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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Measuring Your Own Soil Moisture To Better Target Yield Potential

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The issue

To target maximum grain yield, the nutrients required by the crop need to be matched to the potential yield. Measuring Plant Available Water (PAW) is critical to calculating potential yield.

This farmtalk shows how to measure soil moisture on areas of your farm, so it can be used to calculate yield potential and ultimately a nutrient budget.

Equipment required

- soil auger or soil probe
- tape measure
- snap-lock bags
- permanent marker
- balance with 0.1 gram precision
- paper bags
- microwave oven and
- recording sheets.

When

PAW is calculated by subtracting a baseline of unavailable soil water (soil moisture lower limit) from all the moisture in the soil at the time of measurement. The soil moisture lower limit is measured once a crop has dried off in spring. The easiest time to measure is after harvest, provided no late rainfall has distorted the soil moisture results. MSF has found this generally doesn't vary for the same crop between seasons. The next critical time to measure is around late March, prior to seeding. Soil nutrients including deep nitrogen can also be measured at this time.

Where

It is important to choose representative paddock areas. Try to sample a uniform soil type (or areas of similar EM38 zones). Soil from preferably six holes can be grouped for more reliable results. Record each sampling position using GPS, or along a monitoring path so future samples can be taken from the same vicinity.

What to do

Sample the soil in 3 to 4 intervals down the profile using an auger.
For example:
0-10, 10-30, 30-60 and 60-100cm or
0-20, 20-40, 40-60, 60-80cm.

Discuss the best separation of the soil profile with a local agronomist to match soil sampling with root depth. 0-10cm samples are of more value for nutrition than for stored moisture.

Place each sample in a marked plastic bag bulking samples from the soil type and similar depth. Seal the bag and place the samples in a cool spot.

Once you get the samples home follow the steps below:

1. Label paper bags and obtain empty paper bag weight.
2. Mix soil in snap lock bag before opening.
3. Place 40g to100g of soil in paper bags (more soil (200g) and time will be needed if scales only measure to 1g accuracy). Estimate % stone and record. Remove stones and organic residues prior to drying to avoid possible shattering or burning.
4. Record weight of sample in the bags.
5. Place sample in microwave and cook on high for approximately 2 minutes per 50 grams, and then check for dryness. If still moist, continue to dry and check. A small cup of water, covered with a paper towel should be placed in a corner of the microwave oven to absorb excess microwave energy when the soil samples become dry.
6. Once dry, record the weight of sample bag.
7. Cook on high for additional 1 minute.
8. Weigh and record weight of sample.
9. If weights have not changed, go to calculations; otherwise cook on high an additional minute. It will soon become apparent as to the general time required for the sample to become dry.

Calculating crop available stored moisture

The easiest way to calculate your soil moisture is to download a DIY Soil Moisture Measurement Spreadsheet from the MSF website www.msfp.org.au, and follow the instructions.

Percentage of Soil Moisture is worked out by:

(wet wt – dry wt) x 100 / dry wt

eg. (83g – 75g) x 100 / 75g = 10.7%

Converting % moisture to water (mm) in each sample:

Water (mm) = % soil moisture x soil bulk density (see Table 1) x No. of 10cm intervals in sample x (100–% stone)/100

Eg. for a clay loam, 20cm zone with 10% stone:
10.7% x 1.5 x 2 x (100 -10)/100 = 28.9mm water

Table 1: Bulk Density (g/cm3) for various soil textures

Texture	Bulk Density
Sand (S)	1.7
Loamy Sand (LS)	1.6
Sandy Loam (SL)	1.5
Light Sandy Clay Loam (LSCL)	1.4
Loam (L)	1.2
Sandy Clay (SC)	1.4
Clay Loam (CL)	1.5
Light Clay (LC)	1.6

Add all the samples down the soil profile, to obtain the soil water content of the soil.

To work out PAW prior to sowing, you need to subtract the Dry Crop Soil Water (harvest time) from the Pre-Sowing Soil Water totals.

This PAW can then be added to your Growing Season Rainfall (GSR) to calculate a new Potential Yield. The GSR for your area is the average Apr-Oct rainfall from historical records. Many Mallee rainfall stations are located on the Mallee Calculator (see MSF website), which can also give you the GSR averages for different deciles, allowing targeted management toward below or above average years.

Evaporation will vary with soil type and rainfall (see Table 2 below). A new yield potential can be worked out using the following formula:

Potential Yield =
(GSR + PAW – Evap mm) x 20 kg/mm/ha/1000
eg.180 + 20mm – 85mm (LSCL) x 20/1000 = 2.3 t/ha

Farmtalk is compiled by
Mallee Sustainable Farming Inc
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Table 2: Estimated Evaporation (mm) based on Soil Type and Rainfall*

GSR	S	LS	SL	LSCL	L	SC	CL	C
140	60	65	70	75	80	85	90	110
170	70	75	80	85	90	95	100	110
200	80	85	90	95	100	105	110	120
230	90	95	100	105	110	115	120	130
260	100	105	110	115	120	125	130	140

*The evaporation rates in Table Two have not been experimentally verified but represent the current best assumption of the authors.

The Mallee Calculator can also be used to estimate Yield Potential and nitrogen (N) requirement. However, N alone is rarely the only yield limiting factor, and the challenge is therefore to manage all things within your control to maximise economic yield.

Where to next

Soils and yield potential vary substantially within and between paddocks. The goal now, is to be able to manage that variation so that each area is yielding to its full potential. As variable rate technology becomes available on more Mallee farms, systems are being developed using Precision Agriculture for more targeted crop management using tools such as EM38 soils mapping, strategic soil testing (for example the Your Soils Potential soil testing system developed by Rural Solutions SA) and variable rate seeding. This will allow farmers to better target their inputs according to varying paddock potential, meaning money can be saved in areas of low potential, and profits increased where yield potential is higher.

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