

Sprinkler Uniformity in Greenhouses and Nurseries©

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INTRODUCTION

Greenhouses and nurseries aim to achieve crops that are of a consistent grade and that can be marketed evenly as one line, all at the same time. To achieve this, every plant should receive the same amount of water and at the same application rates. Many growers have long overlooked uniformity of watering systems in the greenhouse and nursery industries and many systems have grown haphazardly as properties have expanded. There are now readily available the sprinklers and the tools to easily design and supply a sprinkler irrigation system that will give the grower uniform watering from sprinkler irrigation systems.

UNIFORMITY OF DATA

All leading sprinkler manufacturers test their sprinklers in laboratories to gather the data on where the water falls across the sprinkler coverage. Generally most sprinklers have a higher application rate close to the sprinkler and then lesser amounts further out. This data is then used in simple computer programmes such as WinSpace [SPACE (Sprinkler Profile and Coverage Evaluation) for Windows, Centre for Irrigation Technology California State University, Fresno, California, U.S.A.] to see how even the water is applied at various spacings. Most irrigation designers in New Zealand have this programme available to them. From the WinSpace programme the evenness of the watering pattern is measured by three different formulas. These are:

- Christiansen's Coefficient of Uniformity (CU%)
- Distribution Uniformity (DU%)
- Scheduling Coefficient (SC) (5%)

These are all measures of how even the water is applied to the area and all should be considered when looking at the results. Both CU and DU should be given when considering the results as each formula has its strengths and weaknesses. Christiansen's Coefficient of Uniformity does not always account for the severity of over or under watered areas while Distribution Uniformity may be misleading if individual amounts of the lowest application rates are widely spread over the total area. Scheduling Coefficient gives a measure of the additional time required at the area of lowest application (usually measured over 5% of the area) to achieve the average application rate.

Table 1. Desired results for different situations.

Measure of uniformity	Greenhouse	Nursery
CU%	>90%	>85%
DU%	>85%	>75%
SC	1.1	<1.3

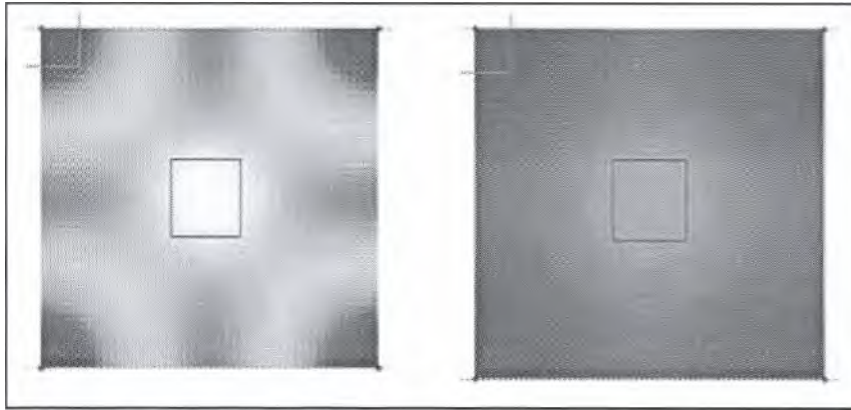


Figure 1. Densogram examples.

DESIGN OF THE SYSTEMS

Using the WinSpace programme the designer is able to enter the following data:

- Height of sprinkler above the crop.
- Spacing between sprinklers and between laterals.
- Sprinkler operating pressure.
- Sprinkler pattern (e.g., strip watering for tunnels, rectangular, triangular, etc).
- Sprinkler model (nozzle, swivel, and flow).

The result is a uniformity evaluation shown by a densogram.

The densogram examples shown (Fig.1) indicate:

- Sprinklers mounted in each corner.
- Darker area is higher application and lighter area is lesser application rates.
- Areas of most water and least water.

The other data provided is:

- Application rate (mm/h).
- Measures of uniformity CU%, DU%, SC.

RESULTS

By varying the spacing, model, and pressure it is very easy to find the best sprinkler combination for any given situation. Often by changing the spacings by even the smallest of amounts (<0.5 in) or a change from rectangular to triangular spacings can have a drastic effect on the uniformity.