IRRIG8Quick

Irrigation Performance Quick Test

Guidelines for Travelling Irrigators

PAGEBLOOMER

What is the Irrigation Quick Test about?

The purpose of the Irrigation Performance Quick Test is to determine the depth of irrigation applied during an irrigation event and how uniformly the irrigation is distributed.

It is designed so irrigation managers can do the testing and calculations themselves. As well as this guideline, a worksheet is available to assist. If your findings are unexpected, or suggest low performance, you should consider getting professional advice.

Why you should check your irrigation?

Profitability – effective irrigation maximises production. A well setup system makes money!

Sustainability – efficient irrigation minimises water and energy use and leaching. A well setup system saves money!

It is essential for irrigation managers to know how much water is being applied as it is an important input into any irrigation budgeting or scheduling process. It is particularly important if nutrients are being applied with the irrigation either as effluent or fertigation.

The uniformity of irrigation determines whether all plants are receiving the same amount of water. As uniformity decreases, some plants will be more over-watered while some are more under-watered. Again, this is especially so if applying nutrients.

What is involved?

The Quick Irrigation Performance Test method is based on measurements of irrigation collected in twenty-four identical buckets. Follow bucket placement instructions carefully and read volumes as accurately as possible to be sure of best results.

Determine the speed of the irrigator as it passes over the collector buckets. You can measure the speed at different locations along the run length to check if the speed (and therefore depth applied) is constant.

There are some extra tests and checks you can do. You can record water flow from your water meter and compare with results from the bucket collection results. You can record energy usage and determine the energy (and cost) needed to pump irrigation.

What will the testing tell you?

The main things the Quick Test will tell you are:

Applied Depth – what depth of water the irrigator is applying. Compare the measured applied depth to your target application as a calibration exercise.

Distribution Uniformity – DU describes the evenness with which plants receive water. The higher the Distribution the better the system is performing. And the higher the uniformity, the more confident you can be that your measurements are truly representative of your system's performance.

Excess Water Use – EWF The excess water use factor identifies how much extra water is required during a full irrigation because of non-uniformity.

What do you need to do?

- Gather information about your system – you should be able to do this yourself.
- Record the data on the worksheet.
- Work out the answers using the worksheet calculations.

When should you do it?

Choose test conditions that are typical for your farm. Performance may change if multiple irrigators are running, or if another large draw off (milking shed needs) starts to take water.

It may be useful to test in different wind conditions and operating from different hydrants on a long mainline.

What are the Quick Test's limitations?

The depth of water applied will change if the speed of the irrigator changes. A faster speed puts on less water.

The uniformity will change with machine pressure, lane spacing, topography and wind.

The Quick Irrigation Performance Test will only provide information for a given machine running at a given position at a given speed and pressure on a given day. As any of these change so will irrigator performance.

Measurement Procedure

What equipment will you need?

This guide and the worksheet

22 Collectors of the same diameter (at least 150 mm) – 9 Litre plastic buckets are good
1 Measuring cylinder (about 2 Litre)
1 5 m tape
2 Electric fence standards
1 Stop watch
1 Pen or pencil

Dealing with overlap

If irrigation from adjacent runs overlaps, this must be taken into account. To account for overlap, buckets are placed in the overlap zone and measured depths combined. The effective depth and evenness is the combined effect of both runs.

1. Place a marker half way between two hydrants. This is the edge of the "Lane".
2. Mark the extent of obvious wetting when the irrigator runs. This is the "Wetted Width".
3. If the wetted width is greater than the lane width, you need to account for overlap.
4. Place one bucket half way between the edge of the lane and the edge of the wetted width [see **'L11'** in Diagram 2].
5. Mirror this inside the edge of the lane, setting another bucket at the same spacing from the edge of the lane [see '**L10** in Diagram 2].
6. Arrange nine more buckets at even spacing to cover the area back to the centre line (the hose or cable) [see '**L9-L1**' in Diagram 2]. The spacing may be different to overlap buckets.
7. Repeat 4, 5 & 6 on the right hand side.

NOTE:

If the system has no overlap, leave buckets L11 and R11 out. Spread 10 buckets each side of the irrigator and don't do overlaps in the calculations.

If the system has more than 20% overlap, you should use extra buckets in the overlap zone.

Speed test

1 Set two markers (e.g. fence standards) 5.0m apart along the hose or cable
2 The markers should cross the line of collectors
3 Measure the time for the irrigator to travel between markers.

Field test layout

Ideally do three tests along the length of the irrigators travel path. This checks if the same depth is applied at the start and end of runs.

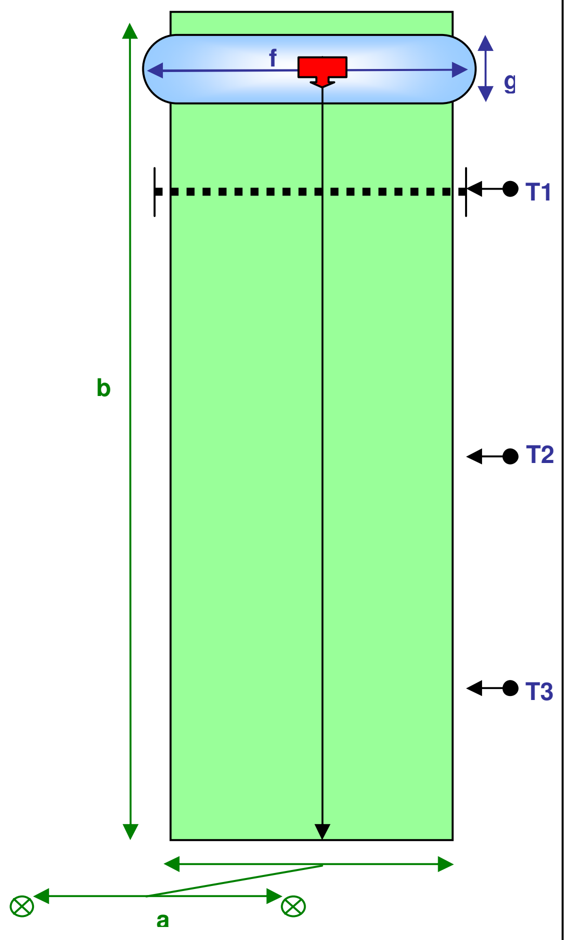


Diagram 1. Key Dimensions
Letters refer to Field Details on Page 3

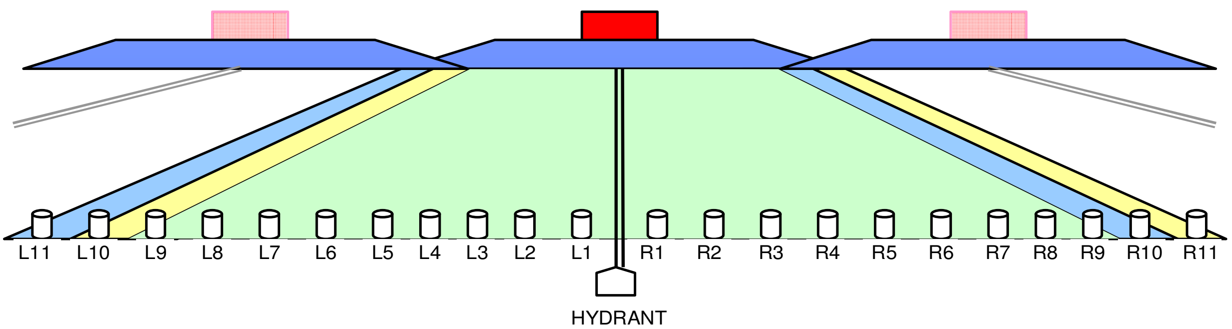


Diagram 2. Collector bucket positions relative to irrigation lane and wetted width

Why does performance change?

Machine travel speed determines how long any area receives water. The travel speed often varies along the length of an irrigation run. Some machines slow down in windier conditions. Some machines speed up as more hose or cable is wound on the reel. It is useful to test irrigators at the beginning and end of typical runs and in different wind conditions.

Lane spacing is the distance between the centre of side-by-side irrigation runs. Normally this is the same as the spacing between hydrants at the end of the field. How far sideways do you shift the irrigator? Changing spacing has very significant effects on uniformity and average applied depths.

Irrigator wetting width is the spread of water both sides away from the centre line (the hose position). It varies with wind direction and speed.

Wetting pattern width is the other dimension of the wetting pattern. It is the average width of the area being wetted at any time, measured parallel to the direction of travel. For most booms, the wetting pattern width is fairly constant. For circle or half circle patterns, the width of wetting measured two thirds of the way from the hose to the wetted edge is a good estimate.

What is acceptable?

Applied Depth

You should expect your measured applied depth to be within 10% of your target depth. A result within 5% is better. Depth will change with speed, so check speed in different locations along the irrigation run.

Distribution Uniformity

DU > 0.9	Uniformity is excellent - the system is performing very well. You can be confident of this result.
0.9 – 0.8	Uniformity is good - performance better than average. You can be confident of this result.
0.8 – 0.7	Uniformity is adequate - performance could still be improved. The result is likely to be a good indication of system performance.
0.7 – 0.6	Uniformity is fair - system should be investigated. Results may be less reliable – redo the testing to check.
DU < 0.6	Uniformity is poor - system must be investigated. Results are less reliable – redo the testing to check.

Example Recording Sheet for Travelling Irrigator Performance Quick Test

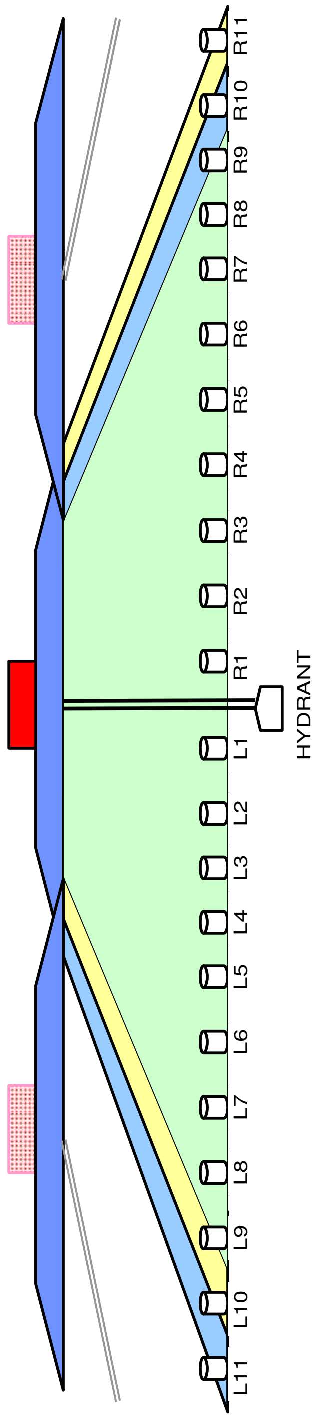
Use the Sheet to record details from the field and to complete some extra calculations. Take care to enter information using the same measurement units (e.g. millimetres or metres) as specified in the Recording Sheet. This will ensure your calculated answers have the correct units too.

Test Details		
Farm Name		Drylands
Tester's Name		Montie
Test Date		20 Nov 07
Test Machine		Red Gun
Test Field/Run		Back Paddock
Target Irrig Depth	[mm]	25
Test distance	[m]	5
Test time	[min]	15
Speed	[m/min]	0.33
Test Flow	[L/min]	750
Test Pressure at pump	[kPa]	450
Test Pressure at irrigator	[kPa]	210
Wind conditions		Light from North

Field Details			
a	Hydrant / lane spacing	[m]	90
b	Run length	[m]	300
c	Area Irrigated (**a** x **b** / 10,000)	[ha]	2.7
d	Number of runs		4
e	Total Area (**c** x **d**)	[ha]	10.8
f	Irrigator wetting width	[m]	100
g	Wetting pattern width	[m]	11
h	Wetting area (**f** x **g**)	[m^2]	1100
i	Bucket diameter	[mm]	160
j	Open area (**i** / 2000)^2 x 3.14	[m^2]	0.020
k	Applied Depth	[mm]	24.3
m	Speed	[m/min]	0.33
n	Flow Rate (**a** x **k** x **m**)	[L/min]	722

Recording Sheet for Travelling Irrigator Performance “IRRIG8Quick” Test

Enter your field measurements from buckets in Column 1.
Complete the overlap adjustments in Column 2.
Complete the calculations in Column 3.



Column 1	
Collected Volumes	
R11	1 *100*
R10	2 *200*
R9	*250*
R8	*380*
R7	*450*
R6	*510*
R5	*470*
R4	*430*
R3	*350*
R2	*450*
R1	*500*
L1	*500*
L2	*460*
L3	*390*
L4	*450*
L5	*440*
L6	*500*
L7	*490*
L8	*470*
L9	*360*
L10	1 *180*
L11	2 *150*

Column 2	
Overlapped Volumes	
Add Boxes R11 and L10 from Collected Volumes and enter in L10 Below. Repeat for R10 and L11	
R10	2 *350*
R9	*300*
R8	*380*
R7	*450*
R6	*510*
R5	*470*
R4	*430*
R3	*350*
R2	*450*
R1	*500*
L1	*500*
L2	*460*
L3	*390*
L4	*450*
L5	*440*
L6	*500*
L7	*490*
L8	*470*
L9	*410*
L10	1 *280*
SUM of 20	*8580*
AVG of 20	*429*

Column 3	
Calculations	
Enter the lowest five volumes in boxes 1 – 5	
1	*280*
2	*300*
3	*350*
4	*350*
5	*380*
SUM of 5	*1660*
AVG of 5	*332*
Calculate DU: Divide average of lowest five by average of all twenty	
AVG of 5	*332*
AVG of 20	*429*
DU	*0.77*
Calculate average applied depth: Average volume ÷ Bucket Area ÷ 1000	
AVG of 20	*429*
Area m^2	*0.020*
Depth mm	*24.3* mm
Calculate Excess Water Factor EWF% ((Depth ÷ DU) –Depth) ÷ Depth x 100	
Depth	*24.3*
DU	*0.77*
EWF	*29* %