

Designing for even water distribution

Uniform distribution of irrigation water will maximise the yield response to the applied water and make the irrigation job both water and energy efficient.

Uneven irrigation application often produces large variations in crop yield and can also result in excessive run-off and leaching of nutrients and fertiliser out of the root zone. Improving distribution uniformity can lead to better overall crop performance, irrigation efficiency and economic returns.

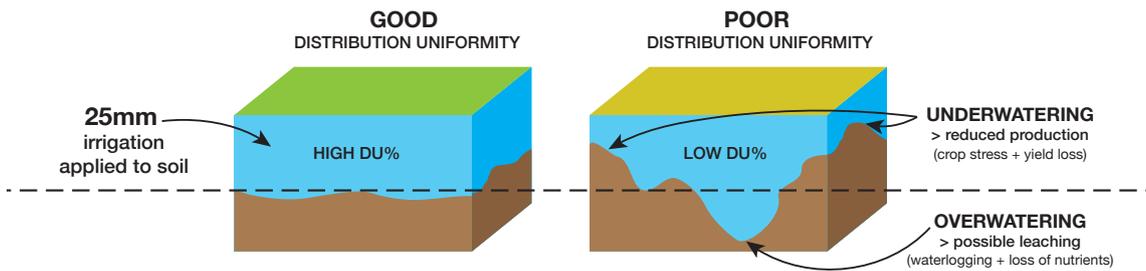


Figure 2 Distribution Uniformity

Under-watering areas within the paddock can lead to:	<ul style="list-style-type: none"> • Slower crop growth and reduced yield • Reduced root growth, limiting access to soil water and nutrients 	<ul style="list-style-type: none"> • Plant stress and reduced response to applied water • Surface sealing of the soil
Over-watering areas within the paddock can lead to:	<ul style="list-style-type: none"> • Reduced yield due to leaching of nutrients • Increased disease incidence 	<ul style="list-style-type: none"> • Reduced yield response to applied water • Bogging machinery and associated soil compaction and damage to the root system

Uneven distribution of irrigation water results in several associated resource and economic losses, such as:

- **inefficient energy use** for pumping
- **water loss** due to poor infiltration, ponding or deep drainage below the root zone
- **nutrient loss** due to leaching and or run-off
- **chemical loss** due to leaching and or run-off
- **lower return on investment** due to poor system design resulting in yield losses.

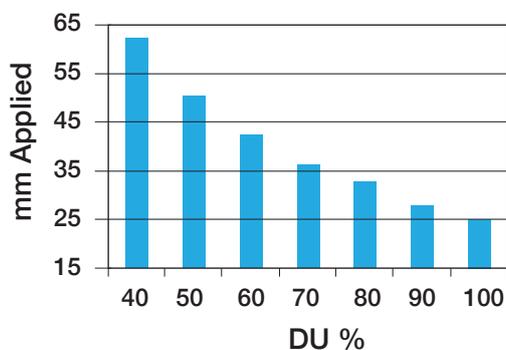


Figure 3 How DU % affects irrigation quantities when 25mm is required¹

To compensate for uneven distribution, it might be necessary to apply more water to ensure the drier areas of the paddock receive sufficient water for crop growth. This may result in exacerbating the problem in low-lying areas of the paddock.

For example, this graph (Figure 3) represents the quantity of water required to apply 25 mm as distribution uniformity increases. Using this graph, you can see that 38 mm of irrigation water would need to be applied to deliver 25 mm to the driest area on the paddock at 70% distribution uniformity.

¹ Source: Irrigation for profit – Three years from March 2000 – June 2003, Department of Primary Industries & Fisheries

Improving distribution uniformity will result in the application of less water and a reduction in pumping time, while achieving the crop's yield potential.

Distribution uniformity measures how evenly an irrigation system applies water to the crop.

It is calculated as the ratio of the average irrigation volume applied to the quarter of the field (or grid) that receives the least irrigation water and the average volume applied across the whole field (or grid).

Field trials have shown that distribution uniformity can be improved through:

- **Properly designed irrigation systems.**
- **Insisting on a system check** by the supplier to include distribution uniformity as part of the purchasing contract.
- **Understanding the system** that you are using (e.g. pressure tolerances of sprinklers, application limitations, etc).
- **Maintaining the system for peak performance** (e.g. monitoring sprinkler and nozzle wear, drive mechanisms, pump delivery, etc).
- **Monitoring system performance** (e.g. checking equipment to monitor application rates and pumping costs, etc)

The target distribution uniformity levels for common irrigation application systems in sugarcane are:

- **85 per cent** for fixed sprinkler and travelling gun systems,
- **90 per cent** for centre pivots, lateral moves and booms, and
- **95 per cent** for above-ground drip systems.



Next Steps

Achieving even distribution needs to be one of the highest priority outcomes when designing or re-configuring an irrigation system. Professional irrigation designers will take into account many factors, including the soil type and topography and features of the chosen irrigation equipment.

Conduct field tests to determine the application pattern of the irrigation system. A 'catch can' trial can be conducted on any type of overhead irrigation system and the data used to calculate the distribution uniformity of the system. Use the method outlined in the 'Checking water distribution in pressurised irrigation systems' information sheet to set up a catch can trial.

Resources:

Fact Sheet - 'Checking water distribution in pressurised irrigation systems'

Fact Sheet - 'Adjusting travelling guns for even distribution'