farmtalk

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

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Mallee Sustainable Farming Inc. (SA, NSW, VIC)

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Success with Sandy Soils

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The issue

Traditionally, sandy soils in the Mallee have been difficult to manage, having low fertility, high levels of root disease and weeds, poor yields and prone to erosion.

Modern farming methods promoted by Mallee Sustainable Farming (MSF) have lead to sandy soils becoming some of the most even, consistent, and most productive zones of the farm, particularly in below average rainfall years.

This farmtalk focuses on understanding why sandy soils can become so responsive, and what are the keys to turning sandy soils around.

What we know

In general, Mallee sands tend to have low levels of organic carbon (between 0.2-0.8%) compared to loamy soils.

With little clay or small pore spaces, sands tend to have less protection of organic matter from microbial breakdown and lower soil organic matter build up. Similarly, micro-organisms have fewer places to survive from predation by other soil organisms and from dehydration.

Under traditional practices, sandy soils produce low amounts of dry matter that is left after harvest or pasture. Carbon inputs are too low to support significant microbial populations and activities.

Even though sands hold lower amounts of total soil water compared to heavy textured soils, a greater portion of soil water is available for both the soil organisms and plants. In low rainfall years (decile 3 and less) sandy soils tend to provide more available water to crops than loams due to their lower wilting point. Furthermore, rainfall events tend to penetrate deeper into the rootzone that generally has few subsoil constraints and less capillary rise. Therefore there is less water loss through evaporation on sandy soils in low rainfall seasons.

Keys to sandy soils success

Increasing Carbon Turnover

"These soils are basically screaming out for carbon" says Dr David Roget, former CSIRO Senior Research Scientist, "so growing good crops more often has shown to greatly improve soil microbial activity, leading to a much more robust, dynamic and fertile system."

Soil organisms (biota) are essential for mallee soils, playing a key role in nutrient production, availability and retention. This is more critical in sandy soils as they lack clay, cation exchange capacity and inherent fertility. Carbon inputs from crop residues form the essential energy and nutrient supply for microbial activity.

Australian Government Department of Agriculture, Fisheries and Forestry
GRDC Grains Research & Development Corporation
CSIRO
Government of South Australia Department of Water, Land and Biodiversity Conservation
Victoria Department of Primary Industries
mallee catchment management authority
NSW Industry & Investment
Rural Solutions SA
Lower Murray Darling CMA Catchment Management Authority
Government of South Australia SARDI Research and Development

Increased microbial biomass and activity leads to greater mineralisation of nutrients and fixation of nitrogen through non-symbiotic nitrogen fixation. As nutrients become bound in the microbial biomass, they are protected from leaching, especially in years of high summer rainfall. MSF trials have measured this as high as 50kg N/ha.

Adequate Nutrition

Nitrogen rates of at least 20-30kg/ha in sands is generally required to grow good crops and produce enough dry matter growth to feed the soil biota.

MSF Variable Rate Trials over many paddocks and seasons have also revealed that the sandiest zones of paddocks are often much lower in phosphorus. They were also far more responsive to phosphorus application, often even where the levels were considered adequate (Colwell P>20 ppm). Therefore, you should always soil test sand hills separately to flats, and not neglect phosphorus and also zinc in these areas.

Rotation

Intensive cropping can really improve sandy soils as fertilizing every year leads to greater production and turnover of organic matter and carbon, which is vital for building soil biota.

Disease control through rotation is also vital for turning sandy soils around. For example, sowing lupins into rye or triticale stubbles can certainly set the soils up for a successful wheat cropping phase. In lower rainfall areas farmers have found that cropping two successive years of cereal rye has provided excellent soil cover, a good disease break and returned high levels of organic matter.

No Tillage

NoTill seeding is critical for success on sands. Row spacings of 10”-12” with presswheels create large furrows which channel rainfall into the seed row, resulting in small rains becoming far more affective in the seed zone. This technique can be especially advantageous in non-wetting sands, as the ridges between the rows remain dry and hostile for weeds.

Deep working narrow points also help break up root disease and soil compaction and allow for a deeper profiling of nutrients to encourage better root growth. Be aware that compaction in sands often occurs deeper than 15cm, and deep ripping may still be beneficial. This can be tested by digging a hole in your sand hill after the crop has dried off, to assess if there is still wet soil remaining at 15-40cm.

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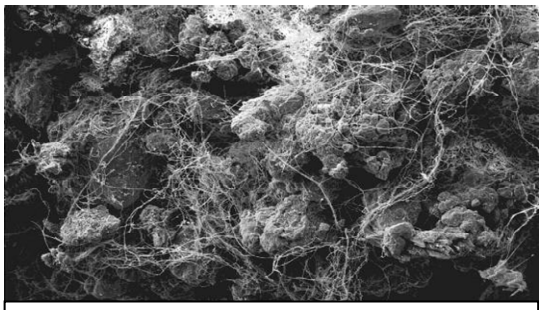
Cultivation has a very negative affect on sand, as the carbon has poor protection and is readily “burned up” and lost to the system. Cultivation will also break up soil structure that has been created by the binding glues and fungal hyphal networks of the soils micro-organisms, thus increasing the risk of wind erosion.



A network of fungal hyphae binding sand particles and small aggregates on to wheat stubble.

A healthy dynamic soil

Because the carbon and biota held in sands are relatively unprotected, once soil microbial populations are built up, the soil has a greater ability to respond to rainfall and readily supply nutrients to crops when they are needed. Therefore the fertility and health of the soil is greatly improved.

Increased microbial populations and biological activity can also suppress soil diseases and improve crop production on sandy soils.

Where to next

Productive management of sands involves regularly providing adequate nutrition to grow healthy crops with high organic matter turnover, using no-till seeding.

Targeting inputs into these sandy soil zones using variable rate, precision agriculture technology will help maximise their efficient management and production.

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