



# HOW MUCH WATER DO DATE PALMS NEED?

Research on irrigation requirements in arid and saline environments

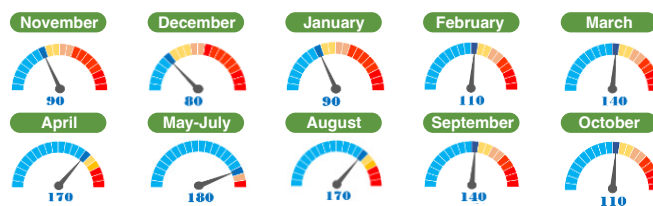
Date palms (*Phoenix dactylifera* L.) originate in the Arabian Peninsula, Middle East, and North Africa. Their high-value fruit is economically and culturally important to the region and has been an essential part of farming systems for over 5000 years. The tree thrives in hot and arid climates and in salty soil. This makes its continued cultivation especially key to food security and livelihoods as the region experiences hotter and drier

conditions, and increased water scarcity, under climate change. However, the tree still requires some water and there are upper limits to the salinity it can tolerate. To work out just where those limits lie, the International Centre for Biosaline Agriculture (ICBA) carried out research at our long-term test plantation in UAE to find out the water requirements of several varieties of date palm at various levels of soil salinity.

## Seasonal water requirements of date palm

The chart below illustrates daily water consumption per date palm tree, in liters, for each month. These numbers are indicative only, and will vary based on local conditions, variety, tree spacing, tree age, and the specific agroecosystem. In general, during the post-harvest period (November-December/winter) water requirements are relatively low, at under 90 liters per day per tree. At the beginning of the vegetative growth phase, but before the pollination period (January-February/spring) this rises to a maximum of 110 liters per day per tree. During the period of fruit growth, formation,

consumption tends to peak at around 180 liters per day per tree. Then, when the fruit is ripening, water consumption rates correspond to the previous period, but there is an option to reduce them to speed up fruit ripening and coloring, which increases the sweetness of dates and maintains their hardness.



## Water requirements under saline conditions

When irrigating date palm under saline conditions, it is important to use a safety factor of 10-25% as a buffer in case

the atmospheric water demand is not periodically adjusted. In addition, if irrigating with saline water, an X% soil washing factor should be taken into account. You can calculate this factor using one of the following formulas:

### Irrigation requirements under saline conditions

$$\text{Irrigation} = \frac{(ET - \text{effective precip})(1 + \text{leaching req.})}{\text{Application efficiency}}$$

### Leaching requirement for surface irrigation

$$LR = \frac{EC_w}{5EC_e - EC_w}$$

### Leaching requirement for drip system

$$LR = \frac{EC_w}{2(\max EC_e)}$$

Where:  $EC_w$ : salinity of the applied irrigation water in dS/m

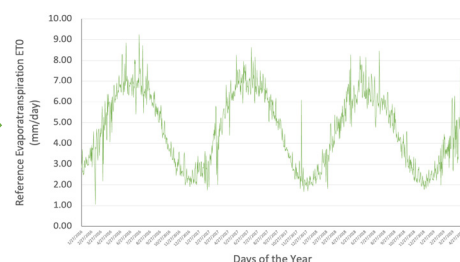
$EC_e$ : average soil salinity tolerated by the crop as measured on a soil saturation extract to obtain the acceptable yield (for example, only 10% of yield reduction)

## Example calculation: water salinity of 10 deciSiemens per meter (dS/m) and date palm variety with salinity tolerance of 9 dS/m

### Weather Data

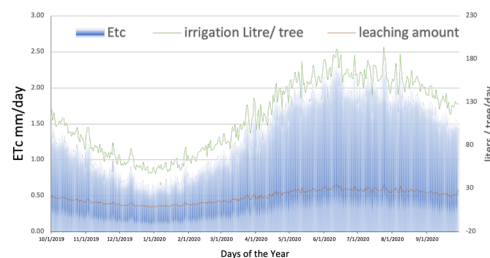


### Estimating Reference Evaporation Using Daily Weather Data from ICBA



✗ Crop coefficient

### Estimating irrigation requirement



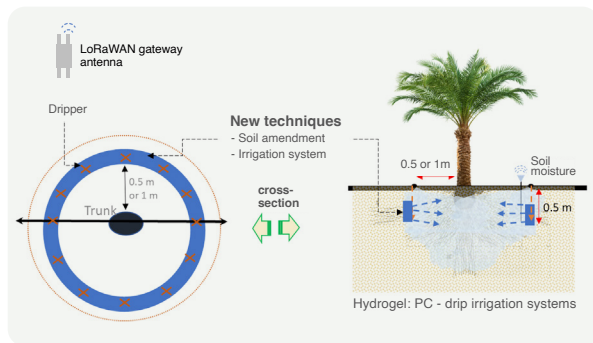
Daily average water consumption of palm trees at ICBA according to seasonal demand for reference evaporation. The irrigation schedule is in line with the crop factor recommendation made by Al-Ma'ini et al. 2019



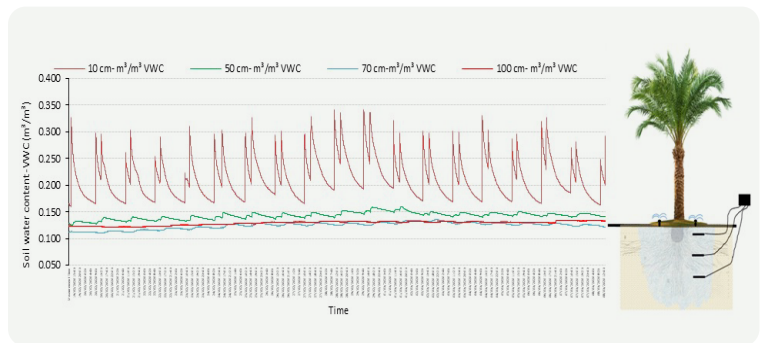
## How data-driven water-saving technologies can improve date palm water efficiency

New technology has revolutionized data-driven irrigation scheduling for date palm varieties, resulting in potential

on-farm water and energy savings. ICBA has also obtained promising results from water-saving technologies such as soil amendments and subsurface irrigation systems. These breakthroughs have opened new possibilities for sustainable agriculture and efficient resource management.



Irrigation systems and installed soil-moisture sensors at the ICBA plantation



Sensors at three different depths (right). Soil water content graph (left).

## General tips for watering date palm

- The date palm root system is known for its strength and depth. Its roots extend horizontally to the same distance as the fronds, and 3-5 meters deep into the soil. However, 75% of the roots only grow as deep as 70-100 centimeters (depending on the irrigation system used and irrigation scheduling).
- Insufficient water can reduce the growth rate and decrease the quality and yield of the fruit, while excessive irrigation can limit fruiting.
- Drip and bubble irrigation systems are recommended as they are highly efficient (up to 85%) and allow for precise

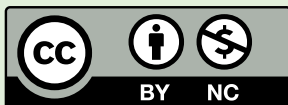
application of water and fertilizer, improve the spread of the root system, and prevent salt build-up in the root area through regular washing.

- Water with high levels of salinity (more than 10 dS/M) can negatively impact the farm's profitability. To mitigate this, it's recommended to use better-quality water for salt leaching. If the water is very salty, a high quantity of freshwater will be required for leaching, which can make the entire operation impractical.
- To prevent the buildup of salt in the soil, it's also essential to have a good drainage system in place – especially in saline conditions.

### Citation

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ICBA is an international not-for-profit applied agricultural research center with a unique focus on marginal environments where an estimated 1.7 billion people live. It identifies, tests and introduces resource-efficient, climate-smart crops and technologies that are best suited to different regions affected by salinity, water scarcity and drought, among other factors. Through its work, ICBA helps to create jobs, and improve livelihoods, food security and nutrition for some of the poorest rural communities around the world.

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