

# Simple calculations for furrow irrigation

## Calculations

1. Average inflow rate (L/sec)
2. Area watered per irrigation (ha)
3. Volume applied per irrigation (ML)
4. Volume applied per hectare (ML/ha)
5. Compare application to crop use

Some simple measurements and calculations are valuable when evaluating a furrow irrigation system. These measurements and calculations provide a baseline and can be used to evaluate the effect of any changes.

### 1. Average inflow rate (L/sec)

The simplest way to measure the inflow rate is with a bucket and stopwatch. Fill a bucket with water at the cup and record the volume (L) and time (sec). Take 3-4 readings per row over four or more rows, the more the better.

Calculate the average volume and time for each row. Then calculate the average inflow rate (L/sec) for each row by dividing the average volume by the average time. Calculate the average inflow rate across all measured rows by adding the inflow rates for each row and dividing by the number of rows.

### 2. Area watered per irrigation (ha)

To calculate the area watered per irrigation: multiply the number of rows being watered by the row spacing (metres) and the block length (metres), then divide by 10,000 to get an area in hectares.

$$\text{Area (ha)} = (\text{row spacing} \times \text{no. rows per irrigation set} \times \text{row length}) / 10,000$$

### 3. Volume of water applied per irrigation (ML)

The total volume of water applied during an irrigation event in megalitres (ML) is: the inflow rate (L/sec) multiplied by 3,600 (to convert to L/hr) by the number of rows being irrigated by the irrigation duration (hrs) divided by one million.

$$\text{ML} = (\text{inflow rate} \times 3,600 \times \text{rows watered} \times \text{irrigation duration}) / 1,000,000$$

### 4. Volume applied per hectare (ML/ha)

To calculate the volume of water applied per hectare, divide the total volume of water applied by the area being irrigated.

$$\text{ML/ha} = \text{total volume (ML)} / \text{area (ha)}$$

### 5. Compare volume applied to crop water use

Crop water use (mm) can be calculated using WaterSense or crop factors. The crop water use can then be compared to the amount of water applied by irrigation (mm) to see if the irrigation is supplying sufficient water or an excess amount. If the irrigation application efficacy is greater than 1, the amount of water being applied by irrigation is more than is being used by the crop. If the number is less than 1, then the irrigation is not replacing the water used by the crop. Water that is applied in excess of crop use can be lost through run-off or deep drainage.

$$\text{Irrigation water applied (mm/ha)} = \text{ML/ha} \times 100$$

$$\text{Crop water use (mm)} = \text{days between irrigations} \times \text{daily water use (mm/day)}$$

$$\text{Irrigation application efficacy} = \text{applied water} / \text{crop water use}$$





**Example**

**Variables**

Row spacing: 1.52 m

Number of rows per irrigation set: 50

Days since last irrigation: 14

Row length: 580 m

Irrigation duration: 24 hours

Average crop water use: 4.8 mm/day

**1. Measuring and calculating inflow rates**

*\* answer rounded to one decimal place*

Reading	Row 1		Row 2		Row 3		Row 4	
	L	Sec	L	Sec	L	Sec	L	Sec
#1	7.5	7.0	7.5	7.5	7.0	6.5	7.5	6.5
#2	7.2	6.5	7.0	7.0	8.5	6.0	8.0	7.5
#3	8.4	8.0	8.0	6.5	7.0	7.0	8.5	7.5
#4	6.5	6.0	6.5	7.0	8.0	8.0	7.0	7.0
Average *	7.4	6.9	7.3	7.0	7.6	6.9	7.8	7.1
L/Sec *	1.1		1.0		1.1		1.1	
Average for measured rows (L/sec) *	1.1							

**2. Area watered per irrigation (ha)**

Area (ha) = (row spacing x no. rows per irrigation set x row length) / 10,000

Area (ha) = (1.52 m x 50 x 580 m) / 10,000

= 4.41 ha (answer rounded to 2 decimal places)

**3. Volume of water applied per irrigation (ML)**

ML = (inflow rate x 3,600 x rows watered x irrigation duration) / 1,000,000

ML = (1.1 L/sec x 3,600 x 50 x 24 hr) / 1,000,000

= 4.75 ML (answer rounded to 2 decimal places)

**4. Volume applied per hectare (ML/ha)**

ML/ha = total volume (ML) / area (ha)

ML/ha = 4.75 ML / 4.41 ha

= 1.08 ML/ha (answer rounded to 2 decimal places)

**5. Compare volume applied to crop water use**

Irrigation water applied (mm/ha) = ML/ha x 100

= 1.08 ML/ha x 100

= 108 mm/ha

Crop water use (mm) = days between irrigations x daily water use (mm/day)

Crop water use (mm) = 14 days x 4.8 mm/day

= 67.2 mm

Irrigation application efficacy = applied water / crop water use

Irrigation application efficacy = 108 / 67.2

= 1.6

Therefore, in this scenario the irrigation is replacing 1.6 times the amount of water used by the crop since the last irrigation.