



farmtalk



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

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Managing Water in Mallee Farming Systems

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The Issue

In the Mallee we need to identify management practices that maximise returns for every millimetre of available water, e.g. kg of grain per hectare per year or \$ per hectare per year.

There are two sources of water for growing crops - **Plant available water stored in the soil at sowing time** and seasonal **rainfall**, which is highly variable and largely unpredictable. The growing season rainfall at Waikerie ranges from about 50 to nearly 350 mm, as shown in Fig. 1. This 7-fold difference between the driest and wettest seasons on record is typical across the Mallee.

What we know

About Plant available water stored in the soil

- After heavy rain, the soil pores fill with water. Once excess water drains, the soil reaches its upper limit (UL) of water holding capacity. The UL is a soil property largely driven by soil texture. Fig. 2 illustrates the increase in UL with depth as clay content increases for a soil at Euston.

- Crops can extract soil water only to a specific point, which is referred to as the lower limit (LL) of water holding capacity. Lower limits are strongly dependent on soil texture, but are also influenced by other factors. Subsoil chemical constraints widespread in the Mallee, such as sodicity or salinity, restrict the ability of crops to extract water, thus increasing the lower limit.

- The maximum amount of plant available water is the water held between the lower and upper limits, shown as the yellow area in Fig. 2. For a typical sandy loam soil in the Mallee with no chemical or physical constraints, the maximum amount of plant available water in a 1-m profile is about 80

mm. For the soil in Fig. 2, salinity below 0.6 m prevented the crop from extracting water and so reduced maximum plant available water to 64 mm.

About seasonal rainfall

- The **variation of growing season rainfall** is huge, as illustrated in Fig. 1.

The El Niño based forecasts can identify extreme seasons. In some locations, early season rainfall could be an indication of seasonal conditions. The effectiveness of new forecasting tools is being assessed.

- The **timing of rainfall** is critical. There are two key periods in terms of yield response to water availability:

- The opening of the season - early sowing opportunities favour higher yield potential, provided frost risks are properly managed. Data from the Focus Paddocks indicated an average yield reduction of 17 kg grain per day delay in sowing beyond mid April.

- The 30 days period bracketing flowering, when grains are set. Crop yield is extremely sensitive to stresses in this period, including water deficit.

- The **fate of rainfall** is variable and important. Rainfall can follow several pathways - direct soil evaporation, runoff, deep drainage, crop transpiration, and weed transpiration.

- **Crop transpiration is the only component of the water budget that is linked to productivity.** All other pathways are unproductive, and some (e.g. deep drainage) are also undesirable for environmental reasons. Management needs to aim to limit water movement via these unproductive pathways and leave more water available for crop transpiration.



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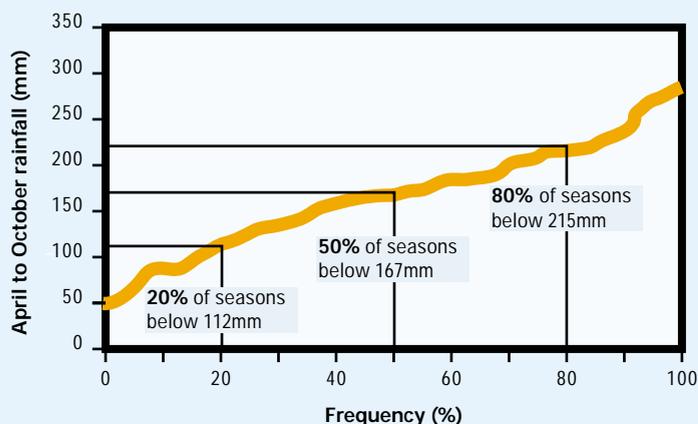


Figure 1. Cumulative frequency distribution of growing season rainfall recorded at Waikerie between 1900 and 2000.

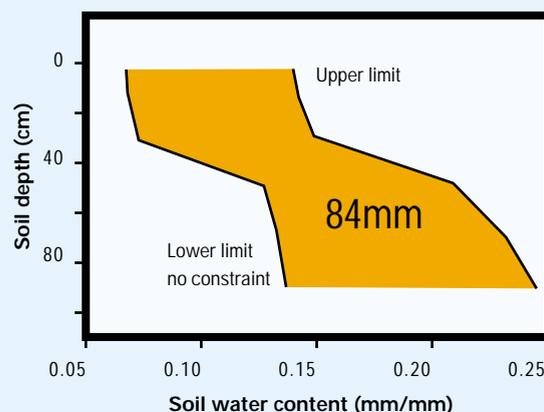


Figure 2. Profile of upper and lower limits of plant available water measured in a sandy loam soil at Euston. The orange area indicates the amount of available water in a full profile.

What you can do

- **Determine the upper and lower limits of water holding capacity for each paddock.**

Remember that as for other soil properties, there is spatial variation in both these limits, which needs to be considered when deciding where in the paddock samples have to be taken. Also, the lower and upper limits, like soil texture, are **very stable properties** of the soil. Thus, costs associated with measuring these properties may be offset against the long-term benefit of using this information in managing the paddock.

- **Measure soil water content in the profile around sowing time.** Use measured soil water content and lower limits to work out the amount of water that is available to the crop. Aim to measure soil water content as close as possible to sowing time, as large errors could result from early measurements.

- **Use rain forecasts with caution.** Even though rainfall predictions are far from perfect, they could be used to manage risk and make educated guesses on seasonal conditions. We need to bear in mind that forecasts cannot be evaluated on a single-season basis; long-term runs are required to determine whether a forecasting method is useful or not in our particular situation.

Where to from here

- **Consult extension officers, who are familiar with the measurement of soil properties,** and could help you in working out sampling procedures and methods to measure the upper and lower limits for your paddocks.

- **Combine your two sources of water to calculate attainable yield.** Following with the example at Waikerie, assuming an average seasonal rainfall of 167 mm, and plant available water in the soil at sowing of 56 mm, gives a total of 223 mm. Using a French and Schultz type approach, target yield may be calculated at around 2.8 t/ha. Determine whether yield calculated with this approach is realistic for your field, and correct if required.

- **Assess input requirements to achieve your target yield.** A user-friendly package has been put together to manage soil water and seasonal rainfall in the calculation of target yield and nitrogen requirements. The package is specifically tailored for the Mallee region, and is freely available on request.

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