DETERMINING READILY AVAILABLE WATER FROM SOIL TEXTURE INFORMATION

SMARTER IRRIGATION FOR PROFIT PROJECT 2

Readily available water (RAW) is the term used for the water available within the effective root zone of a crop or pasture, that is easily extracted by the plant.

The unit of measure for RAW is mm. The main drivers of RAW for a specific crop or pasture are the soil texture and structure, and the depth of the crop or pasture root system. This depth or the effective root zone differs for different crops. The amount of water that can be held by soils differs with soil texture and structure.

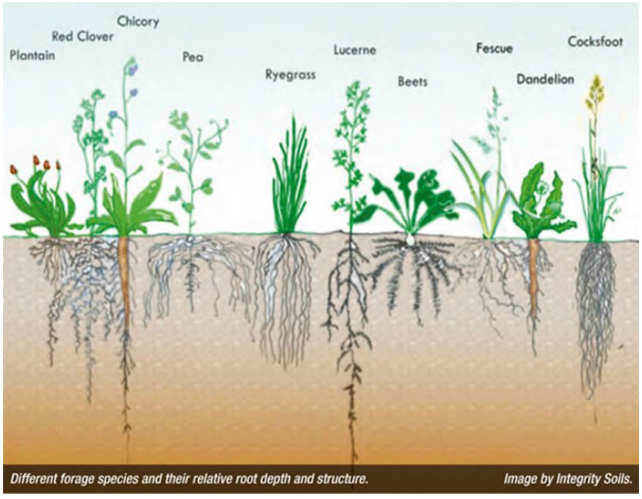
Plant available water (PAW) is a measure of the total available water that the plant can extract from the soil (defined as the amount between field capacity and the wilting point of the plant), whereas RAW is the amount that a plant can **easily extract** from the soil without impacting its growth.

This fact sheet provides instructions on how to determine RAW for different soil textures, different soil texture layers within the root zone, and effective root zones (ERZ) of different crops or pastures.

Step 1 Determine the effective root zone

For an irrigated pasture the effective root zone is generally between 20 and 40cm. This can vary depending on soil type and pasture species. For a well-managed irrigated temperate pasture on a uniform soil it is generally 30cm. In contrast to pastures, the effective root zone for maize and lucerne can extend beyond a meter provided there are no major soil constraints (eg compaction, acidity).

Figure 1 Effective root zone of different forage species and their root structure



Source: **reddit.com/r/NoTillGrowery/comments/7j2xm3/ryegrass_as_a_no_till_cover_crop_for_indoor_beds/**

Effective root zone is determined by digging a pit or taking an intact large diameter core from each of the main soils that the crop or pasture is being grown in and identifying the depth of the main fibrous root mass (Figure 2).

Australian Government
Department of Agriculture, Water and the Environment

UNIVERSITY of TASMANIA
TIA
Tasmanian Institute of Agriculture

Dairy Australia

This project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural R&D for Profit program, Dairy Australia and University of Tasmania, Tasmanian Institute of Agriculture.

Figure 2 Effective root zone – fibrous roots which comprise the effective root zone may only extend a third as far as the deepest roots.

Source: **agric.wa.gov.au/citrus/calculating-readily-available-water?page=0%2C1** *Calculating Readily Available Water | Agriculture and Food*

Step 2 Identify and measure the thickness of the different soil layers within the effective root zone

Although a number of soils will have only one soil layer within the effective root zone, in some soils there is a change in soil texture within the effective root zone.

Figure 3 Photo showing soil texture layers

Source: University of Tasmania, Tasmanian Institute of Agriculture

It is important to know the depth of these layers within the effective root zone as this will determine the amount of water held within the effective root zone.

Step 3 Identify the texture of the soil in each layer of the effective root zone

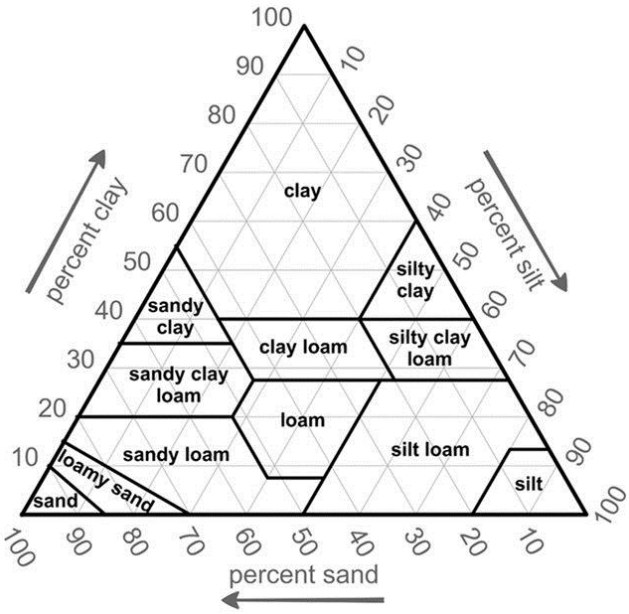
Soil texture describes the relevant percentages of particle sizes within the soil. They are grouped according to their size: clay (< 0.002mm), silt (0.002–0.02mm) and sand (> 0.02mm).

The soil texture of each layer is an important characteristic as this will determine the amount of water that is available to be held within the effective root zone. You need to assess the soil texture within each layer.

To determine soil texture class, collect a suitable soil sample from each layer (typically a minimum of 300g of soil, but depends on the laboratory and method used). Have your samples tested by a NATA and ASPAC accredited laboratory for particle size analysis (per cent silt, sand and clay) using the wet chemistry method.

Once this data has been received, the texture triangle can be used to determine the texture of the soil (Figure 4).

Figure 4 Soil texture triangle



Source: **journals.plos.org/plosone/article/figure?id=10.1371/journal.pone.0131299.g001**

Step 4 Calculate how much readily available water is in the effective root zone

Once we know the depth of the effective root zone and the soil texture in each layer work out how much RAW is held in the effective root zone.

Different soil textures have different amounts of RAW (refer to Table 1). If RAW data is available from soil samples that have been tested in your region, these can be used. RAW is often reported for a range of water tension or suction levels measured in kPa. Values for water stored between -10 kPa (upper limit, i.e. field capacity) and -60 kpa (lower limit, i.e. refill point) is most appropriate for lucerne, maize and pastures.

Table 1 Typical RAW for a range of soil textures

Soil texture	Readily available water (mm/m)
Sand	30
Loamy sand	50
Sandy Loam	70
Loam	90
Clay	50
Clay loam (ferrosol)	80
Well-structured clay	60

Source: Bill Cotching

Using the table of RAW values above, you can identify the RAW for each soil layer. Then by multiplying the thickness of each soil layer by its RAW value the amount of RAW in each layer is determined. Note – if there are stones or gravel in the soil horizon, the per cent of stones and gravel needs to be estimated and the RAW value reduced by this percentage. To calculate the total amount of RAW in the effective root zone, add the amount of RAW in each layer together.The following is an example of a RAW calculation for a uniform clay loam soil supporting a pasture with an effective root zone of 0.3m:

From table 1 the readily available water (RAW) for 1 m depth of a clay loam is 80mm/m.

The effective root zone of the irrigated pasture is 30cm or 0.3m

Effective root zone (m) x RAW mm/m = RAW in effective root zone (mm)

0.3(m) x 80 (mm/m) = 24mm of RAW in the effective root zone

Figure 5 Measuring soil texture layers

Source: Calculating Readily Available Water | Agriculture and Food

WORKSHEET

Using the information from the above fact sheet determine the RAW for the effective root zone of the pasture or crop you are growing.

Step 1 Determine the effective root zone

Effective root depth of crop/pasture _____(m)

Step 2 Identify and measure the thickness of the different soil layers within the effective root zone

How many soil texture layers within the effective root zone? _____

What is the thickness of each soil layer within the effective root zone?

Layer 1 _____ (m)

Layer 2 _____ (m)

Layer 3 _____ (m)

Step 3 Identify the texture of the soil in each layer of the effective root zone (Figure 4)

Layer 1 _____

Layer 2 _____

Layer 3 _____

Step 4 Calculate how much readily available water is in the effective root zone

Use table 1 to determine the RAW for each of the soil texture layers identified.

Layer 1 _____ (mm/m)

Layer 2 _____ (mm/m)

Layer 3 _____ (mm/m)

Calculate the RAW for each layer using the following:

Thickness of soil layer (m)_x RAW for soil texture (mm/m) = RAW for the layer (mm)

Layer 1 _____ (m) x _____ (mm/m) = _____ (mm)

Layer 2 _____ (m) x _____ (mm/m) = _____ (mm)

Layer 3 _____ (m) x _____ (mm/m) = _____ (mm)

Calculate the total RAW for the effective root zone by adding the RAW for each layer.

Layer 1 _____ (mm) + Layer 2 _____ (mm) + Layer 3 _____ (mm) = ERZ RAW _____ (mm)

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3325 | May 2021