farmtalk

This article contains information most relevant to the less than 350 mm rainfall mallee farming region

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Farmtalk is a product of the Mallee Sustainable Farming Inc. Tri-State Research and Extension team

Mallee Fallow Management

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The Issue

Fallowing of a paddock for the preparation of a crop is a major land management activity in the Mallee. Fallowing has been used to conserve moisture, mineralise nitrogen, control weeds and prepare the soil for sowing.

Fallow lengths vary from 3 to 12 months, with approximately two thirds of fallows longer than 6 months. Long fallow management varies from full chemical fallow to full mechanical tillage ranging from 0 to12 cultivations (with an average of 3.3 across the Mallee Sustainable Farming (MSF) Inc. area), when preparing for a wheat crop.

Fallowing has been cited as a major cause of environmental problems because:
• it can reduce the number of growing plants in a paddock, and therefore the amount of deep draining soil water used; and

• it can reduce groundcover and soil aggregation levels to below 50%, which greatly increases the risk of wind erosion in the Mallee.

What do we know?

Based on the research undertaken on the MSF core trial sites, the focus farmer paddocks and previous work in the Mallee, there are some general guidelines on fallow management that have been developed.

Cultivation and erosion are linked.
• As the number of cultivations used in the fallow increases, the risk of erosion increases. (Figure 1).

• If groundcover and aggregation levels are low to start with, just one cultivation and sowing can put a paddock at risk of erosion.

• Cultivation disrupts the stabilization of aggregates formed through the actions of micro-organisms. Aggregates of larger size (>1mm) are at less risk of erosion compared with unstable and small aggregates.

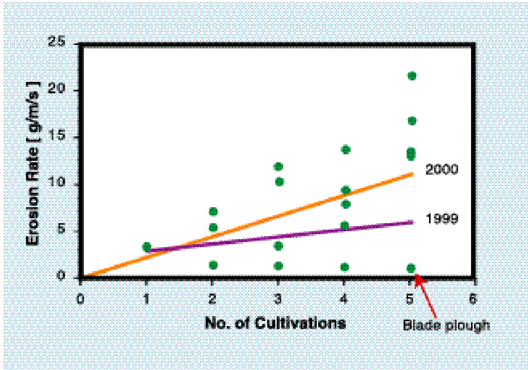

Figure 1. Relationship between the number of cultivations and the erosion risk on the MSF focus paddocks for two years

• On average, based on the data from the 45 focus paddocks, between 2 and 4 cultivations can put a paddock at risk of erosion.

• If blade ploughs, and chisel ploughs with wide sweeps, are used to maintain groundcover, greater numbers of cultivations can be used with less risk of erosion (see blade plough in figure 1).

• Summer weed control using herbicides and blade ploughs reduces erosion risk.

Moisture storage capacity and soil type are linked.
• Long fallow on sands or loamy sands has been shown to have no benefit for soil moisture storage. This is because there is inadequate water storage capacity in sandy soils (30-70 mm of plant available water in the top metre of soil) and because of high evaporative rates from sands over summer. (Figure 2).

• The concept of a 'dust mulch' breaking the capillary action that causes evaporation has not been observed on MSF Inc. trial sites in the Mallee.

• Fallowing in dry years stores minimal soil moisture. Therefore, if there is no significant rainfall, there is little value in fallowing. The 2002 year is an example of this. Similarly,

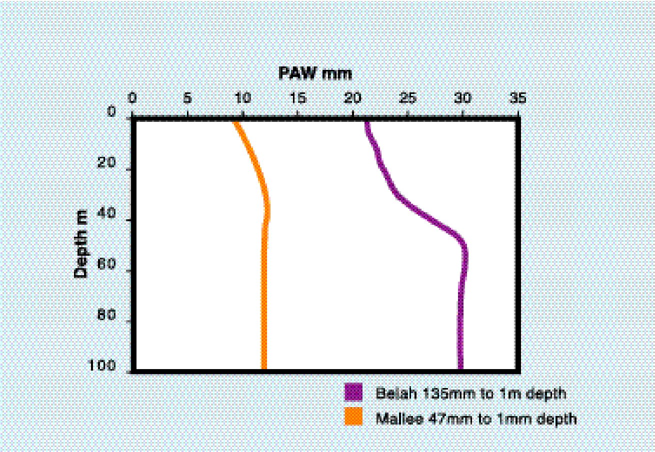

Figure 2. Plant available water (PAW) profiles for belah and mallee soils

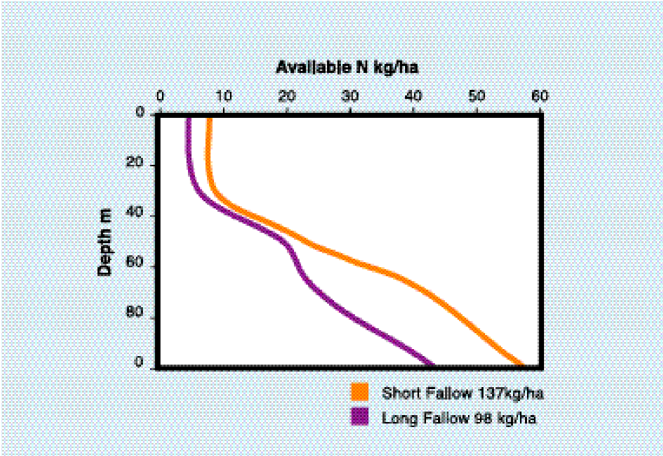

Figure 3. Available N profiles for two fallow lengths at the same Mallee site

crops are incapable of using what little stored soil moisture there is in drought years because of limited plant root development.

• Rainfall from late January onward contributes the most to available stored water at sowing.

Nitrogen (N) production and storage in fallows
• For optimal plant growth, N needs to be available to the plant. Fallows result in an increase in available N early in the season; however, fallows result in an overall decline of soil microbial biomass and groundcover.

• In years with high summer rainfall, particularly on sandy soils, this extra available N can be readily leached below the reach of the crop roots, resulting in a significant N deficiency. (Figure 3).

• The higher the organic levels of your soil, the lower the rate of leaching.

• Summer weeds rapidly use up soil water and nitrogen and need to be controlled chemically where tillage is not used.

Tillage impact on N and moisture storages
• Crops direct drilled into standing stubble retain soil moisture longer than those using cultivation systems do. This effect is not large but can be useful for getting crops away in dry years.

• Conventional cultivation systems promote faster mineralization of nitrogen which is more prone to leaching beyond the root zone.

• No differences in N and moisture storage have been measured between conventional cultivation methods. Therefore, the use of plough or a chisel plough will lead to the same amount of soil moisture and N being stored.

Crop production and fallow
• Long fallowing means foregoing a possible crop or pasture, and has to be considered when evaluating systems.

• On sands and loamy sands there are little or no soil moisture benefits from long fallows and some significant production risks (erosion, N leaching, and organic matter decline).

• On sandy loams and clay soils there is more justification for long fallows as there is the potential to store extra soil moisture that may result in yield benefits of up to 0.6 t/ha. Such benefits may not occur in very dry years (no rainfall to store) and wet years (water is not key limiting factor).

What this means

• There is a **greater risk of erosion on long fallowed sandy soils** (Figure 4) because they have lower soil aggregation levels and they require more groundcover to protect them.

• **Use of herbicides and stubble retention equipment,** e.g. blade ploughs, can help **maintain groundcover and aggregation levels** for erosion control.

• **Fallow is more suited to sandy-loam and clay soils,** because these soils have the capacity to store some soil water.

• **Fallow is not suited to sands** because the storage capacity is low and the evaporative loss is high.

• **Nitrogen storage is also higher** in loams and clay loams because they have lower rates of leaching and more microbial biomass to store nitrogen.

Actions/options to consider

There are a number of actions that can be taken to maximise the efficiency of a fallow.

• **Limit long fallows** (> 5 months) to soils with more than 15% clay content (that is, sandy-loam surface texture through to clay) because they can store soil water.

• **Consider continuous cropping on sandy soils** because fallowing is less efficient and erosion risk is reduced. The nutrient efficiency and productive capacity of these soils can be significantly improved with intensive cropping (Figure 5).

• **Use herbicides and stubble retention equipment** to maximise groundcover to protect the soil from erosion, reduce evaporative loss and nitrogen leaching. Stubble retention also provides energy for microbial growth and formation of larger-sized aggregates.

• **If not using a long fallow, commence fallow after January** to reduce disease risk and encourage microbial mineralisation of nitrogen.

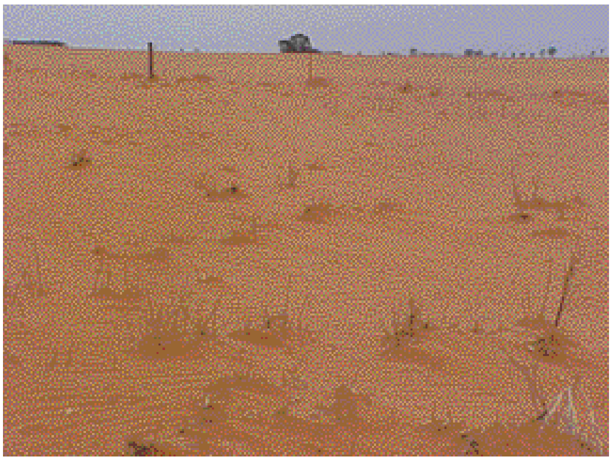

Figure 4. Wind erosion caused by long fallow

Where to from here?

• **Undertake soil testing** to establish the texture of your soil types.

• Consider **fallowing according to soil type**, e.g. long fallow on loamy flats and short fallow on sandy rises.

• **Modify fallow machinery** to increase trash flow and reduce burial of stubble.

• **Get involved** with groups looking at herbicide use for **summer weed control**.

• The following case study (Next page) - **"Systems Change is Achievable"** provides an insight into management of a mallee farming system, without reliance on fallow, at Waikerie, South Australia.

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Figure 5. Intensive cropping on sandhills offers greater production opportunities

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Systems Change Is Achievable

A case study examining options in farming systems in the mallee

Gill Stewart Extension Leader, Mallee Sustainable Farming Inc.
Allen Buckley - Farmer, Waikerie, South Australia

Allen and Jenny Buckley farm in the Mallee at Waikerie, SA, and have been moving towards reducing the fallow component of their farming system since the mid 1990s. In talking with Allen, you understand why the move towards no-till was embraced, and you start to be taken on an interesting journey stretching back to the late 1980s.

Where it all began

Allen had been extremely frustrated by the soil erosion that had been occurring, and by the visible degradation of the environment. Not being satisfied with the management of a system that was losing production on specific soil types, and in which the long term viability was being tested, Allen started to search for information and answers to solve the problems he was facing.

This journey has been an ongoing process of building networks with researchers, farmers and agronomists. Together they worked to resolve issues that were impacting on the productive capacity of the farming system and health of the natural resource base. Allen found great value in participating in field days and conducting his own on-farm trials that targeted specific issues.

Gaining confidence

These measures have all contributed to a better understanding and greater confidence in fine-tuning the mechanics of the system's change. Over time, it became clearer to Allen that the potential to change the farming system was real, and was not as big a risk as previously thought.

A significant hurdle that was overcome, and which lead to the start of the system's change, was the ability to refine the seeder set up to handle more trash. Once Allen worked out how to reset the tine configurations to sow on twelve-inch spacings, confidence in the new system was becoming real. "Once I realised I could resolve issues," Allen said, "I became more confident with this seeding system, which led to the purchase of a new seeder in 1998; a Case Concord seeder with Anderson openers, which gave me the ability to deep band fertiliser and get good seed placement in varying soil texture conditions."

Other challenges

Moving towards continuous cropping using no-till has meant closer management of the whole system, which in Allen's case, included livestock. The shearing program was moved from August to April, and lambing changed from April to July, to better fit in with the cropping system. Paddocks for sheep feed are sown and managed as part of the cropping program. This results in improved productivity and better weed control than can be achieved from volunteer grassy pastures, and provides a more trouble-free return to crop the following year.

Summary

Allen has experienced many benefits of the systems change, including:

- a significant reduction in dust created from summer weed spraying operations, which has increased the efficacy of chemicals applied;
- eliminating the risk of soil erosion in all seasons, through a well managed system;
- later crops yielding equally to early sown crops;
- after 8 or 9 years, the weed burden in this system has been lowered; and
- increased profit and sustainability from cropping the whole farm every year.

"In summary," Allen said, "I believe that the move to continuous cropping and no till has been the best decision I have made in 35 years of farming."

Allen Buckley addressing farmers on managing mallee farming systems at Waikerie 2003 core site field day

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