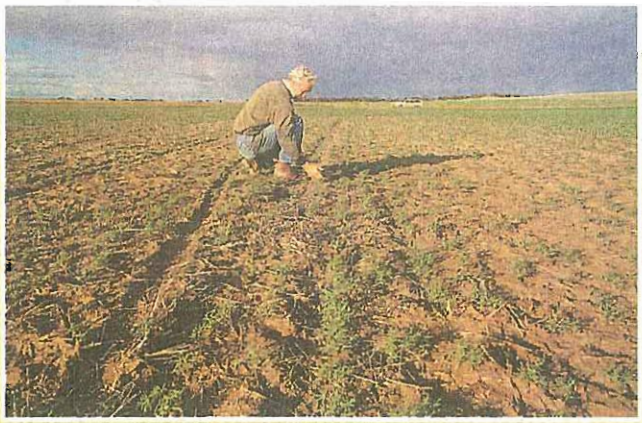
FACT

The loss of 1 mm of topsoil represents 10 to 12 t/ha. Such losses occur frequently on bare soils and often go unnoticed.

PROVEN SOLUTIONS

Direct drilling

Direct drilling, or the sowing of a crop into unworked soil, is the ultimate form of reduced tillage. Any weeds present before sowing are controlled with herbicides.



▲ *Direct-drilling has an important role to play in situations of high erosion risk as in sowing grain legume crops.*

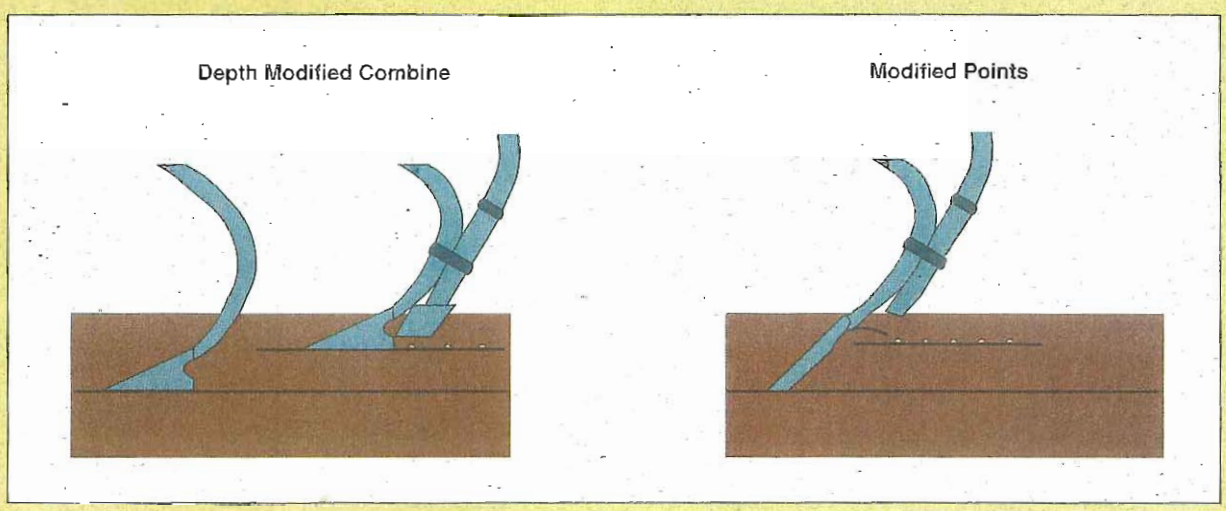
Direct drilling:

- ***is markedly superior to other forms of reduced tillage in lifting soil organic matter;***
- ***minimises the risk of wind erosion;***
- ***provides the opportunity for higher yields through more timely sowing;***
- ***reduces the use of machinery and fuel;***
- ***maintains ground cover.***

Rhizoctonia control with direct drilling

Repeated cultivation is not necessary to control rhizoctonia. To reduce the risk of rhizoctonia when direct drilling:

- spray weed growth from an early break in the season at least two to three weeks before sowing, but do not delay sowing beyond the optimum date;
- break up rhizoctonia at sowing by using a depth modified combine or modified points with a deeper working narrow keel, to disturb the soil below the depth of planting.



FACT

Dust lost through wind erosion is the most fertile part of the soil. Dust samples collected near Loxton using a wind tunnel to simulate wind erosion had 12 times more total phosphorus than the surface soil of the paddock.

PROVEN SOLUTIONS

INCREASE ORGANIC MATTER IN THE SOIL

The organic matter in the soil plays a vital role in preventing wind erosion and maintaining crop production and overall farm viability.

Organic matter:

- ***is the main binding agent in sandy soils;***
- ***contains almost all the soil nitrogen reserves;***
- ***improves the capacity of the soil to store and supply plant nutrients;***
- ***is concentrated in the top few centimetres of the soil.***

Organic matter

Organic matter or humus is formed by the decomposition of plant and animal residues by micro-organisms.

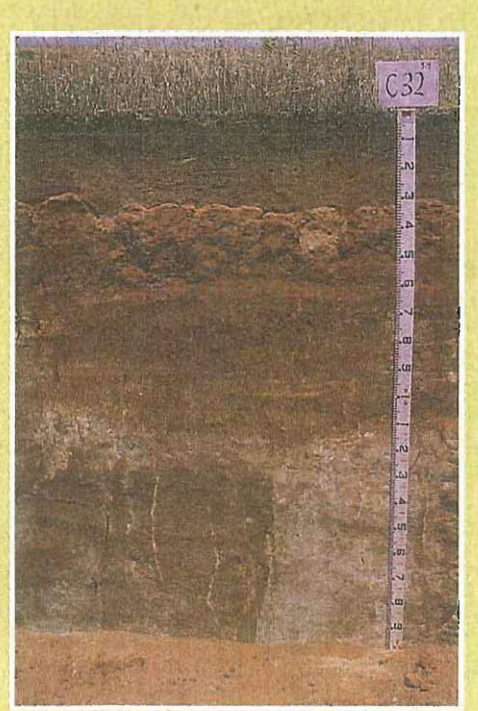
Anything that increases the organic matter content of the soil will tend to increase the ability of the soil to resist erosion.

Soil organic matter can be increased

- Use a rotation that includes vigorous legume pastures.
- Grow well fertilised crops with healthy root systems.
- Minimise tillage.
- Retain stubble and pasture residues.
- Monitor organic matter through soil tests for organic carbon.

The object is to maintain high organic matter levels. Restoring depleted organic matter is a difficult and long-term process.

▲ *Organic matter is fundamental to soil fertility, crop production and overall farm viability.*



▶ *The dark colour of the topsoil is due to accumulation of organic matter.*

FACT

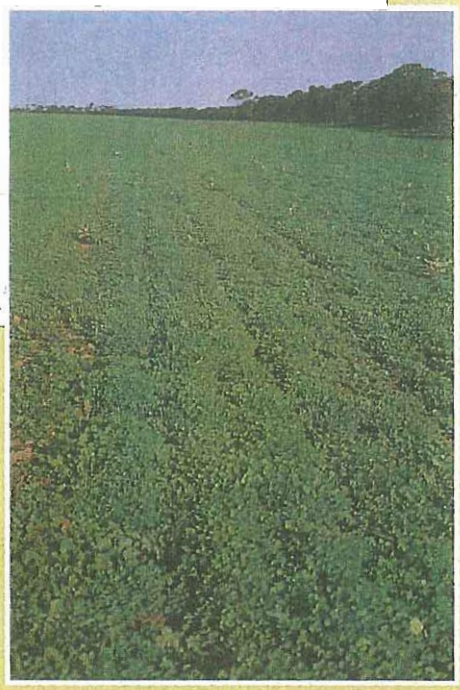
In most soils, about 95 per cent of the nitrogen is present in the organic matter. Only a small proportion of this is released each year for use by a crop.

PROVEN SOLUTIONS

GROW VIGOROUS LEGUME PASTURES

Planned rotations that include a vigorous legume pasture phase are essential for the long-term well-being and productivity of the land.

Because of the variation in rainfall, soil types and rotations across the district, a number of different pasture legumes, including annual medics and clovers, lucerne and vetches, have a role.



▶ *The essential features of a well-managed pasture are legume dominance, high plant density and insect and weed control.*

Benefits of a vigorous legume pasture phase:

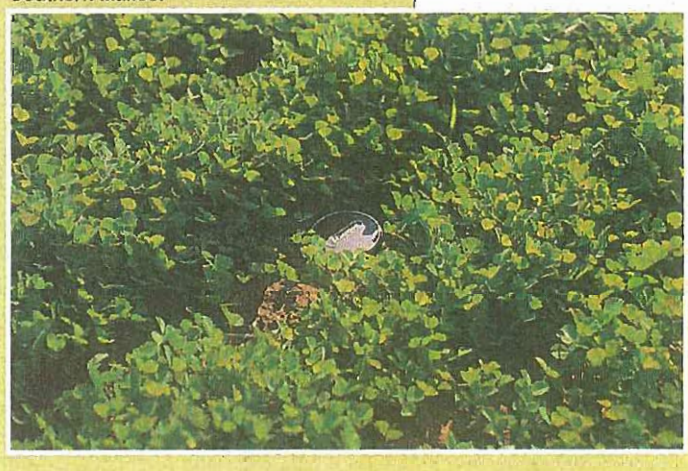
- ***increased organic matter and stability of the soil;***
- ***improved nitrogen fertility in the soil;***
- ***a break in the cycle of cereal diseases;***
- ***a good quantity of high-quality stockfeed;***
- ***protection from wind erosion.***
- ***reduced weed problems.***

Annual medic pastures

In the Murray Mallee the proven and reliable way to improve the nitrogen fertility of the soil and to control crop diseases is to grow annual medic pastures. Annual medics are well suited to the Murray Mallee because they are:

- adapted to neutral or alkaline soils;
- drought tolerant and suited to areas with an annual rainfall of less than 375 mm;
- well suited to regular cropping rotations.

▼ *A sown medic pasture in the Southern Mallee.*



▶ *A volunteer pasture in the Northern Mallee.*

FACT

A good medic pasture can increase soil nitrogen by more than 50 kg/ha. This is equivalent to at least 110 kg/ha of urea.

PROVEN SOLUTIONS

PLAN ROTATIONS AND CROP MANAGEMENT

Well planned rotations and sound crop management will optimise production and minimise the risk of wind erosion.

Rotations

Plants with healthy roots make best use of water and nutrients. Rotations that control root diseases such as cereal cyst nematode and take-all, will maximise yields and ground cover. Use rotations that include:

- vigorous legume pastures to break the cycle of cereal diseases;
- cereal varieties that are disease resistant;
- a planned weed control program in which grass weeds are controlled the year before the crop.

▲ *Control root diseases to maximise yields, ground cover and build-up of organic matter.*

Crop according to land class

Match crop type and cropping frequency to the capability of the land. This will help to maximise crop yields and protect soils from wind erosion.

Sow early

Sow the land most prone to wind erosion first. Sow crops as early as possible to:

- reduce the time the soil is exposed to the wind;
- enable rapid crop establishment while the soil is still warm;
- coincide with a period of fairly calm weather;
- provide the opportunity for maximum crop yields.

▲ *Match crop type to the capability of the land and sow the land most prone to wind erosion first.*

Maintain adequate soil fertility

Maintain adequate soil fertility through a planned fertiliser program and rotations that include vigorous legume pastures.

FACT

Rotations that include a vigorous legume pasture provide the highest yields of high protein wheat.

PROVEN SOLUTIONS

PLAN FERTILISER USE

Planning fertiliser use is essential to improve and maintain soil fertility for optimum crop and pasture yields, and to prevent the depletion of soil nutrients through removal in farm products.

To develop a planned fertiliser program, determine the nutrient status of soils, crops and pastures by keeping accurate paddock records and using soil and plant tests.

The main nutrient deficiencies that occur in the district are nitrogen, phosphorus and zinc.

▲ *A well planned fertiliser program is required for productive crops and pastures.*

Nitrogen

All Mallee soils, in their natural state, are deficient in nitrogen. To prevent a nitrogen deficiency:

- in the short term, apply nitrogen fertiliser;
- in the long term, increase the reserve of nitrogen-rich organic matter in the soil by growing vigorous legume pastures.

Application of nitrogen fertiliser is essential when sand drift is being stabilised.

▲ *The strip of crop on the left was sown without phosphate fertiliser.*

Phosphorus

Mallee soils are naturally low in phosphorus. Regular additions of phosphate fertiliser are required for maximum growth of crops and pastures.

Zinc

Zinc deficiency is widespread across the district. The most reliable method for identifying zinc deficiency is to tissue test crops or pastures.

FACT

One tonne of wheat contains about 21 kg of nitrogen, 3 kg of phosphorus and 2 kg of sulphur.

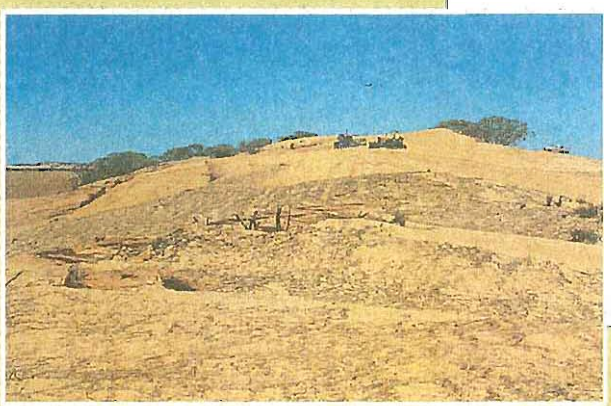
PROVEN SOLUTIONS

STABILISE AND MAINTAIN SANDHILLS

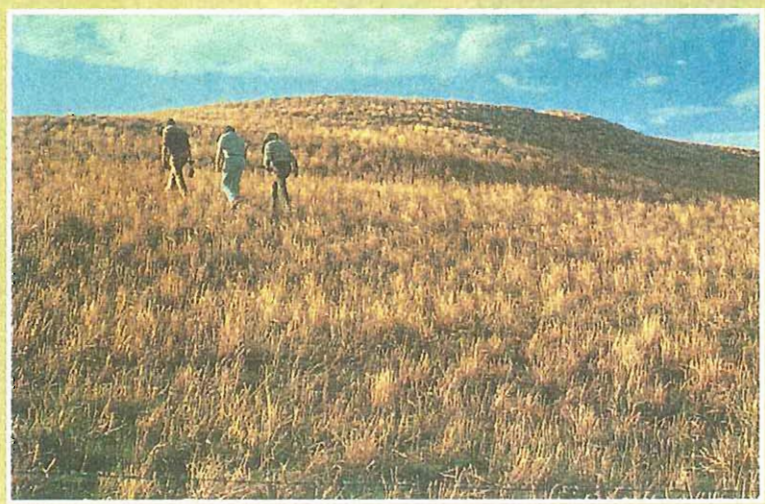
To successfully stabilise and maintain sandhills a long-term management plan is necessary. Ideally, sandhills should be fenced and covered with deep-rooted perennial vegetation. Once sandhills are stabilised it is far easier and cheaper to maintain them with small inputs each year than it is to ignore maintenance for a few years and then try to catch up.

Key elements for stabilising and managing sandhills

- Eradicate rabbits.
- Bulldoze steep banks to enable sowing.
- Sow early with cereal rye - before sowing the crop land.
- Sow the cereal rye with ample nitrogen and phosphate fertiliser.
- Resow with cereal rye as necessary to maintain stability, improve soil fertility, control weeds and renovate pastures.
- Fence and control grazing to maintain at least 70 per cent ground cover.
- Establish permanent vegetation cover, preferably with deep rooted perennial plants such as
  - — lucerne, evening primrose and perennial veldt grass;
  - — fodder shrubs;
  - — native vegetation.



An example of successful sandhill stabilisation and management - bulldozing, sowing with cereal rye and an ongoing soil fertility and pasture improvement program.
▲ 1983
▶ 1991.



◀ A sandhill fenced and sown to perennial veldt grass with a cover crop of cereal rye.

PROVEN SOLUTIONS

ERADICATE RABBITS

In the past rabbits have been a major problem in the district: the damage they did to crops, pastures and native vegetation eventually led to wind erosion. They continue to be a huge problem in some areas and are an ongoing management problem across the Mallee. Rabbits are a major cause of instability of sandhills and an obstacle to revegetation. Even low numbers of rabbits cause considerable damage, and they have the potential to rapidly increase in number with good seasonal conditions.

Management

The most effective program is one that aims for **eradication** of rabbits through a coordinated effort amongst neighbouring land-holders.

For successful rabbit eradication:

- conduct a thorough poisoning program in late summer;
- destroy all accessible warrens;
- fumigate inaccessible warrens and re-opened burrows.

◀ *Ripping rabbit warrens after a successful baiting program.*

▶ *Regeneration of native vegetation after the eradication of rabbits from the local area.*

FACT

Eight rabbits have about the same grazing impact as one sheep.

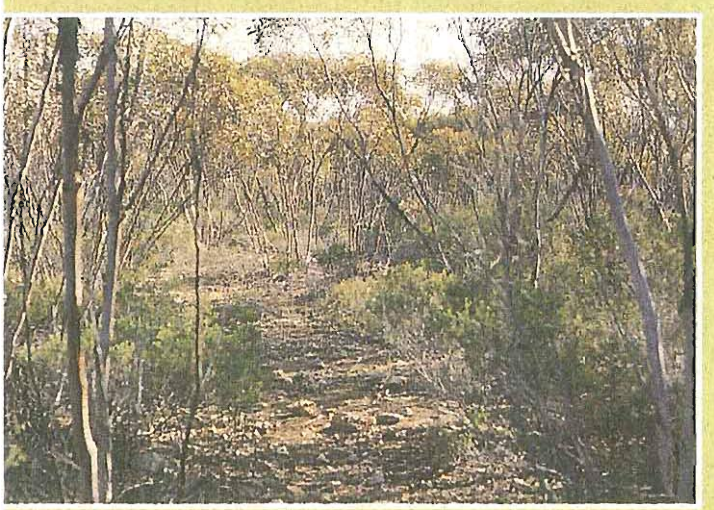
PROVEN SOLUTIONS

INCREASE WATER USE

In the long term, land use in the Murray Mallee can only be sustained if water use and ground water recharge closely reflect the rates that applied when the land was in its natural uncleared state. The aim is to minimise the amount of ground water recharge by maximising water use. To be effective this requires all land-holders to adopt land management strategies that maximise water use.

Water use can be increased

- Grow high-yielding crops and pastures, and limit the use of long fallow.
- Revegetate cleared sandhills with deep-rooted perennial vegetation, either agricultural or native species.
- Wherever possible, grow plants that use a lot of water, such as lucerne.
- Conserve remnant native vegetation.
- Establish native trees and shrubs on land of low productivity.



▲ *Mallee trees, which can have roots reaching a depth in excess of 20 metres, are extremely efficient at extracting water.*

▼ *Lucerne requires a lot of water and has an important role to play in increasing water use on sandhills.*

FACT

The replacement of native vegetation with annual crops and pastures has increased the amount of rainwater seeping down to the watertable. As the watertable rises salt stored in the landscape is mobilised. In other parts of the state this has led to the development of dryland salinity. In the Murray Mallee it will increase the flow of saline ground-water into the River Murray leading to an increase in the salinity of the river.

PROVEN SOLUTIONS

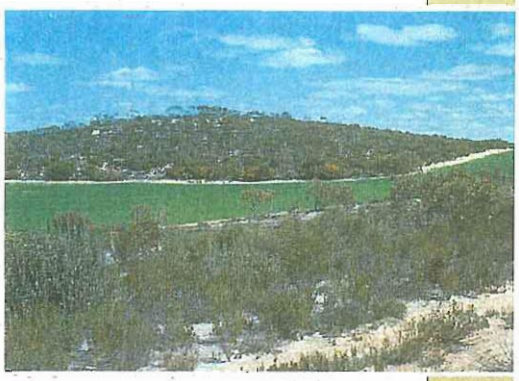
CONSERVE AND ESTABLISH NATIVE VEGETATION

Conserve remnant native vegetation

Most of the original native vegetation has been removed to make way for agricultural development. Grazing, burning, fragmentation and isolation, and invasion by weeds and vermin has degraded much of what remains. Sound management of the remaining native vegetation is essential to ensure that regeneration occurs and that it is of benefit to future generations.

A number of practices help conserve native vegetation.

- Fence and exclude stock.
- Eradicate rabbits and other vermin.
- Control weeds.
- Follow the guidelines in the publication, *How to manage native vegetation in the Murray Mallee: A conservation handbook*, published by the Department of Environment and Land Management.
- Enter into Heritage Agreements with the Department of Environment and Land Management over areas of native vegetation.



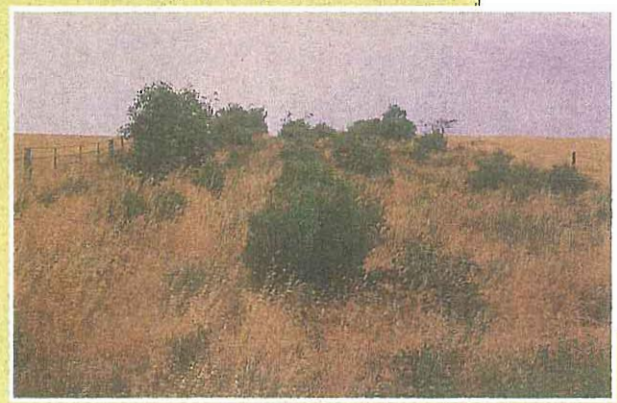
▲ *Native vegetation uses a lot of water, gives permanent protection from wind erosion and provides shelter and habitat for birds and other wildlife.*

Establish native vegetation

Native vegetation can improve agricultural production and should be established wherever possible, for example:

- for the protection of crops, pastures and livestock;
- to increase water use on areas of low productivity such as sandhills, stony land and paddock corners;
- to provide permanent cover on sandhills;
- for woodlots, honey and amenity purposes.

▼ *Native vegetation established using direct-seeding. (Photo courtesy of G Dalton, Woods and Forests.)*



▶ *Saltbush planted on a shallow sandy soil to provide a valuable source of fodder.*

FACT

Of the original area of native vegetation in the Murray Mallee about 20 per cent remains uncleared and about 50 per cent of this is in conservation parks.

PROVEN SOLUTIONS

BE PREPARED FOR DROUGHTS

Droughts are a part of farming in the Murray Mallee, especially in the northern areas. To minimise their impact on farm profitability and soil erosion, a plan to cope with them must be in place.

Wind erosion during droughts and dry years can be reduced

- Use temporary feedlots as a means of quickly reducing grazing pressure while adequate ground cover still remains.
- Establish a feedlot or a paddock suitable for hand feeding (for example, a stony paddock or a clay flat) and hand feed some sheep (for example, hoggets) in years other than droughts to gain confidence and experience in the technique.
- Store fodder or be prepared to buy fodder as required by the feedlot system.
    - Run sheep not kept in a feedlot in small mobs in separate paddocks over the farm.
    - As soon as sufficient rain falls, sow drifting areas and resow wind damaged crops.
    - Plan the layout of farm improvements, especially fences and water points.
    - Use sound land management practices, such as farming according to the capability of the land and minimum tillage.

▲ *Use a temporary feedlot or hand feeding to rapidly reduce grazing pressure during dry years.*

MANAGE WATER REPELLENCE

Water repellence often causes poor establishment and growth of crops and pastures, greatly increasing the risk of wind erosion and the amount of water draining into the watertable. It is a difficult problem to overcome but some farmers in the Murray Mallee are managing to produce good crops and pastures on severely repellent soils.

Management options for water repellent soils include:

- maintaining adequate ground cover;
- sowing in the bottom of furrows;
- the use of press wheels;
- good weed control;
- sowing at the optimal time;
- the establishment of lucerne, perennial veldt grass and evening primrose on the most erodible situations and where water repellence is severe.

PROVEN SOLUTIONS

PLAN THE PROPERTY

All land should be used within its capability so that it is in as good as, or better, condition for future generations. This means more than just preventing drift on sandhills - it involves all aspects of property management and their integration into a profitable, sustainable and efficient farming system. The best way to achieve this is to develop and implement a property plan.

Property planning involves consideration of all the components of a property, including climate, land types, native vegetation, property improvements, rotations, crops and livestock, cultivation practices, economics, and personal goals.

Principal steps in property planning

- Assess the resources of the property and the capability of the land.
- Plan the best arrangement of property improvements.
- Identify the land use and management options to which the land is suited.
- Establish a financial plan, priorities and a work program to implement the plan.
- Review the plan regularly.

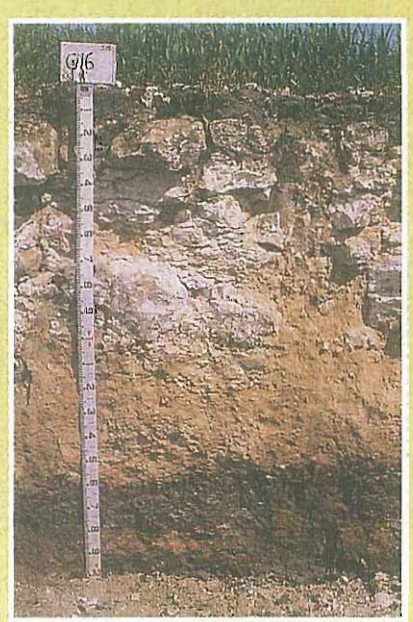
Soil conservation boards encourage land-holders to prepare property plans, and are authorised to approve plans that conform with the district plan.

A property plan:

- *ensures that land is used efficiently and within its capability;*
- *saves money and increases profitability in the long run;*
- *ensures that any money spent on property improvements is spent wisely and as part of a long-term program;*
- *may take as long as 10 or 20 years to implement, but progress will be orderly and affordable.*

▲ *Property planning gives rise to efficient, profitable and sustainable land use.*

Knowledge of the soil types and their characteristics is the first step in property planning.



PROVEN SOLUTIONS

PLAN THE PROPERTY

Land capability

Assessing the capability of the land is the first step in property planning. Eight land classes are used to rank agricultural land from highest to lowest capability. The capability of the land, and therefore the land class into which it is placed, depends on the nature and severity of the limitations present (for example wind erosion potential, rockiness and salinity). The classes are summarised as follows.

Class	Capability	Land use options	Broad land management categories
I	Very high	Many	Arable. No special requirements.
II			Arable. Simple practices required.
III			Arable. Intensive management practices required.
IV			Semi-arable. Occasional cropping.
V			Non-arable. Improved pastures.
VI			Non-arable. Rough grazing only.
VII			Non-arable. Permanent vegetation cover essential.
VIII	Very low	None	Non-arable. No agricultural use.

Examples of land classes and land management.

Land with a potential for wind erosion.

II Flats with sandy loam to sandy clay loam surface texture. Arable. Standard management of minimum tillage, stubble retention and a rotation that includes a pasture phase.

III Lower slopes of large sandhills. Arable. Standard management, with crops restricted to barley, triticale or cereal rye.

IV Mid slopes of large sandhills. Semi-arable. Sow early with cereal rye to maintain stability.

VII Crests of large sandhills. Non-arable. Maintain native vegetation.

PROVEN SOLUTIONS

Property improvements

Careful planning of property improvements has the following benefits:

- improved erosion control;
- ease of management;
- greater stock carrying capacity.

Fences

▲ *A sandhill fenced off from the adjacent arable land for ease of management.*

- Avoid right angles or sharp bends on sandy soils.
- Avoid placing a fence on or across a sandhill.
- Keep fences stock proof.
- Whenever possible, separate sandhills from firmer land and cleared land from uncleared land. This will allow crop type, cropping frequency and grazing management to be adapted to the capability of the land.

Access

Keep laneways wide to:

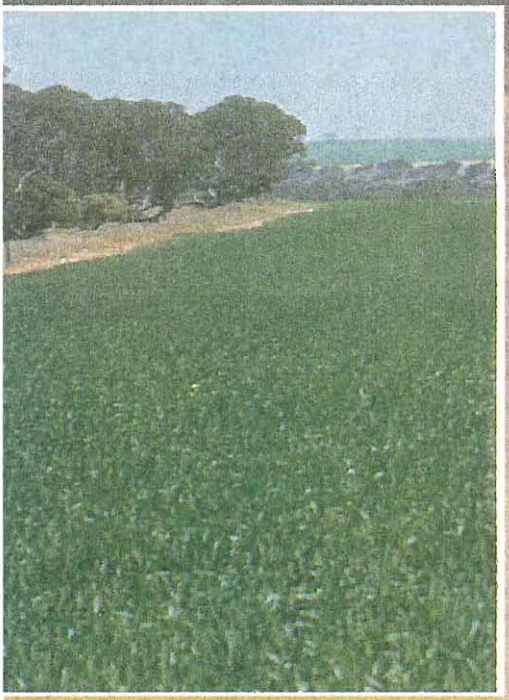
- minimise trampling and erosion;
- enable them to be managed for weed control and pasture improvement with standard machinery.

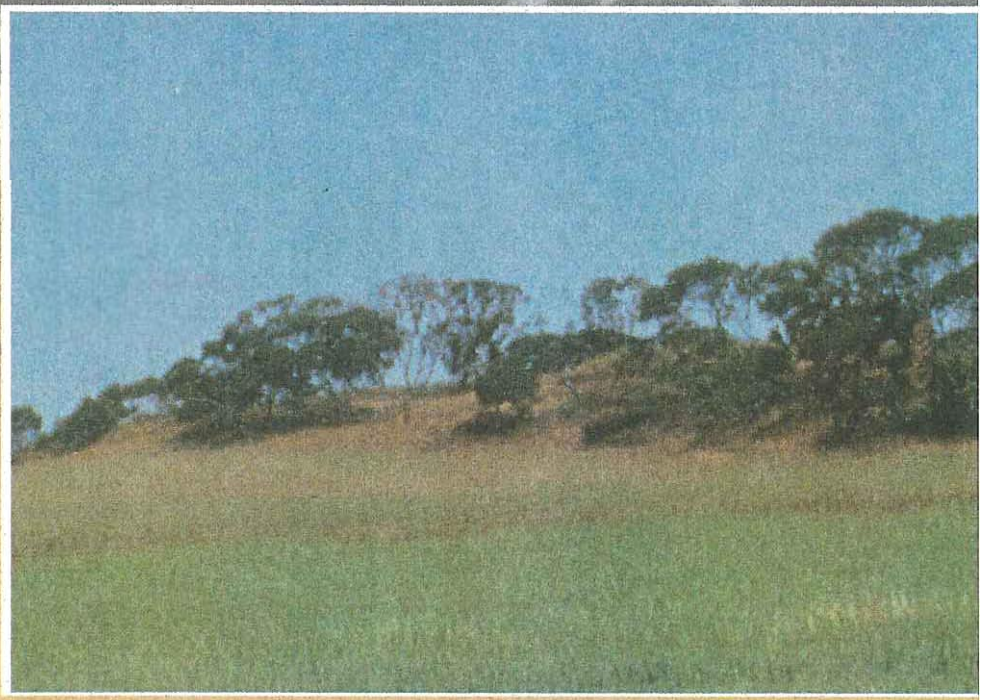
Site laneways and gates carefully to prevent them becoming focal points for erosion. Where possible sow laneways with perennial pasture, such as lucerne, veldt grass and evening primrose.

▲ *Site troughs on heavy textured soils or stony ground.*

Watering facilities

- Try to site tanks on hilltops so that water can be reticulated to a number of paddocks.
- Site troughs on heavy or stony ground, ideally near the paddock centre or half way along a fence.
- Locate troughs so that stock do not have to walk over sandhills to reach them.
- A trough on both sides of a sandhill will reduce trampling and the risk of wind erosion.
- Install more than one water point in large paddocks over 200 ha to encourage even grazing and reduce the trampling around each water point.
- Place troughs on the eastern side of paddocks to reduce the grazing pressure on the south-west corners.





Where to get more information?

For further information contact your nearest soil conservation board member. More detailed information than presented here on managing land within its capability is available in the Murray Mallee District Soil Conservation Plan.

Information and advice is also available from the Department of Primary Industries offices at Murray Bridge (085-35 6400), Loxton (085-84 7241), Lameroo (085-76 3345) and Wanbi (085-87 4151).