



Best Management Practice Sprinkler System Performance

The aim of Best Management Practice (BMP) sprinkler layouts is to ensure irrigation water is applied evenly, and at a rate that the growing media can absorb. The following presents two examples comparing non-BMP and BMP layouts, and the potential water savings that can be achieved by BMP layouts.

Comparison of the Water Use of Two Systems with Different Mean Application Rates		
	System 1	System 2
Sprinkler	Hardies Rotoframe	Hardies Water-bird V Red Jet
Spacing	6m x 6m	6m x 6m
Operating pressure	150 kPa	200 kPa
Mean Application Rate (MAR) mm/hr (BMP<15)	22.0	8.4
Coefficient of Uniformity (Cu) (BMP > 85%)	87.4	92
Scheduling Coefficient (Sc) (BMP <1.5)	1.4	1.2
Growing media absorption rate (mm/hr)	12	12
Water requirement (mm)	7.4	7.4
Irrigation time (minutes)*	52	63
Water applied L/1000m ² /irrigation event	19066	8820
Water retained in pots L/irrigation event	2450	2450
Runoff losses L/irrigation event	16616	6370
Total water applied ML/1000 m ² /annum (200 irrigation events/annum)	3.81	1.76
Water saved by System 2 ML/1000 m ² /annum		2.05
\$ saved by System 2 - \$/annum/1000 m ² with 200 irrigation days and water cost of \$2.41/kL**		\$4940
Water used by plants - ML/1000 m ² /annum	0.49	0.49
Annual runoff - ML/1000 m ² /annum	3.32	1.27

*Irrigation time is calculated using the time taken for the media to absorb 7.4mm of water in the driest container. If the MAR exceeds the absorption rate of the growing media, the irrigation time is calculated using the absorption rate of the growing media, i.e. Water requirement ÷ Absorption Rate x 60 x Sc. If the MAR is less than the absorption rate, the MAR is used to calculate the run time i.e. Water requirement ÷ MAR x 60 x SC.

Matching the Mean Application Rate (MAR) to the absorption rate of the growing media helps to decrease water use by minimising the water lost through leaching. If water is applied at a rate that exceeds the absorption rate of the growing media, the excess water isn't absorbed, and flows through the growing media and out of the container. The example shows annual savings both in water applied and wastewater of 62% or 2.95 ML/1000m²/annum

Small Investments Can Reap Great Rewards

Expenditure on larger capital projects are too often put in the future plan rather than a current projects file. However, some operators have found that spending a little can reap great rewards at very little cost.

One production nursery wanted to upgrade an ugly growing area with an unreliable irrigation system. This area was a home for the plants most likely to survive there no matter what. An evaluation of the irrigation proved how poor it was. The Coefficient of Uniformity (Cu) was 30%, meaning the water was applied across the area was incredibly inconsistent. The Scheduling Coefficient (Sc) was 18! This meant water was being applied at 18 times what would normally be required, in an attempt to water everything evenly.

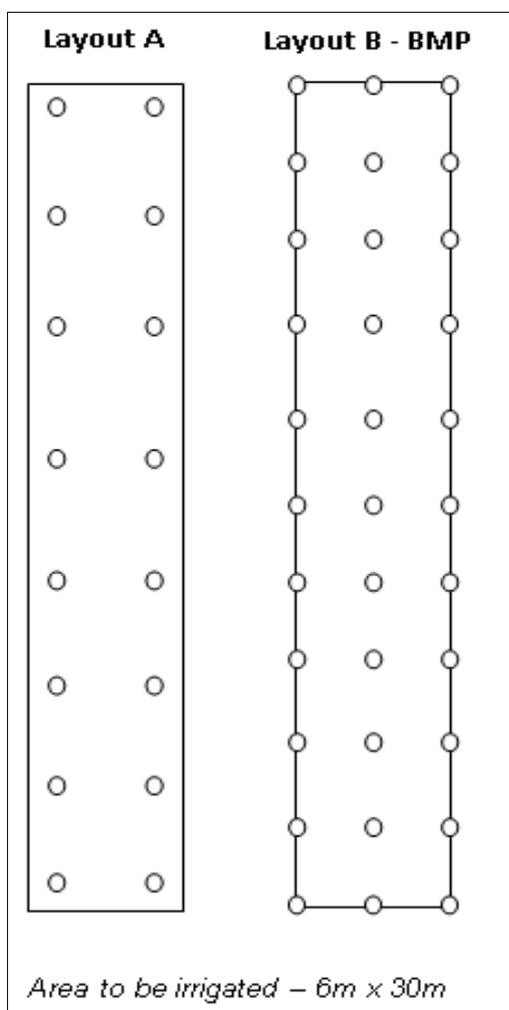
The irrigation system was upgraded to Nursery Industry Best Management Practice (BMP) standard, with sprinklers installed in a 3m x 3m grid pattern. The system was monitored to achieve the desired operating pressure given in the sprinkler data sheet. When the system was re-evaluated and achieved a Cu of 86% and a Sc of 1.4, both within the BMP performance guidelines.

The nursery took the opportunity to simultaneously upgrade the growing area. New drainage gravel and weed-mat were installed. The complete project cost \$1500. But the benefit was astounding. The growing area turnover while in poor condition was \$28 000. Now, with the new growing surface and an irrigation system that can be relied on, the projected return from the retrofitted growing area is a staggering \$92 000!

The area looks fantastic with healthy and uniform crops neatly set out. Importantly, everyone involved is so proud of what they achieved; they now are ready to start another project as they can see how a little investment can reap great rewards.

This shows the high MAR of System 1 leads to significant amounts of the applied water leaching through the growing media and being lost as runoff. While the irrigation time for System 2 is longer than System 1, the water use is significantly less due to the MAR matching the absorption rate of the growing media.

The second way BMP sprinklers layouts save water is through better application uniformity. This is achieved by setting the sprinklers out on a square grid, with the sprinklers located to the outside edge of the growing area. A common comment by nursery operators is that locating sprinklers around the outside of the growing area wastes water, as the water that falls outside the growing area is lost. In reality, less water is used, because the lower Scheduling Coefficient (SC) of the BMP design, i.e. better uniformity, reduces run times and reduces overall water use. The following example of a growing area 6m x 30m demonstrates this, and identifies the potential savings that can be achieved.



**Water charges in both examples vary between local government areas. Cost savings are based on water use charges from Allconnex Water in the Redlands area, based on a flat rate of \$2.41/kL.

Comparison of a BMP and Non-BMP layout		
	Layout A	Layout B
Spacing	4m between sprinklers located 1m in from edge of block	3m grid located to edge of growing bed.
Sprinkler number	16	33
Flow rate/sprinkler - L/hr	171	89
Scheduling Coefficient (Sc)	2.4	1.2
Mean Application Rate (MAR) mm/hr	9.7	9.7
Duration of irrigation (minutes) to apply 6mm to the driest container. Using the formula - mm to apply ÷ MAR x Sc x 60 (minutes)	89	45
Volume applied (L)/ irrigation event	4,058	2,203
Volume applied L/ annum – 300 irrigation events	1,217,400	660,900
Water saved by layout B		556,500
Per annum water savings @ \$2.41/kL (Allconnex Water - Redlands)**		\$1,341.17

This comparison shows considerable water and dollar savings when using a BMP irrigation design. The BMP sprinkler layout applies 46% less water when compared to layout A, despite the water from the BMP design falling outside the growing area.

For more information on BMP irrigation systems refer to 'Managing Water in Plant Nurseries'.

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