Selecting Nursery Sprinklers

Well designed and installed overhead irrigation systems can operate efficiently for many years. Selecting an irrigation system to operate to nursery industry best management practice (BMP), along with implementing a regular monitoring and maintenance program, is vitally important in ensuring many years of comparatively trouble free operation.

The process of selecting a sprinkler and establishing an irrigation system for a particular cropping situation requires a small amount of research and investigation, and can be broken into a number of simple steps.

***Step one: Sprinkler spacing**. Select a preferred sprinkler spacing to match cropping, production and infrastructure requirements. Always check for obstacles such as posts, ceiling height, and pathway locations that may interfere with supply pipes or riser/sprinkler locations at the intended sprinkler spacing.*

Individual sprinklers perform best within a range of spacings. Single stream sprinklers are generally better suited to wider spacings, as they produce larger droplets which are more effectively thrown over longer distances.

Close sprinkler spacing requires more risers, fittings and sprinklers, increasing system installation costs, and may present more obstacles to production, equipment movement and mechanisation. However, with closer spacing less water will be applied outside the growing area.

Sprinklers used for wider spacing have larger droplet sizes, which contact the growing media surface with considerable velocity, resulting in splash of water and growing media, and increasing growing media compaction. Wider spacing may also result in the droplets being more wind affected.

The actual spacing is determined by the dimensions of the area. For an existing area, the spacing should be made to ensure that sprinklers are positioned to the edge of the growing area. For example, if the area was 42 m long and 25 m wide the distance between sprinklers would be either 4.2 m x 4.12 m (closest to a 4 m grid), or 5.25 m x 5 m (closest to a 5 m grid).

***Step two: Test the available system pressure and flow capacity.** Test the operating pressure and determine the flow rates available at the proposed irrigation zone. Pressure and flow rates should be measured at a location as near as possible to the irrigation zone, not at the pumping station.*

The available operating pressure at the irrigation zone is a key factor in deciding which sprinkler is suited to a particular situation. If only very low pressures are available (150 kPa and lower), sprinkler options are limited.

The available flow rate may be a determining factor in what Mean Application Rate (MAR) can be achieved and the size of irrigation zones that can be installed.

The irrigation system, including main supply lines, pipes and fittings should be designed by an irrigation professional, to ensure the required *pressure and flow rates can be maintained throughout the system.*

Step three: Sprinkler orientation. *Sprinkler orientation refers to whether the sprinklers are to be used in an inverted or upright position. Some sprinklers can be used in both orientations by using different spinners.*

Upright sprinklers will usually be secured on a riser, and inverted sprinklers hang from a structure. The height and density of mature crops, and the ceiling height of any structure will influence the decision as to whether an upright or inverted sprinkler is selected.

Supporting sprinklers above the crop gives flexibility in the location of growing beds and may be desirable in situations with high plants in high structures. The cost of installation may also need to be considered, as additional support may be needed for inverted sprinklers. The sprinklers designed for inverted applications will usually have a flatter trajectory and, in some cases, the spinner is designed to prevent build-up in the spinner bearing. Non-drip valves may also be needed if the sprinklers are located above the crop.

When installing upright sprinklers in structures it is imperative that the height of the trajectory of the sprinkler is taken into consideration to ensure that the water stream does not strike the roof of the structure.

Step four: Select a droplet size and distribution pattern *to provide the required plant canopy penetration, minimise wind effects and minimise water application outside the irrigation zone.*

The ability to penetrate thick foliage and the effects of droplet size on small plants may need to be considered. This in turn is influenced by the jet size and operating pressure and their effect on droplet size.

Sprinklers producing large droplets provide improved canopy penetration. Stream rotator sprinklers are generally selected for extremely dense canopy situations, larger plants and wider sprinkler spacing, due to their superior canopy penetrating qualities. However, large droplets can cause excessive growing media splash and plant damage on sensitive crops. Lower mean application rates (MAR) and small droplet sizes may be necessary for small container sizes.

Wind affects all sprinklers to some degree, and sprinklers with small droplet sizes will be more affected. The amount of wind, and the degree to which sprinklers are affected, may also determine the time of day that plants can be irrigated effectively.

If the amount of wind is a consideration, a single stream rotator sprinkler is the preferred choice. Wind effects will be greater if pressures are at the higher end of the range for a particular sprinkler due to the reduced droplet size, and closer spacings (4 m to 5 m grid) are recommended in areas affected by high or constant wind.

Select a full or part circle sprinkler pattern and determine if there is a requirement for road guards. Road guards may be required to redirect irrigation water from roadways and sensitive areas. Close spacings will reduce the amount of water applied outside the irrigation zone if road guards are not used.

Step five: Make a short list of suitable sprinklers*. Once the basic system data has been collected a short list of suitable sprinklers can be developed using the manufacturers specification sheets as a guide. These sprinkler specification sheets provide information on:*

- *the height used in sprinkler testing*
- *available plates or deflectors*
- *pressure, flow, wetted diameters, nozzle codes and sizes*
- *sprinkler trajectories, e.g. flat, low, high, convex.*
- *filtration requirements*
- *droplet formation*
- *assembly and connection requirements.*

Step six: Determine the water quality and level of filtration required*. Sprinklers with complicated mechanisms may not operate reliably if there is a build-up of deposits from salts in the water. If the water is not filtered, sprinklers with small jet sizes or integrated filters may block quickly. Sprinklers with small jet sizes, or internal gears and filters, may not be suitable where there is little or no filtration of the water.*

The presence of abrasive substances in the water may limit the sprinkler options to ones with few moving parts, and construction using materials that are wear resistant.

The filtration requirements for each sprinkler and nozzle combination selected can be obtained from the manufacturer's specification sheet or irrigation equipment suppliers.

Step seven: Select a sprinkler height above the crop/growing surface. *When selecting an appropriate height for a sprinkler the first consideration is to ensure the sprinkler is high enough above the crop canopy to achieve the maximum radius of throw. Sprinkler tests are conducted at specified heights, so it is important when considering modelled data that the height the test was conducted at is noted, and this should then be the minimum height of the sprinkler above the crop.*

The sprinkler stream should not be intercepted by the crop, or be affected by obstacles such as shade house roofs. The selection of an appropriate

sprinkler height needs to consider sprinkler stream trajectory, crop and roof height.

Sprinklers that have very high or very low trajectories are more likely to be affected by the wind, but the degree of effect also depends on the height of the sprinkler itself.

Sprinkler height should be adjustable if changes in cropping type are planned.

Step eight: Ensure selected the sprinkler and irrigation layout meets industry BMP parameters.

Mean Application Rate (MAR) *10 – 25 mm/hr. The application rate of the irrigation system needs to be matched to the absorption rate of the growing media. This in turn is determined by the jet size and spacing of the selected sprinkler. For bark growing media, the MAR should be between 10-15 mm/hr, but for growing media containing coir the MAR can be as high as 25 mm/hr.*

Uniformity measures of the irrigation layout need to meet BMP efficiency benchmarks of:
Co-Efficient of Uniformity *(CU) >85% and*
Scheduling co-efficient *(SC) <1.5.*

The industry BMP parameters can be supplied to irrigation designers and installers as a reference standard. These performance parameters can be included in payment contracts for new installations.

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Parameter	Rivulis Rondo – Yellow jet	Philmac Challenger - Olive jet	Philmac StreaMaster – Olive jet	Nelson R10T 9 P6 – Grey jet	Nelson R10 Turbo - Grey jet	Antelco Rotor Rain – Blue jet	Netafim Powernet - 15 deg	Naan Dan Mamkad 16 - Yellow jet	Rainbird LF 800 - Blue nozzle
Spacing - 4m square	√	√	√	√	√	√	√	√	√
Orientation - upright	√	√	√	√	√	√	√	√	√
Mean application rate - 10mm/hr	√	√	√	√	√	√	√	√	√
Pressure - 230 kPa maximum available	√	√	√	√	√	√	√	√	√
Wind effects – single stream sprinkler					√		√	√	√
Trajectory - medium					√		√	√	√
Droplet size - medium					√		√	√	√
Filtration – good - fast sand filter					√		√	√	√
Availability					√			√	√
Test Results SC <1.3					√			√	√
Test results – CU > 90%					√			√	

Example of a sprinkler selection checklist

Step nine: Choose a sprinkler *that meets all the parameters in the selection steps, is readily available, fits within budget, and has acceptable maintenance requirements. The availability of a particular sprinkler for trialling purposes may also be a consideration .*

When the above decisions have been made, the final choice of sprinklers comes down to the efficiency of each sprinkler and layout. This can be determined by setting up a trial area and running a catch can test to determine which sprinkler has the best uniformity, and whether they meet minimum BMP guidelines.

The nursery industry has researched the performance of a variety of sprinklers. This research used the Sprinkler Profile and Coverage Evaluation program, SPACE, and was conducted at the Australian Irrigation Technology Centre (AITC) in South Australia. The research considered sprinklers in upright and inverted positions and at a range of different spacing configurations. From this information NGIQ has developed a sprinkler selection tool to assist growers with sprinkler selections, and this can be downloaded from the NGIQ website.

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