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Information

Scheduling Drip Irrigation Systems

This topic is still the subject of a great deal of research, hence no one method has been universally adopted by growers. Various approaches to the subject have been made from different angles, using meteorological data, the soil and crop situation.

It is advisable to determine the irrigation frequency and duration by paying attention to the finer points, but it would be untrue to say that success will only come by calculating the irrigation requirements. It can, however, be said that scheduling drip by calculations will aid maximum results from your crops, by eliminating yet another variable factor in the plants growth.

Scheduling by Evaporation Data
Most growers calculate their irrigation requirements using evaporation data as the basis for it. As the weather changes from day to day, or month to month, the rate at which trees consume the water changes also. The duration between irrigation applications will therefore be longer in cooler weather and shorter in hotter weather.

This produces a straightforward and simple way of knowing what is happening in the root area, consequently in the plant, by using evaporation figures. One must adjust these figures with the rainfall to arrive at an irrigation requirement.

The accepted method of evaporation data compilation in the UK has been by the use of the Penman formula but experience has shown that, due to the restricted area to which one is applying water, only a percentage of the evaporation figure need be replaced.

This percentage replacement is called the crop factor and for ease of calculation is shown as a decimal of 1, viz 50% = .5. It can be guessed and amended by manual adjustment or calculated.

No one factor can be regarded as suitable for all crops, but most nurseries use an initial figure of .4 up in the early part of the season and .6 up to late summer. The change in factor is due to the increase in leaf cover during the growing season.

On fruit such as apples and citrus .6 is most widely used, but going down to .4 on heavy clay soils, and up to .7 on sandy soils.

The factor can be checked by the constant watching of either strategically placed tensiometers, or the size of the wetted zone area. In large tree containers check the drainage water from the base of the container or insert tensiometers into the bottom 75 mm of compost. In a field grown crop the size of the wetted area is determined by pushing a 10 mm diameter rod into the soil. When the extremity of the wetted area is reached, the rod is much harder to push into the soil. The correct figure is reached when the tensiometers produce an even pattern; that is not gradually rising or falling after each irrigation session; or when the wetted area stays constant, not increasing or decreasing from its present area.

Since very few nurseries have solid cover as seen from the air, there is a further adjustment to be made to refine the use of evaporation date. That is to estimate the amount of actual ground that is covered by the foliage. The simplest way to do this is to determine the rectangular area based on the length and width of a typical tree. A rectangle rather than a circle is recommended as the rectangle method gives some allowance for the side exposure of the tree.

A better assessment takes into account the total allotted tree area, as well as the crop canopy and calculated by the following formula.

If the area covered by the crop canopy was greater than 50% of the allotted area, then the crop factor only is used. When the crop canopy is less than 50% of the allotted area, the remaining area is divided by 2 and then added to the crop canopy area. Alternatively use the allotted area only, with the crop factor containing the necessary tree size adjustment.

Example

Canopy area 1.5 m x 1.5 m	2.25 m^2
Allotted area 2.5 m x 2 m	5.00 m^2
Crop canopy	0.45 (45%)
Allotted area	0.55 (55%)

$$\text{Crop factor} = \left(0.45 + \left(\frac{0.55}{2}\right)\right) \times 0.55$$

$$= (0.45 + 0.275) \times 0.55$$

$$= 0.398 \supseteq (0.4)$$

Using the crop factor in the main formula the main irrigation application formula is as follows:

Metric

Evaporation in mm's x crop factor x allotted area m^2 = lts/tree

Imperial

$$\frac{\text{Evaporation in inches x crop factor x allotted area in ft}^2}{1.92} = \text{galls/tree}$$

Apply the water volume per tree to the flow rate of the drippers to each tree. i.e. 2 x 4 lt/hr (8 lts/hr)

The time for irrigation according to the evaporation data would be:

i.e. 10 mm evaporation x 0.4 x 5 m^2 = 20 lts. 20 lts/8l/hr = 2.5 hours

Rainfall

The rainfall reduction time can be equally simplified thus: -
Assuming tree spacing and canopy of the previous example of allotted area and crop canopy:

Canopy area 1.5 m x 1.5 m	2.25 m^2
Allotted area 2.5 m x 2 m	5.00 m^2
Crop canopy	0.45 (45%)

Allotted area x crop canopy % = litres per tree/mm of rain

The figure is then applied to the drip system as in the case of evaporation.

5 x .45 = 2.25 lts/tree/mm of rain. 10 mm rain = 22.5 lts/8 lts/hour drippers = 2.8 hours reduction.

For each 10 mm of evaporation the system is run for 2.5 hours (2 hours 30 minutes) and for each 10 mm of rain the system is left off for 2.8 hours (2 hours 48 minutes).

On face value these calculation would appear to be complicated, but if the best results are to be obtained from a drip system, then this point of scheduling correctly is of the utmost importance.