farmtalk

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

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Fact Sheet #6
June 2003

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

How do we manage Nitrogen in Mallee soils?

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What is the issue

In mallee farming systems a more informed assessment of plant Nitrogen (N) demand and availability is critical to achieving water defined potential yields. In regions where potential production is defined by the availability of water (rainfall + stored soil water) it is essential to have sufficient N available to the crop to maximise production.

What we know about Nitrogen in mallee soils

Results from Mallee Sustainable Farming Inc. research indicate that **targeting higher yields** and **applying appropriate amounts of fertiliser N** is more profitable than alternative conservative systems targeting lower yields and lower fertiliser inputs

Research Investigations at MSF Inc. Core sites and Focus paddocks indicate that-

• The availability of nitrogen to crops is often limiting *the crops* ability to attain maximum yields defined by the amount of available *water*

• Nitrogen balance calculations are showing net negative balances under cereals and in some rotations ie. More N is being taken out of the soil than being put in - see fig. 1

• To maintain productivity and the amount of N stored in soils, N removed in grain must be replaced through fertiliser additions or N fixation inputs.

• Nitrogen is leaching down the soil profile out of the root zone of annual crops -

- Focus paddock results suggest losses up to 50 kg N/ha/yr can occur.

- High levels of inorganic N (>500 kg N / ha) have been found between 2 and 6m in some soils indicating significant losses of plant-available N below the root zone of agricultural crops.

• Nitrogen mineralisation occurs at variable rates depending on seasonal conditions -

• Mineralisation is a biological process that increases with increasing temperature and soil water content.

•Over summer, mineralisation can contribute a significant amount of N to the soil profile at sowing provided adequate summer rains are received.

•Deep soil N tests can be used to account for the N released by this process.

•Season mineralisation has contributed an average of 40 kg N/ha across the treatments monitored at the core sites, with values ranging from as low as 12 to as high as 80 kg N/ha.

What this means

Management can significantly alter amount of N in the soil profile at the start of the next growing season.

Supporting research data indicates that -

• Legume residues from the previous season provide additional N to the next crop

• Cereal crop residues can slow down the release of N

• N mineralisation rates after canola are higher than other non-legumes

Nitrogen can be added to the soil by biological N fixation which occurs under legume pastures -

• Measurements of N fixation by medic pastures in the core sites indicate that the legume component of the pasture is fixing most of its N. However, low growth rates have led to low additions of N to the soil (<20 kg N/ha/year).

and pulses

• Strategic use of pulses based on early rains and season starts can give large inputs of fixed N (100kg N/ha). About 1/3 is retained in the residues after harvest which can be released in the following years.

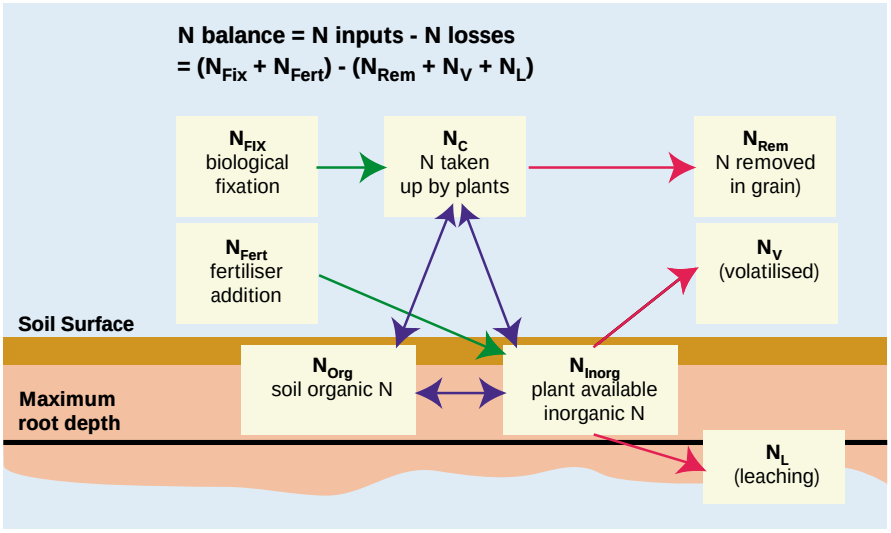

Fig 1. N pools and transfers important to completing N balance calculations for an agricultural system

N supply to crops can be manipulated through fertiliser N application rates and the management of pulses and legume pastures. Reduced productivity of legume pastures will impact on N fixing rate and total soil N reserves. In order to preserve soil N status, increased rates of fertiliser N may be required.

What action can YOU take?

An improved understanding of N cycling in mallee soils will help match N supply with the N demand of crops. Key actions are as follows -

Balance calculations

• A simple balance calculation (fertiliser N – grain N removed) can indicate whether soil N reserves are being depleted. Even with high fertiliser N inputs used in the MSF Inc. core sites (27 kg N/ha), negative N balances (-13 to –30 kg N/ha) were obtained under cereal (non-legume) crops.

Role of legumes

• Legumes can be used in rotation with cereals to improve soil N status and N balance; however adequate legume growth and N fixation is essential. Under proper management practices (inoculation, early sowing, adequate P status) the N benefits derived from pulse crops (peas) have been good.

Soil testing

• Measurements of N contained in the soil profile at sowing are critical to determine N fertiliser requirements. MSF Inc. core sites, focus paddocks and other paddock data suggest a range of **30-200 kg N/ha (0-100m)** can occur. All of this N may not be available to crops due to subsoil constraints or low season rainfall.

Microbial populations

• Microbial tied up N makes the N less susceptible to leaching but this process can compete with plants for soil N to create N deficiencies early in the growing season following cereal crops.

Where to from here?

Future research will be focused on developing improved

• **Predictions of N mineralisation** - so we can define the amount of N that can be mineralised and supplied to plants from the soil during a given growing season.

• **Matching of fertiliser requirements with potential plant demand** - so we can maximise 1) crop yields, 2) the efficiency with which applied fertiliser N is used and 3) the average profitability of mallee farming systems.

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