IRRIG8Quick

Irrigation Calibration Quick Check

Guidelines for Sprayline Irrigation

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What is the Irrigation Quick Check about?

The purpose of the Irrigation Calibration Quick Check 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 checking 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 Calibration Check 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.

Check the flow rates from sprinklers on a number of spraylines. Compare these to determine the overall performance of a system with multiple spraylines.

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 checking tell you?

The main things the Quick Check 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 (e.g. a milking shed) starts to take water.

It can be useful to test in different wind conditions and check the operation of different spraylines especially over large areas or varying terrain.

What are the Quick Check's limitations?

The depth of water applied will change as pressure changes or if different nozzles are fitted. Check the right nozzles are installed.

The uniformity will also change with different shift spacings, topography and wind.

The Quick Irrigation Calibration Check will only provide information for the tested sprayline running on that hydrant at that pressure on that day. As any of these change so will irrigation 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 1 Litre)

1 50 m tape

1 Stop watch

1 Pen or pencil

Field check layout

The calibration check is based on two lines of collectors (transects) placed across the sprayline. This assesses whether the same depth is applied at the start and end of the sprayline. The calculations give an average value for the whole sprayline based on both transects.

Dealing with overlap

Sprayline irrigation typically has overlap from adjacent sets. 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 overlapped sets.

Testing Layout

1. Place a marker half way between two adjacent operating positions or "Sets" ('a' in Diagram 1).
2. Mark the extent of obvious wetting when the irrigation runs. This is the "Wetted Width" ('f').
3. If the wetted width is greater than the set width, you need to account for overlap.
4. Place one bucket half way between the edge of the set and the edge of the wetted width [see **'L6'** 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 '**L5** in Diagram 2].
6. Arrange four more buckets at even spacing to cover the area back to the centre line (the lateral pipe) [see '**L4-L1**' in Diagram 2]. The spacing may be different to overlap buckets.
7. Repeat Steps 4, 5 & 6 on the right hand side (**R1-R6** in Diagram 2).
8. Then repeat Steps 4 to 7 at position T2 (**L7-12** and **R7-12** in Diagram 2).

Application test

1 Set 24 buckets in two rows across the sprayline [see **T1** and **T2** in Diagram 1]. The first row is at the second sprinkler, the second row half way between the last two sprinklers

2 Run the irrigation to collect an easily measured amount of water. It need not be the whole usual run time. Record the run time

3 Measure the volume of water caught in each bucket and record on the Record Sheet, taking care to record each in the correct position

4 Do the calculations as shown in the worksheet

NOTE: If the system has no overlap between sets, leave out buckets L6, L12, R6 and R12. Spread 10 buckets at each transect and don't do overlap calculations. If the system has more than 25% overlap, this method may not give fair representation of effects.

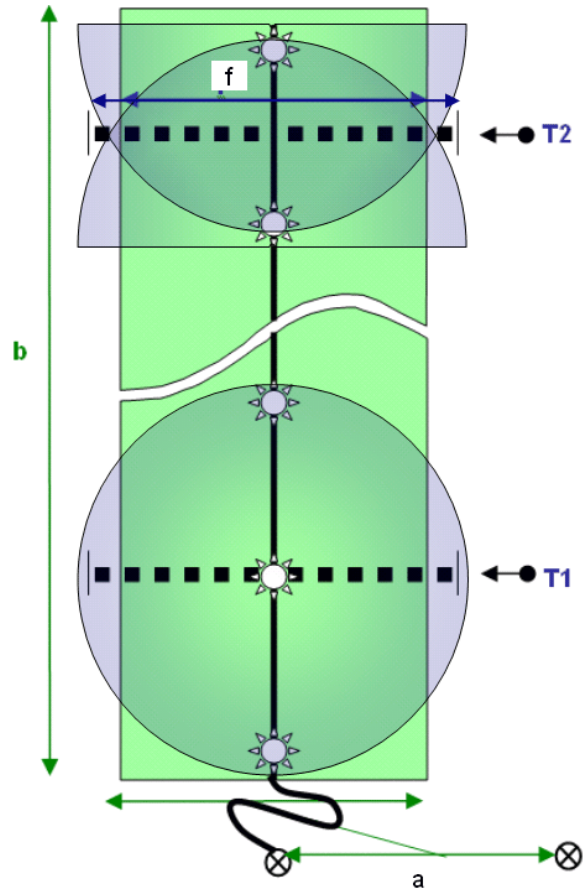


Diagram 1. Key Dimensions
Letters refer to Field Details on Page 3

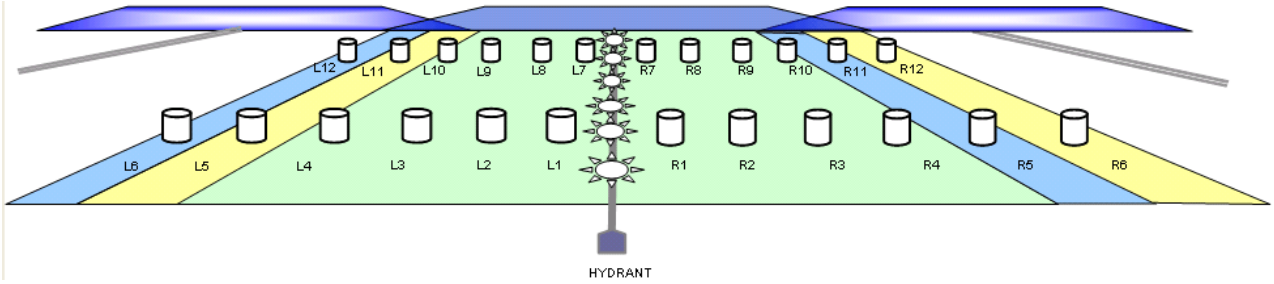


Diagram 2. Collector bucket positions relative to irrigation set and wetted width

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.

Why does performance change?

System run time determines how long each area receives water.

Set spacing is the distance between the centre of the sprayline in one position and the next. How far sideways do you shift the irrigation? 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 will vary along the sprayline depending on sprinkler positions. Estimate the width that includes most of the wetness.

Wetting patterns vary with pressure, wind direction and speed. Sprinkler angle and nozzle size and wear can also make a considerable difference to results.

If multiple spraylines operate on a system, their performances can vary due to inlet pressure and length of the spraylines. It is advisable to measure a number of representative spraylines to determine if differences are significant.

Variation can be managed, primarily by adjusting run times, to get ensure equal application depths across the system as a whole.

Example Recording Sheet for Sprayline Calibration Quick Check

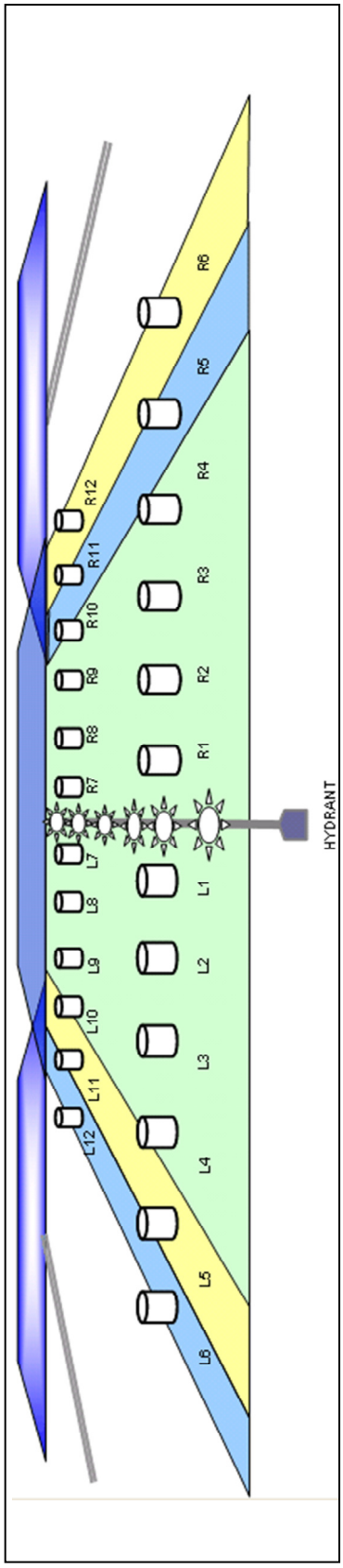
Use the Sheet to record details from the field and to complete some extra calculations. Take care to enter information using the same measurement units (e.g. millimetres or metres) as specified in the Recording Sheet. This will ensure your calculated answers have the correct units too.

Test Details	
Farm Name	*Dairylands*
Tester's Name	*Daisy*
Test Date	*20 Nov 07*
Test Sprayline	*B 13*
Test Field	*Back Paddock*
Target Irrigation Depth [mm]	*25*
Test duration [hr]	*2.0*
Normal irrigation duration [hr]	*8*
Test Water Meter Flow [m3/h]	*11.2*
Test Pressure at pump [kPa]	*450*
Test Pressure at sprayline [kPa]	*140*
Wind conditions	*Light from North*

Field Details		
a	Set spacing [m]	*15*
b	Sprayline length [m]	*105*
c	Area Irrigated (**a** x **b** / 10,000) [ha]	*0.1575*
d	Number of spraylines	*8*
e	Total Area (**c** x **d**) [ha]	*1.26*
f	Sprayline wetting width [m]	*15*
g	Wetting area (**b** x **f** x **d**) [m^2]	*12,600*
h	Bucket diameter [mm]	*160*
i	Open area (**h** / 2000)^2 x 3.14 [m^2]	*0.020*
j	Test Applied Depth [mm]	*17.25*
k	Test Duration [hours]	*2*
m	Application Rate (**j** / **k**) [mm/h]	*8.63*
n	Flow Rate (**g** x **j** / **10,000)** / **k** [m3/h]	*10.87*

Recording Sheet for Sprayline Irrigation Calibration "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		Column 2		Column 3	
	Collected Volumes		Transect 1 Overlapped Volumes		Calculations	
			Transfer and Add volumes as shown to calculate overlap		Enter the lowest five volumes in boxes 1 – 5	
Transect 1 Collectors	R6	1 100	R5+L6	2 290	1	140
	R5	2 200	R4	240	2	160
	R4	240	R3	260	3	180
	R3	260	R2	380	4	190
	R2	380	R1	450	5	240
	R1	450	L1	510	AVG of lowest 5	182
	L1	510	L2	470	AVG of ALL 20	345
	L2	470	L3	430	Calculate DU: Divide average of lowest five by average of all twenty	
	L3	430	L4	350		
	L4	350		1 320	DU	0.53
	L5	1 220	AVG of 10	370	Compare beginning and end averages – Transect 1 / Transect 2	
	L6	2 90	Transect 2 Overlapped Volumes			
	R12	1 20	R11+L12	2 140	T1/T2	1.16
Transect 2 Collectors	R11	2 80	R10	190	Calculate average applied depth: Average volume ÷ Bucket Area ÷ 1000	
	R10	190	R9	350		
	R9	350	R8	410	AVG of 20	345
	R8	410	R7	450	Area m^2	0.02
	R7	450	L7	490	Depth mm	17.25
	L7	490	L8	470	Calculate Excess Water Factor EWF% ((Depth ÷ DU) –Depth) ÷ Depth x 100	
	L8	470	L9	360		
	L9	360	L10	180	Depth	17.25
	L10	180	L11+R12	1 160	DU	0.53
	L11	1 150	AVG of 10	320	EWF	89
	L12	2 50				