

How much water to apply and how often

1. What sort of soil do you have and how much water can your soil hold

Determine your soil texture using the ribboning technique

Soil texture	Ribbon length (mm)
Sand	0
Loamy sand	5
Clayey sand	5-15
Sandy loam	15-20
Light sandy clay loam	20-25
Loam	25
Sandy clay loam	25-40
Clay loam	45-50
Sandy clay & light clay	50-75
Light medium clay	75-85
Medium clay	85-100
Heavy clay	>100

https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0005/164615/determining_soil_texture_using_ribboning_technique.pdf

Determine your soil water holding capacity

Soil texture	Water holding capacity (mm/m)	Water in 30cm root zone (mm)
Sand	20-85	6-25
Loamy sand	65-125	19-38
Sandy loam	105-145	31-44
Loam and silt loam	165-230	50-69
Clay loam	145-210	44-63
Clay loam	125-190	38-56

2. What is your allowable soil moisture deficit

35-50% is often used (ie apply irrigation when 35-50% percent of water in soil has been used)

Convert the allowable deficit to mm based on soil water holding capacity in root zone.

3. How much evapotranspiration (ET) has occurred

$ET(\text{crop}) = ET(\text{reference}) \times \text{crop factor}$

Find $ET(\text{reference})$ from Bureau of Meteorology <http://www.bom.gov.au/wat/eto/>

In summer it is around 7mm/day

Crop factor depends on crop and growth stage

Reasonable values for most vegetables are: early growth 0.7, mid growth 1.05, late growth 0.95

For more crop factors see:

<http://irrigationtoolbox.com/ReferenceDocuments/Extension/BCExtension/577100-5.pdf>

<http://www.fao.org/3/a-f2430e.pdf>

4. When to water

Add up the $ET(\text{crop})$ each day since the last watering, and subtract any rainfall amount. When this figure reaches your allowable deficit it is time to irrigate. The amount to apply is the deficit amount.

You can calculate a rough idea of how often to water (if there is no rainfall):

days between watering = $\text{deficit}(\text{mm}) / \text{average } ET(\text{mm})$

For more explanation on using evapotranspiration for irrigation scheduling see

<https://www.ag.ndsu.edu/publications/crops/irrigation-scheduling-by-the-checkbook-method-1>

An alternative approach

For an alternative look and feel method (without the maths!) see

https://www.lsuagcenter.com/portals/our_offices/departments/biological-ag-engineering/extension/agriculture_and_environment/irrigation/irrigation-scheduling-made-easy-using-the-look-and-feel-method

'Feel' guidelines for estimating the amount of plant-available water to be replaced with irrigation as a function of soil texture

Available Water Remaining in the Soil	Sands Loamy Sand	Sandy Loam	Clay, Clay Loam, Sandy Clay Loam	Sandy Clay Loam Loam
100% (i.e., field capacity)	When ball is squeezed, no free water appears on soil but wet outline of ball is left in hand			
Suggested Irrigation	None	None	None	None
75% to 100%	Wet soil; forms a fragile ball	Forms a ball that breaks easily	Forms a ball; very pliable	Easily ribbons between thumb and forefinger; feels slick
**Suggested Irrigation	2.5 to 5mm	5 to 7.5mm	5 to 10mm	5 to 10mm
50% to 75%	Soil is moist; forms a fragile loose ball	Forms weak ball that falls apart	Forms ball; slightly plastic; slightly slick	Soil is moist; forms ball and slight ribbon
**Suggested Irrigation	5 to 7.5mm	7.5 to 10mm	7.5 to 12.5mm	7.5 to 15mm
25% to 50%	Appears slightly moist; forms a very fragile ball	Appears dry, will not form a ball	Somewhat crumbly but holds under pressure	Forms ball under pressure; somewhat pliable
**Suggested Irrigation	7.5 to 12.5mm	7.5 to 15mm	7.5 to 15mm	7.5 to 17.5mm
0% to 25%	Dry, loose, single-grained, flows through fingers	Dry, loose, flows through fingers	Powdery, dry; easily breaks into powdery condition	Hard, cracked; may have loose crumbs on soil surface
**Suggested Irrigation	7.5 to 12.5mm	7.5 to 15mm	7.5 to 17.5mm	7.5 to 17.5mm

**Suggested Irrigation = Suggested amount of irrigation, per 30cm of effective root zone depth, to replenish soil moisture to field capacity

Conversion factors (approximate)

1m head = 10kPa 1psi = 7kPa 1 bar = 100kPa = 14.5psi

Other useful links

DPI Water testing

<https://www.dpi.nsw.gov.au/about-us/services/laboratory-services/water-testing>

Measuring delivery of drip irrigation systems

<https://www.agric.wa.gov.au/strawberries/measuring-delivery-drip-irrigation-systems>

Pipe friction loss calculator

<https://www.nationalpump.com.au/calculators/friction-loss-calculator/>

If you want information in more depth, the UN Food and Agriculture organisation has a series of great papers on irrigation and drainage

Crop evapotranspiration	https://www.researchgate.net/publication/284300773_FAO_Irrigation_and_drainage_paper_No_56
Water quality for agriculture	http://www.fao.org/3/T0234E/T0234E00.htm
Crop water requirements	http://www.fao.org/3/a-f2430e.pdf