

Irrigating based on evapotranspiration

Plant water use is determined by a mixture of environmental and plant-based factors. Some important reference terms to know include:

- **Evaporation**, which is the process of water being converted into vapour.
- **Transpiration**, which is the process that generates water loss from the plant.
- **Evapotranspiration**, which is a combination of the above, the water lost from a plant due to the water gradient between the plant and the environment. This is calculated based on a mix of solar radiation, wind speed, air temperature and humidity.
- **Crop factor (CF)** is a crop-specific proportion of evaporated water that needs to be replaced by irrigation.
- **Crop coefficient (Kc)** similar to CF but refers to the proportion of evapotranspiration that needs to be replaced.

Crop factors and crop coefficients vary based on the type of crop, height, age, growth stage (flowering, fruit set etc.) and condition. For mangoes, critical stages are those that contribute directly to the success of the mango crop are the following:

1. Flowering induction
2. Full flowering
3. Fruit set and development

Table 1. Summary of crop coefficient stages

Stage	Practice	Crop coefficient
Pre flowering	Reducing irrigation prior to inductive conditions will allow shoots to mature and ready for flowering.	0.39
Flowering and fruit set	Water stress during flowering can result in poor flower development and will limit fruit set. Start watering before flowering to initiate bud growth. Ensure the onset of bud growth is timed with cool inductive temperatures.	0.8-0.85
Fruit development	Water stress during fruit development results in increased premature fruit drop and reduced fruit size. Any water stress during the last month of fruit development can increase the risk of sunburn. To overcome this, irrigation may be needed during the hottest part of the day.	0.8-0.85
Pre harvest-harvest	Reduced irrigation before harvest helps advance the maturity of the fruit and increase fruit dry matter content.	0.58-0.60
Post-harvest vegetative growth	Restart irrigation immediately after harvest to incorporate fertiliser and encourage a good autumn flush.	0.90

Calculating irrigation requirements

You can schedule irrigation based on the crop factor or crop coefficient broadly using the following calculation.

$$\text{Daily water use (mm)} = \text{Evapotranspiration (mm)} \times \text{crop coefficient}$$

The following calculation (step 1 below) can be used to estimate your overall crop water requirements if you are applying for a water licence. With a little more information, it can also be used to schedule your irrigation, using the application rate of your mini-sprinklers and knowing your soil's water holding capacity (readily available water). See the following example for calculations.

Step 1: Calculate DAILY water requirements

- Evapotranspiration data from the [BOM website](#), e.g. 6.2 (mm)
- The crop factor for mangoes at the current stage, e.g. pre-flowering 0.39
- Calculate the daily water requirement:

Daily water requirements = evapotranspiration x crop coefficient (Kc)

$$2.42\text{mm} = 6.2 \times 0.39$$

Step 2: Calculate how much capacity your soil has

- Know the **readily available water storage of your soil** (see [WADPIRD webpage](#)), e.g. **3mm per 100mm depth**
- Calculate soil water storage by multiplying the effective root depth by the soil readily available water:

Root depth x readily available water = soil water storage

$$300\text{mm root depth} \times 3 / 100 = 9\text{mm}$$

Step 3: Calculate irrigation run time per day

- Use the application rate of your mini sprinklers, e.g. 10mm per hour
- Daily water requirement calculated above, 2.42mm
- Calculate the run time in minutes:

Water required / application rate x 60 = run time

$$2.42 / 10 \times 60 = 14.52 \text{ (round up to 15 minutes)}$$

→ **Result:** This means that the daily water requirement is 2.42 mm (step 1), the soil has 9mm of storage capacity (step 2) so the irrigation can be applied once a day for 15 minutes (step 3).