


WATERWISE ON THE FARM

CARING FOR OUR COUNTRY

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Irrinote Factsheet 7

MICROSPRINKLER IRRIGATION: PARTIAL AND NON-OVERLAPPING SYSTEMS

How much am I putting on?

Non-overlapping under canopy irrigation is a form of micro irrigation that has been used since the 1950's. With this form of irrigation, sprinklers are placed near or between trees/vines to deliver water to a confined area rather than irrigating the whole growing area.

There are several brands of micro-sprinklers on the market suitable for under tree irrigation. They come with various nozzle sizes; have differing discharges, operating pressures and throw diameters which can make things complicated! Discharges generally range from 20-300L/hour and sprinklers can operate within a pressure range of between 50-300 kPa (7-43 psi).

Many brands have pressure compensation or flow control technology inbuilt to 'even out' flow at higher pressures.

This Stonefruit orchard uses 35L/hr sprinklers with deflector/range limiter and wetting patterns do not overlap.

Some under tree systems are designed to irrigate only along the lateral/tree row, leaving a dry strip between the rows. Other systems can be designed so that the wetting patterns from individual sprinklers never overlap.

This Irrinote will outline the different methods used to calculate Mean Application Rates (MAR) in mm/hr, Distribution Uniformity (DU%) and Distribution Characteristic (DC) so you can effectively schedule irrigations with your micro sprinklers

Sprinkler output: the simple way

The basic desktop and field based method of calculating sprinkler output in mm/hr is:

1mm of irrigation = 1L ÷ 1m^2 or similarly:

Sprinkler output (L/hr) ÷ wetted area covered by one sprinkler in m^2

For example: a 95L/hr micro sprinkler with a 3.75m throw radius wetted area : 44m^2).

95L/hr ÷ 44m^2 = 2.15mm/hr

Important Note – this is an average and assumes that the 95L is spread evenly over the entire 44m^2 but actually application rates will vary across the wetted area of the sprinkler so it is generally not used. This calculation is very useful if you are irrigating young trees with throw limiters or deflector tabs attached to the swivel of the micro sprinkler.

Undercanopy catch can test (grid pattern)

Although not widely used, you can use your regular catch cups/jars, positioned in a grid pattern to obtain the application rates from the microsprinklers. You will not be able to calculate Distribution Uniformity (%) using the grid pattern as the sprinklers are not fully overlapping and uniformity percentage will always be low.

Example of catch can spacing for radial sprinkler analysis.

The example below, the catch cans have been placed in a grid pattern along the sprinkler line to the edge of the throw radius.

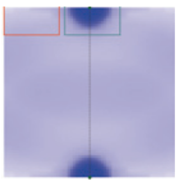
Irrigation Area A 5. Naan 2002 (Red swivel) 90L Sprinklers 20cm, 220kPa. (Amounts in millilitres)

	Tree		Sprinkler			Sprinkler		Tree
row 1	16	14	25	15	18	24	20	16
row 2	12	13	21	15	16	17	14	17
row 3	12	8	12	10	14	5	13	15
row 4	12	6	6	8	7	1	11	12

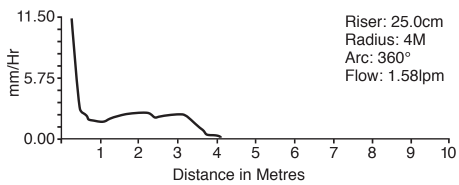
After converting the mL to mm of water and accounting for system run time of 30mins, the MAR over the whole area is 4.3mm/hr.

Software – good to crunch the numbers

There are software packages out there to assist you to do desktop evaluations of different sprinkler models, nozzle types and spacing's. Software such as Winspace Pro, can generate application rates in mm/hr, water distribution graphs, DC% and maximum throw radius from radial analysis catch can data. You can even input your own data and the software will do all the calculations for you. For example, in the blue water distribution graph, the dark blue areas inside the dark green box indicate the wettest area and the light blue areas inside the red box indicate the driest areas. For this example the sprinkler is 95L/hr at a spacing of 3.5m along the lateral. The software calculated a Distribution Uniformity of 78% with a MAR of 4.6mm/hr and a DC of 59%. This is vital information if you are unable to perform tests on the sprinklers in the field.



Winspace Pro graph aerial view (dark blue = high application areas, light blue = average application areas)



Winspace Pro sprinkler distribution cross section graph.

MICROSPRINKLER IRRIGATION: PARTIAL AND NON-OVERLAPPING SYSTEMS (continued)

Non overlapping wetted area evaluation (Radial Analysis)

A more comprehensive method of evaluating and calculating the output in mm/hr of your non-overlapping sprinklers is to perform a 'wetted area evaluation'. From this you can calculate the Mean Application Rate (MAR) and Distribution Characteristic % (comparison between the area that received the average depth with the total wetted area) and maximum sprinkler throw. This process involves using catch cans and placing them in set intervals in a line from the sprinkler to the edge of the throw radius (see picture). You may use sprinkler performance or 'spec' charts to obtain the throw radius. The more closely spaced your catch cans are the more accurate your results will be but a recommended spacing for the catch cans is 0.5m apart. Important Note: the catch can closest to the sprinkler, must be positioned at half the chosen spacing, for this example the first can would be located 0.25m from the sprinkler.

You will need to perform a few calculations to get the MAR and DC% so use the worked example below to guide you through the process.

Example Catch Can Record Sheet

	A	B	C	D	E	F	G	H
Catch Can	Distance from Sprinkler (meters)	Test Radial 1 (mL)	Test Radial 2 (mL)	Totals for each position **B+C**	Totals (mL/hr) **D ÷ test run time (mins) x 60 (mins)**	Average Volume (mL/hr) **E ÷ number of test radials**	Depth of Application (mm) **F ÷ can conversion**	Area Adjusted Depth **A X G**
1	0.25	50	39	89	178	89	8.9	2.2
2	0.75	30	25	55	110	55	5.5	4.1
3	1.25	24	24	48	96	48	4.8	6.0
4	1.75	16	18	34	68	34	3.4	6.0
5	2.25	16	16	32	64	32	3.2	7.2
6	2.75	8	9	17	34	17	1.7	4.7
7	3.25	1	3	4	8	4	0.4	1.3
							Total (*I*)	**31.5**

Example: 30 min test, 113mm catch can used with a conversion factor of 10

Note: You need the 'Converting mL to mm of irrigation' table, which can be found in the Irrigation Efficiency - Principles to Practice workbook.

Worked Example:

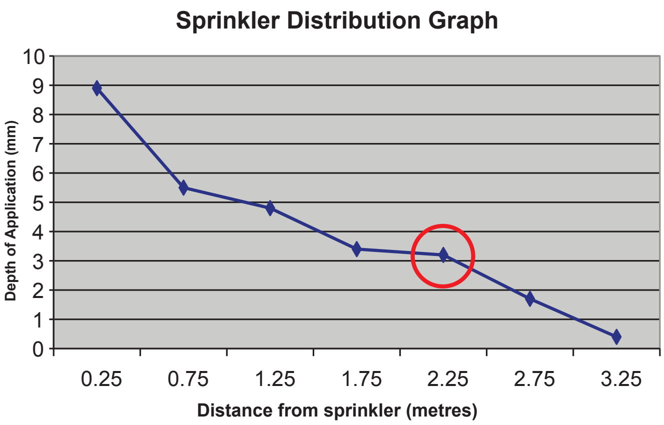
STEP 1: Place the catch cans (min of 2 radials) in a line from the sprinkler to the edge of the wetting pattern. Use 0.5m catch can spacing and 0.25m spacing for the can closest to the sprinkler. See image above.

STEP 2: Run the irrigation system, long enough to get a measurable amount. For this example, the system was run for 30 minutes.

STEP 3: Record collected amounts in milliliters for both radials **(B & C).**

STEP 4: Work out values for columns D, E, F, G, H and I. (See above Example Catch Can Record Sheet)

STEP 5: Use the figures from column A and G and graph the results. Your graph should resemble the one below.



STEP 6: Calculate your MAR

MAR = Total area adjusted depth (I) ÷ Actual sprinkler radius ÷ Actual sprinkler radius

= 31.5 ÷ 3.25m ÷ 3.25m

= 3 mm/hr

STEP 7: Calculate your DC%

DC% = MAR distance (metres) from sprinkler 2 ÷ Actual sprinkler radius 2 x 100

First, using your sprinkler distribution graph, find out the distance from the sprinkler where the MAR (3 mm/hr) occurs. In this case its 2.25m

Second, the actual sprinkler radius is 3.25m

DC% = (2.25 x 2.25) ÷ (3.25 x 3.25) x 100

= 5.0 ÷ 10.5 x 100

= 47.6%

A DC% value greater than 50% is the benchmark. If the DC% is below 50% there is room for improvement with the system. Failure to make improvements will mean that some areas will receive more water and some will not get enough.

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