IRRIG8Quick

Irrigation Performance Quick Test

Guidelines for Linear Move 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?

Two key reasons:

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

Sustainability – efficient irrigation minimises water 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.

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.

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. Measure the speed near the centre – it may vary from end to end as the machine straightens itself.

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 irrigation 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 with and without an end gun operating if fitted.

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 of a linear move will not normally change much if adequate pressure is supplied.

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

24 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

Application test

1. Set your 24 buckets in a row [**T1** Diagram 1] along the length of the irrigator
2. Arrange eight buckets at even spacing under the first span or two of the machine [see '**17 - 24**' in Diagrams 1 & 2].
3. Arrange eight more buckets at even spacing in the middle of the machine [see '**9 - 16**' in Diagrams 1 & 2].
4. Arrange eight more buckets under the last span or two of the machine [see '**1 - 8**' in Diagrams 1 & 2].
5. If there is an end gun, arrange two of these buckets at even spacing between the end wheel track and the extent of significant wetting [see '**1&2**' in Diagrams]
6. Start the irrigator away from (before any water can reach) the line of buckets
7. Run the irrigator keeping it going until it is well past wetting the buckets. Measure the irrigator speed as it passes over the test buckets
8. Measure the volume of water caught in each bucket and record on the Worksheet

Speed test

1. Set two markers (electric fence standards) 5.0m apart beside the end wheel track
2. The markers should be in line with the collectors
3. Measure the time for the irrigator to travel between markers – they move when the carriage hits them

Field test layout

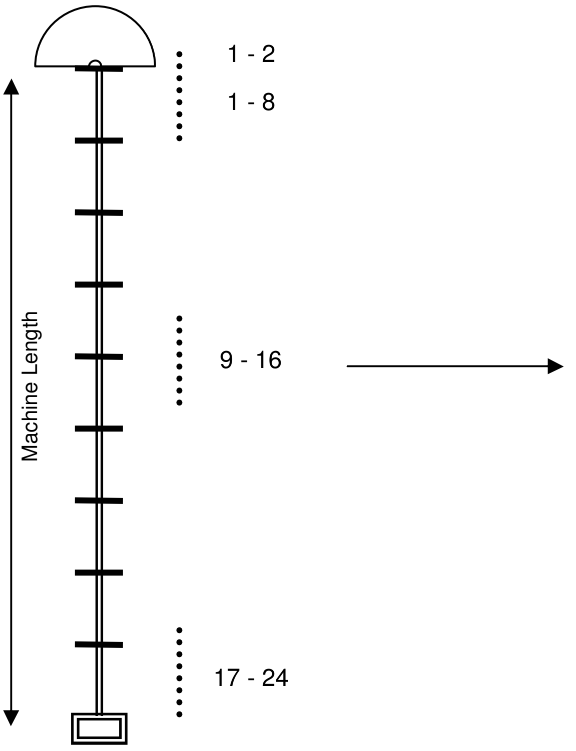


Diagram 1. Key Dimensions
Numbers relate to instructions at left

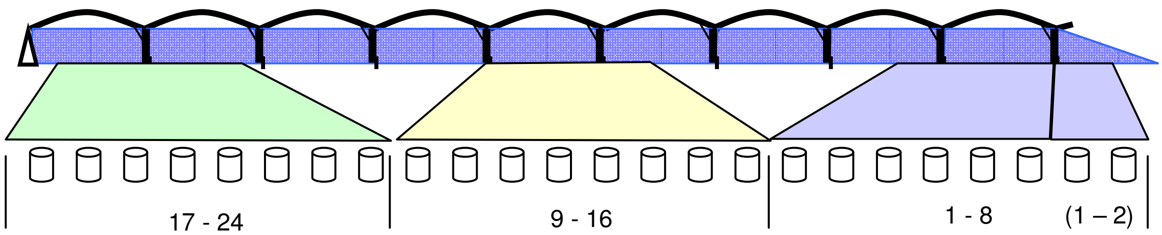


Diagram 2. Bucket Placement
Numbers relate to instructions above

Why does performance change?

Machine travel speed determines how long any area receives water.

Machines will speed up and slow down as they keep in line. A longer test or multiple tests gives best information.

The standard for linear moves is to calculate speed at the centre wheels.

Irrigator wetting length is the distance from the inlet end to the end of the last sprinkler or end gun. Stop the measurement where there is still significant amount of water being applied, rather than the very end of any wetness.

Sometimes there is an unirrigated length at the start of the machine. If so, this should be deducted when calculating machine length.

Wetting pattern width is the other dimension of the wetting pattern. It is the average spread of water both sides away from the centre line (the irrigator spans). The wetting pattern width is fairly constant though it may change a little due to sprinkler positions.

You can use machine speed and wetting area to calculate application rates (intensity) which can be high under some linear moves.

What is acceptable?

Applied Depth

You should expect your measured applied depth to be within 10% of the 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 Worksheet for Linear Move Irrigator Performance Quick Test

Test Details		
Farm Name	*Drylands*	
Tester's Name	*Montie*	
Test Date	*20 Nov 07*	
Test Machine	*T-L Linear*	
Test Position	*135 m from East end*	
Test Pressure [kPa]	At pump	*350*
	At Irrigator Entry	*210*
	At Irrigator End	*140*
Wind conditions	*Light from North*	

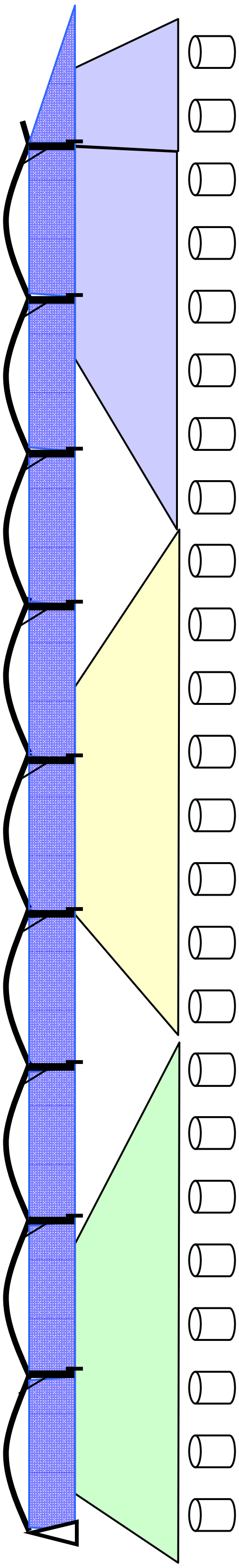
Machine Details		
a	Machine length [m]	*490*
b	End gun extra length [m]	*30*
c	Travel distance one full run [m]	*1200*
d	Area (**a** + **b**) x **c** /10,000) [ha]	*62.4*
e	Number of runs	*2*
f	Total Area (**d** x **e**) [ha]	*124.8*
g	Wetting width [m]	*11*
h	Wetting length [m]	*520*
I	Wetted area (f x g) [m^2]	*5720*

Speed Test (at centre wheels)			
Test Distance	*5*	*5*	*5*
Test time [min]	*14*	*13*	*13.5*
Speed [m/min]	*0.36*	*0.38*	*0.37*

Collector Bucket Details		
i	Bucket diameter [mm]	*160*
j	Open area $(i / 2000)^2$ x 3.14 [m^2]	*0.020*

Example Worksheet for Linear Move Irrigator Performance Quick Test

Enter your field measurements from buckets in Column 1.
Complete the calculations in Columns 2 and 3.



Column 1

Collected Volumes	
1	250
	350
3	450
4	430
5	480
6	450
7	410
8	470
9	430
10	350
11	450
12	500
13	500
14	460
15	390
16	490
17	440
18	500
19	490
20	470
21	510
22	480
23	490
24	500

Column 2

Calculations	
Calculate Low Quarter Average: Enter the lowest six volumes in boxes below	
Low 1	250
Low 2	350
Low 3	350
Low 4	390
Low 5	380
Low 6	430
SUM of 6	2180
AVG of 6	363.3
Calculate Overall Average (all twentyfour)	
SUM All 24	10,740
AVG All 24	447.5
Calculate DU: Divide average of lowest six by average of all 24	
AVG of 6	363.3
AVG of 24	447.5
DU	0.82
Calculate average applied depth: Average volume ÷ Bucket Area ÷ 1000	
AVG of 24	447.5
Area m^2	0.020
Depth mm	22.4

Column 3

Calculate average depth under Sections Average volume ÷ Bucket Area ÷ 1000	
Calculate %'s of machine average depth	
Calculate averages under End Spans	
SUM 1 – 8	3290
AVG 1 – 8	411
Depth mm	20.6
% of AVG	92
Calculate averages under middled spans	
SUM 9 - 16	3570
AVG 9 - 16	446
Depth mm	22.3
% of AVG	100
Calculate averages under first spans	
SUM 17-24	3880
AVG 17-24	485
Depth mm	24.3
% of AVG	108
Calculate Excess Water Factor EWF% ((Depth ÷ DU) –Depth) ÷ Depth x 100	
Overall Depth	22.4
DU	0.81
EWF	23 %

Irrigation Performance Quick Test – Linear Moves