# Water for Profit WHEN AND FOR HOW LONG SHOULD I IRRIGATE?



### Row crop micro-irrigation systems (drip) with overlap of water from emitters along the row

### Calculating when to irrigate

You need to know:

- How much water is available in the soil? This requires an understanding of soil texture, decision on the maximum level of water stress to be applied to the crop and a measure of the crop rooting depth.
- How much water should the crop be using? This requires an understanding of type of crop, stage of crop growth and a measure of climatic conditions including evaporation.

### Step 1: Calculate the readily available water (RAW) in the crop root zone.

| Soil type (texture):               |     |
|------------------------------------|-----|
| Crop stress willing to be applied: | kPa |
| Crop rooting depth                 |     |
| Month one:                         | m   |
| Month two:                         | m   |
| Month three:                       | m   |
| Month four:                        | m   |
|                                    |     |

#### Table 1: Effect of soil texture on readily available water content

| Soil Texture      | Readily Available Water (mm <sub>water</sub> per m soil) between field capacity and; |   |    |    |     |  |  |  |  |  |
|-------------------|--|---|----|----|-----|--|--|--|--|--|
| Crop Stress Level | -20 kPa  | -20 kPa -40 kPa -60 kPa -100 kPa -200 kPa |    |    |     |  |  |  |  |  |
| Sandy             | 30   | 35  | 35 | 40 | 45  |  |  |  |  |  |
| Loamy Sand        | 45   | 50  | 55 | 60 | 65  |  |  |  |  |  |
| Sandy Loam        | 45   | 60  | 65 | 70 | 85  |  |  |  |  |  |
| Loam              | 45   | 65  | 75 | 85 | 105 |  |  |  |  |  |
| Sandy Clay Loam   | 40   | 60  | 70 | 80 | 100 |  |  |  |  |  |
| Clay Loam         | 30   | 55  | 65 | 80 | 105 |  |  |  |  |  |
| Light Clay        | 27   | 46  | 57 | 70 | 90  |  |  |  |  |  |
| Medium Clay       | 24   | 43  | 55 | 65 | 83  |  |  |  |  |  |
| Heavy Clay        | 21   | 40  | 53 | 60 | 81  |  |  |  |  |  |

#### To calculate the RAW in the crop root zone

= RAW (in mm/m) x width of wetted area (in m) x crop rooting depth (in m)

| Month one:   | mm/m | х | m | х | m | = | L/m of tape  |
|--------------|------|---|---|---|---|---|--------------|
| Month two:   | mm/m | х | m | х | m | = | L/m of tape  |
| Month three: | mm/m | х | m | х | m | = | L/m of tape  |
| Month four:  | mm/m | х | m | х | m | = | L/m of tape. |

#### Step 2: Calculate the expected crop water requirement.

Crop water requirement (mm/day) = crop coefficient xevaporation (mm/day)

- Select the appropriate crop coefficient for your crop from the monthly crop coefficients (Kc) fact sheet. Remember that your growing season may differ to the growing seasons shown in this table.
- For each month of the crop growing season, select the appropriate daily evapotranspiration rates (mm/day) and add them to the following table.
- Crop coefficient x evapotranspiration (mm/day) = crop water requirement (mm/day).



| Month                                | Jan | Feb | Mar | Apr | Мау | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Daily evapotranspiration<br>(mm/day) |     |     |     |     |     |     |     |     |     |     |     |     |
| Crop coefficient (Kc)                |     |     |     |     |     |     |     |     |     |     |     |     |
| Crop water requirement<br>(mm/day)   |     |     |     |     |     |     |     |     |     |     |     |     |



• Convert the crop water requirement (expressed in mm/day) to a volumetric measure.

1 mm of water applied = 1 L/m2

100 mm of water applied = 1 ML/ha.

## To convert the crop water requirement to an appropriate volumetric measure

= crop water requirement (mm/day) x crop canopy width (m)

| Month one:   | mm/day | х | m | = | L/day/m of tape  |
|--------------|--------|---|---|---|------------------|
| Month two:   | mm/day | х | m | = | L/day/m of tape  |
| Month three: | mm/day | х | m | = | L/day/m of tape  |
| Month four:  | mm/day | х | m | = | L/day/m of tape. |

# Step 3: Use the data from steps 1 and 2 to work out the expected period between irrigations for each month

| Readily available water (in soil) ÷ crop water requirement<br>irrigation interval |               |                 |   |       |  |  |  |
|---|---------------|-----------------|---|-------|--|--|--|
| Month one:  | L/m of tape ÷ | L/day/m of tape | = | days  |  |  |  |
| Month two:  | L/m of tape ÷ | L/day/m of tape | = | days  |  |  |  |
| Month three:  | L/m of tape ÷ | L/day/m of tape | = | days  |  |  |  |
| Month four:   | L/m of tape ÷ | L/day/m of tape | = | days. |  |  |  |

### Calculating how long to irrigate

You need to know:

- Readily available water content of the area/volume wetted by the irrigation system
- Water application rate or discharge from the irrigation emitter/sprinkler

# Step 1: Calculate the readily available water (RAW) in the crop root zone.

Use the same steps as for Step 1 in the section calculating when to irrigate on the previous page.

# Step 2: Measure the discharge from your irrigation application nozzle/emitter.

Discharge per emitter (L/hr) = volume in container (in Litres)  $\div$  time to fill container (in minutes) x 60 mins/hr

L ÷ mins x 60 mins/hr

Discharge rate = L/emitter/hr

To calculate the discharge per metre of tape:

Discharge rate (L/m/hr) = discharge rate (L/emitter/hr) ÷ emitter spacing (m)

- = L/emitter/hr ÷ m
- = L/hr/m of row.

Step 3: Use the data from steps 1 and 2 to calculate how long to irrigate.

To calculate the period of irrigation

= readily available water (L/m of tape) ÷ discharge (L/hr/m of tape)

| Month one:   | L/m of tape | ÷ | L/hr/m of tape | = | hrs  |
|--------------|-------------|---|----------------|---|------|
| Month two:   | L/m of tape | ÷ | L/hr/m of tape | = | hrs  |
| Month three: | L/m of tape | ÷ | L/hr/m of tape | = | hrs  |
| Month four:  | L/m of tape | ÷ | L/hr/m of tape | = | hrs. |

For more details contact the Growcom members access line on 07 3620 3844.

Disclaimer: This information is provided as a reference tool only. Seek professional advice for irrigation specifics.

A Growcom project conducted in collaboration with the Queensland Department of Agriculture, Fisheries and Forestry and the National Centre for Engineering in Agriculture with funding provided by the Queensland Government's Rural Water Use Efficiency Initiative.





