



# The Nursery Papers

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## Sprinkler layout and selection for outdoor production areas

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A well-designed overhead sprinkler system will apply water evenly to all containers at an application rate that matches the absorption rate of your potting media. This paper provides some recommendations on sprinkler selection, based on sprinkler testing, for various layouts. You can improve the businesses "Bottom Line" by producing plants faster with more even growth while reducing dispatch costs and wastage percentages (throwaways).

The Australian Irrigation Technology Centre (AITC) and most sprinkler manufacturers now provide testing data that allows nursery operators and their irrigation designers to select the best sprinkler for their layout that also suits the operation of the nursery. However, you should always get a set of four sprinklers of the type you are considering and test them yourself at the desired spacing and correct pressure.

### You'll need information on:

- Mean Application Rate, the amount of water applied in mm/hour. To match the absorption rate of the potting media this may need to be less than 10mm - 12 mm/hour.
- Coefficiency of Uniformity measures how evenly water is applied to the area. It is measured as a percentage. Your selected sprinklers should have a number higher than 85%
- Scheduling Coefficient compares the dry section with the average and is used as a multiplier to determine how long to run the sprinkler system to apply enough water to the driest 2% of the area. Your selected sprinkler should have a value of 1.1 to 1.5.

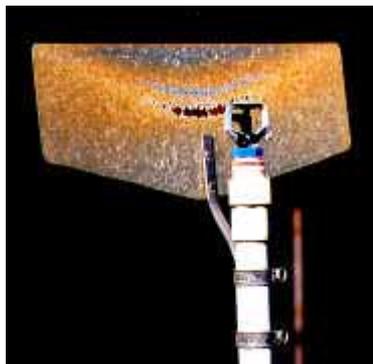
### Selecting a layout

The sprinkler spacing will be determined on:

- How many blocks you want to divide the area into.
- The capacity and pressure available from your pumping unit or water supply.
- The variety of plants and size range that will be irrigated.
- How many hours are available to irrigate the area.

Whichever spacing you select it is important that the sprinklers are arranged so all the containers receive water from four sprinklers. This is the only way you can achieve a low scheduling coefficient and reduce dry spots, over-watering and excessive leaching. This means that the first and last row of sprinklers will be located along the edges of the production area, and sprinkler rows must be run in a way that ensures overlap.

Install full circle sprinklers and don't worry about the water delivered outside the area. The improved scheduling coefficient achieved with this layout will reduce your irrigation time to more than compensate for this lost water. If this water will create a problem then set up some splash plates to restrict the spray.



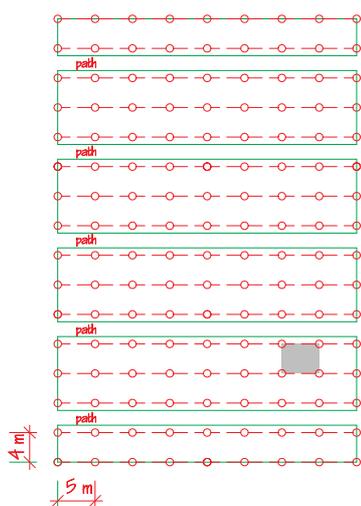
A splash plate deflects unwanted water

## Lets look at a typical outdoor area

The 60 metre x 40-metre area shown in each diagram is laid out with 5 metre wide and 10 metre wide beds and 2-metre pathways. This means that workers only have a maximum distance of 5 metres to walk from path to pot. No attempt has been made to keep water off the paths, because to do so would make the designs overly complicated for little gain.

This area can be irrigated using several sprinkler spacings. Here we have selected three to give you an indication of the flexibility that is available. The grey box in each of the diagrams shows an area watered by four sprinklers. More layout and sprinkler options are available and are detailed in the new edition of 'Managing Water in Plant Nurseries' available from NSW Agriculture.

The book has been completely revamped with over 250- pages of colour photographs, diagrams, research notes and calculations. There is a new set of layouts and sprinkler selection tables for a wide range of nursery structures. Order your copy by phone 1800 028 374 or E-mail [bookshop@agric.nsw.gov.au](mailto:bookshop@agric.nsw.gov.au)



Spacing 4x5 m

**Layout I** has the rows set 4 metres apart with the sprinklers spaced 5 metres apart down the rows. Each red circle is a sprinkler and the dotted lines are pipes. This will require 144 sprinklers and allow the area to be broken up into several blocks for flexible watering. Remember that only those plants within the overlap will be evenly watered. For instance to evenly water the top 5 metre wide bed you would have to run the first three rows of sprinklers.

For example select the Wingfield Challenger Mark II sprinkler from the AITC tested data at Table 1 with the following performance. Mean application rate: 7.1 mm/hour, Coefficient of Uniformity: 92%, Scheduling Coefficient: 1.2

To apply a minimum application of 5mm to the whole area will require an irrigation time of 50 minutes and a total volume of 16,490 litres delivered at 200 kPa.

Table I: Some recommended sprinkler options for 4m X 5m spacing

Sprinkler make and model	jet	Discharge lpm	Pressure kPa	MAR mm/hr	Cu (%)	Sc
Naan mini	Lt green	2.33	150	6.4	91	1.3
Wingfield Challenger II	1.6mm	2.29	200	7.1	92	1.2
Eindor 86I	yellow	2.33	200	7.3	93	1.2
Hardie Waterbird 5	1.65mm	2.56	200	7.7	93	1.2
Antelco Rotor Rain	1.9mm	2.97	200	8.3	91	1.3

Correct pressure is critical to meeting these performance targets. You must be able to measure and adjust sprinkler operating pressure or you'll be disappointed.

## Calculating run times from performance data

The calculation is as follows using Layout 1 as an example;  
 Amount to be applied (5mm) divided by MAR (7.1mm/hr) multiplied by Sc (1.2) multiplied by 60 equals Run time in minutes (50 minutes). Increasing the MAR will reduce run times until you exceed the potting mixes ability to absorb water. Few mixes absorb water any faster than 10-12mm/hr and many are below 10mm/hr. The Sc is also critical to run time and many systems in common use have an Sc of over 2.5.

**Layout 2** has the rows set 12 metres apart with the sprinklers spaced 10 metres apart down the rows. This will only require 30 sprinklers but reduces the flexibility of block watering. Remember that only those plants within the overlap will be evenly watered. For instance to evenly water the top two beds (one 5m and one 10m) you would have to run the first three rows of sprinklers. Running a single row of sprinklers will not apply water evenly to a bed.

For example select the Nelson R2000-K4 sprinkler from the AITC tested data at Table 2 with the following performance. Mean application rate: 5.2 mm/hour, Coefficient of Uniformity: 90%, Scheduling coefficient: 1.3

To apply a minimum application of 5 mm to the whole area will require an irrigation time of 75 minutes and a total volume of 20,520 litres delivered at 345 kPa.

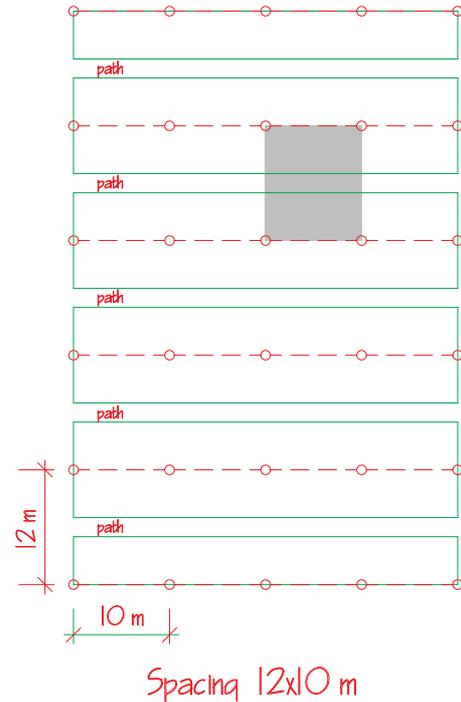
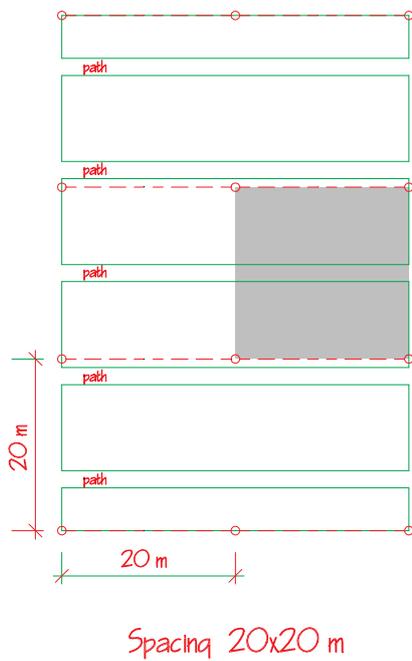


Table 2: Some recommended sprinkler options for 12m X 10m spacing

Sprinkler make and model	jet	Discharge lpm	Pressure kPa	MAR mm/hr	Cu (%)	Sc
Dan Super Mamcad	blue	5.7	250	2.8	87	1.3
Nelson R2000-K4	#14	9.12	345	5.2	90	1.3
Naan 5022	3.5mm	12.47	250	6.6	87	1.4
Martin AG15	4mm	20.45	400	10.1	88	1.3
Hardie Premier	10 x 6	22.3	300	12.2	92	1.3

*Correct pressure is critical to meeting these performance targets. You must be able to measure and adjust sprinkler operating pressure or you'll be disappointed.*



**Layout 3** has the rows set 20 metres apart with the sprinklers spaced at 20 metres apart down the rows. This will require 12 sprinklers and can only practically run as one block. Remember that only those plants within the overlap will be evenly watered.

For example select the Hardie Rainspray 15 sprinkler from the AITC tested data at Table 3 with the following performance. Mean application rate: 7 mm/hour, Coefficient of Uniformity: 94%, Scheduling coefficient: 1.1

To apply a minimum application of 5 mm to the whole area will require an irrigation time of 47 minutes and a total volume of 27,020 litres delivered at 400kPa.

Table 3: Some recommended sprinkler options for 20m X 20m spacing

Sprinkler make and model	jet	Discharge lpm	Pressure kPa	MAR mm/hr	Cu (%)	Sc
Naan 5033	4.9 x 2.5mm	31.6	300	4.6	88	1.4
Hunter I-41	#42	42.4	350	6.6	91	1.2
Hardie Rainspray 15	#14 x #8	47.9	400	7	94	1.1
Toro 640	5.6 mm	46.7	345	7.3	94	1.3
Hardie Monsoon	6.8 x 4.8 mm	65.7	300	10.7	92	1.2

*Correct pressure is critical to meeting these performance targets. You must be able to measure and adjust sprinkler operating pressure or you'll be disappointed.*

### The Bottom Line

The closer spacings in layout 1 will cost more to set up as there is more pipes and sprinklers to install but will use less water, cost less in running costs and provides flexibility in operation. Estimated sprinkler cost - \$235. The wide spacing of layout 3 will require less piping but will use more water and have a higher running cost with the higher pressure required. It only lends itself to a single-block operation giving no flexibility. Estimated sprinkler cost - \$740. The spacing at layout 2 falls between these other layouts in installation cost, water use and running costs. Estimated sprinkler cost - \$384.

### Acknowledgements

This paper is partly based on the results of HRDC project number NY97040 "Evaluation of irrigation sprinklers for the nursery industry." Performance calculations were done using the software package 'SPACEPro' produced by the Centre for Irrigation Technology (California) and available in Australia from AITC Ph 08 8303 8552.

