CIT*-Tested

Notes on distribution accuracy from sprinkler spacing

Water distribution measurements

To measure water distribution in sprinkler patterns, containers are arranged within the sprinkler spacing in an even pattern close to the ground. In order to get meaningful results, the sprinkler system should be run for a fairly long period. Measurements must naturally be taken when there is no wind.The measurements can be analysed in a number of different ways.
The most widely used measures are
- **Christiansen Uniformity Value (CU)**
- **Distribution Uniformity Value (DU)**

Christiansen Uniformity Coefficient (CU)

One very widespread method of measuring distribution uniformity is one named after its inventor, the
Christiansen Method.
The formula for working out the coefficient is:

CU = 100% [1- (average deviation from the mean /mean]

The following example illustrates the method of calculation:
Average precipitation of 15mm is calculated the measurement of a sprinkler system using 50 measuring points. The sum of all deviations among the 50 measuring points totals 115mm. This produces an average deviation of:
115/50 = 2.3mm
which gives the following CU coefficient:

CU = 100% [1- (2,3 / 15)] = 84,6%

Distribution Uniformity Coefficient (DU)

The DU value differs from the CU coefficient in that it puts greater emphasis on the area with too little precipitation.
To work out the DU value, the average of ¼ of the measurements with the lowest precipitation is divided by the full average.

DU = (average of ¼ of the measurements with the lowest precipitation / average of all measurements

Using the same example as before, this produces the following calculation:
With the same 50 measuring points as before the average amount of precipitation remains the same at 15mm. However, the average among the 12 measuring points (¼ of 50) with the lowest levels of precipitation is 11.5mm. This produces the following DU value:

DU = 11,5 / 15 = 76,6%

Evaluating the measurements:

When distribution precision is very good both methods (CU and DU) deliver approximately equal values. If distribution accuracy is less good, the DU values are lower than the CU figures, i.e. the DU figures are more demanding in terms of accurate distribution.
Users' demands in terms of distribution accuracy depend on the crop concerned.
The following examples provide some pointers:

Crops with shallow roots	CU > 85 %	DU > 78%
Vegetables	CU > 80 %	DU > 70%
Crops with deep roots	CU > 72 %	DU > 60%
Feeding in fertiliser using irrigation	CU > 87 %	DU > 80%

Christiansen Uniformity Value (CU)	Distribution Uniformity Value (DU)
> 87% = excellent	**> 85% = excellent**
> 83% = very good	**> 80% = very good**
> 79% = good	**> 75% = good**
> 75% = satisfactory	**> 70% = satisfactory**
> 70% = poor	**> 65% = poor**

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