Department of Primary Industries

primefact

Determining readily available water to assist with irrigation management

August 2014 Primefact 1362 First edition
Agriculture NSW Water Unit

How much water is readily available to plants?

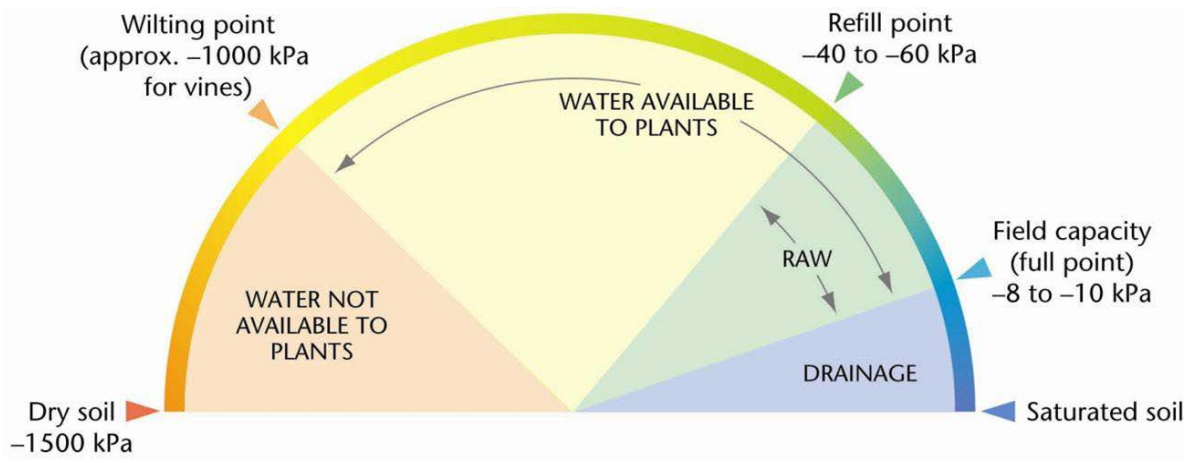
Not all water held in the soil is readily available to plants. Some water is bound so tightly to soil particles it cannot be used by plants. For irrigators it is useful to know how much water is readily available for plant use to provide an indication of HOW MUCH water to apply.

What is RAW?

Readily available water (RAW) is the water that a plant can easily extract from the soil.

RAW is the soil moisture held between field capacity and a nominated refill point for unrestricted growth. In this range of soil moisture, plants are neither waterlogged nor water-stressed.

Soil water content. Depending on the type of crop, RAW for horticultural crops is usually the amount of water held between field capacity (–8 to –10 kPa) and –20 to –60 kPa.



Plant roots will continue to take water from the soil after the refill point is reached. However, this water is not as readily available to plants and the crop finds it difficult to extract. If the soil dries to the permanent wilting point, the plant can no longer remove any water from it: some water may still be present but is completely unavailable.

The drier the soil, as shown by high tensiometer values, the more water needs to be added to bring the soil back to field capacity. These values are presented in Table 1 as millimetres of moisture available per centimetre of soil depth. The figures in kPa across the top of this table correspond to the figures that you would find on a tensiometer gauge.

Table 1. Readily Available Water (mm/cm) stored between -8 and -1500 kPa.

	Soil water deficit (mm/cm)				
Texture grade	-8 to -20 kPa	-8 to -40 kPa	-8 to -60 kPa	-8 to -200 kPa	-8 to -1500 kPa
Sand (S)	0.33	0.36	0.38	0.40	0.62
Loamy sand (LS)	0.45	0.52	0.55	0.58	0.87
Clayey sand (CS)*	-	0.55	0.60	0.64	1.00
Sandy loam (SL)	0.46	0.59	0.65	0.70	1.15
Light sandy clay loam (LSCL)	0.45	0.65	0.74	1.03	1.37
Loam (L)	-	0.69	0.84	100	1.43
Sandy clay loam (SCL)	0.39	0.61	0.71	1.01	1.44
Clay loam (CL)	0.30	0.53	0.65	0.73	1.48
Clays (SC,LC, LMC, MC)	0.27	0.46	0.57	0.66	1.49
Heavy clay (HC)**	-	0.25	0.41	0.49	1.20

*** Interpolated value** **** Samples from Kununurra, WA**

Source: K.G. Wetherby, soil survey and land use specialist. This table is the result of detailed field and laboratory studies on 360 samples from the Murray Mallee and Barossa Valley in SA.

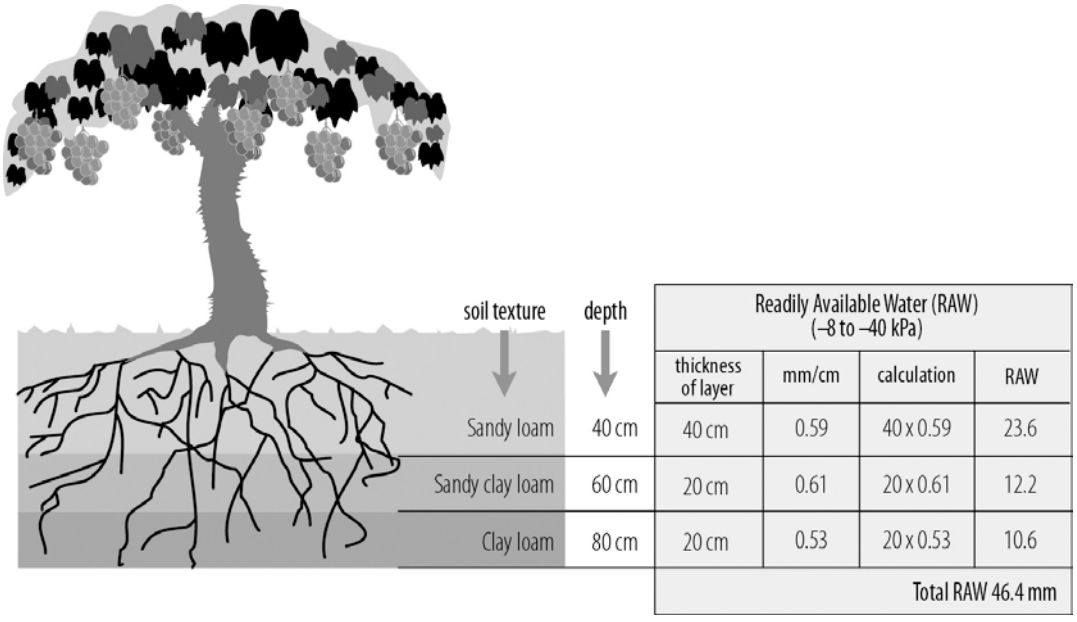
So, for a sand (S) at a tensiometer reading of –40 kPa, you would need to supply 0.36 mm of water for each centimetre depth of soil to bring the soil to field capacity. At –1500 kPa (much drier – beyond the values on a tensiometer gauge) you would need to supply 0.62 mm of water for each centimetre depth of soil to reach field capacity.

Calculating RAW

To calculate rootzone RAW, multiply the thickness of each soil layer (in centimetres) by the RAW of that layer (Table 2). Then add the values for each soil layer in the rootzone to get the total rootzone RAW.

This means that, in the example shown in Table 2, when irrigating with a full cover sprinkler system you should apply approximately 45 mm to refill the rootzone once your tensiometers have reached – 40 kPa. Further sampling or soil moisture monitoring will refine this figure.

Table 2. Readily available water (mm/cm) stored between – 8 and –1500 KPa



		Readily Available Water (RAW) (–8 to –40 kPa)			
		thickness of layer	mm/cm	calculation	RAW
Sandy loam	40 cm	40 cm	0.59	40 x 0.59	23.6
Sandy clay loam	60 cm	20 cm	0.61	20 x 0.61	12.2
Clay loam	80 cm	20 cm	0.53	20 x 0.53	10.6
					Total RAW 46.4 mm

When irrigating with a system that does not apply a full cover water application, the RAW figure is reduced to the approximate wetted area of the irrigation system (eg ⅓ to ¼ for drip irrigation in horticulture). In this example, if irrigating with drip and the wetted area is ⅓ of the orchard, the RAW becomes 15.5 mm (46.4mm x ⅓). This wetted area should be confirmed with soil sampling.

More information

Primefact 1363 *Determining soil texture using the ribboning technique*

Primefact 1364 *Irrigation scheduling principles for horticultural crops*

Acknowledgments

Jeremy Giddings Irrigation Industry Development Officer (Horticulture)

Based on WaterWise on the Farm, Series 1: Irrigation Farm Resources 2004

Published by the NSW Department of Primary Industries.

V14/3260 PUB14/157 Jobtrack 13128