UNIVERSITY OF FLORIDA
EXTENSION
Institute of Food and Agricultural Sciences

FS98-1

Field Evaluation of Container Nursery Irrigation Systems: Measuring Uniformity of Water Application of Microirrigation Systems[1]

Dorota Z. Haman and Thomas H. Yeager[2]

Performance of microirrigation systems can be evaluated by measuring operating pressures, application rates, and uniformity of water application under nursery conditions. In this article, we will present a simple test to determine the uniformity of water application.

In general, high uniformity means that all plants in the irrigated zone will receive almost the same amount of water in a given time. For microirrigation, it means that each microsprinkler or emitter will deliver a specified amount of water to each container.

There is an easy test to evaluate water application uniformity. Measurements of the time required to fill the same container must be performed at a minimum of 18 locations throughout the irrigation zone. The statistical uniformity nomograph (Bralts and Kesner, 1983) is based on statistical coefficient of variation and can be used to determine the overall application uniformity (Figure 1). If the uniformity is low, more than 18 measurements of time (seconds) may be necessary to increase the confidence level of the uniformity measurement. The uniformity test should be performed every six months.

To perform the test you need a small container, such as empty bottle and a watch with a second hand so you can record the time to fill bottle at each location. The following steps are required.

Determine how many measurements represent one-sixth of the total locations in the zone. For example, if a total of 18 measurements are performed, this number is 3.

1. Add the lowest three measurements of time (seconds) and mark the sum on the x-axis of the nomograph.
2. Add the highest three measurements of time (seconds) and mark the sum on the y-axis of the nomograph.
3. If the sums do not fit on the scale or if the value is very small so that it is difficult to read, the sums can be multiplied or divided by a common factor.

1. This document is FS98-1, one of a series of the Agricultural And Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Date first printed: January 1998. Revised: June 2001. Please visit the EDIS website at http://edis.ifas.ufl.edu.

2. Dorota Z. Haman, Professor, Agricultural and Biological Engineering Department, and Thomas H. Yeager, professor, Environmental Horticulture Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611.

4. Read the water application uniformity at the intersection of the two lines passing through these points.

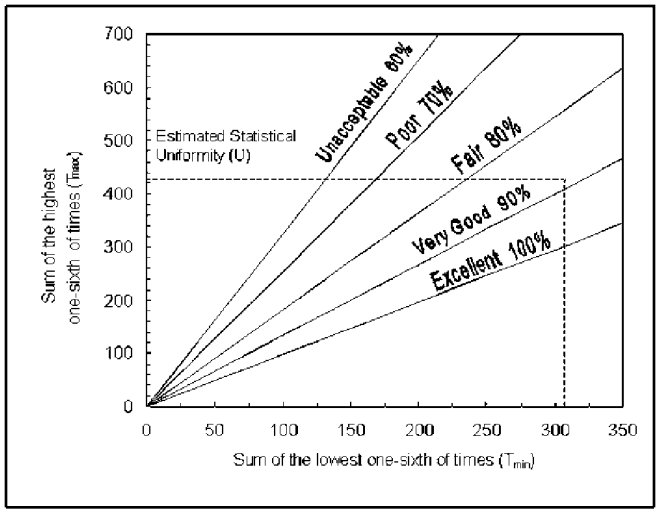

Figure 1. Microirrigation Uniformity Nomograph

Example

Assume that water was collected randomly from 18 emitters throughout an irrigation zone. The time to fill the same bottle was recorded in Table 1.

1. one-sixth of 18 data points = 3

2. +105+110 = 317 seconds (lowest 3 values). Mark this value on horizontal (x) axis of the nomograph and draw a vertical line through this point.

3. +145+150 = 425 seconds (highest 3 values). Mark this value on the vertical (y) axis of the nomograph and draw a horizontal line through this point.

4. Read the uniformity of application. The point of intersection of these lines falls in the section of 80% to 90% that indicates “very good” uniformity of the system. The uniformity of water application by microirrigation emitters should be at least in the category “very good” (see Figure 1), especially if fertilizers are injected into the system.

Low uniformities in microirrigation systems can be due to factors, such as:

- Improper pipe diameters (submains, manifolds, and laterals)
- Too high or too low operation pressure
- Emitters not appropriate for system design
- Clogged emitters
- Changes or wear on system components
  - Changes in pump output and pressure

Table 1. Data set for Example.

Location	Measured time (seconds) to fill bottle
1	110 (low #3)
2	125
3	130 (high #1)
4	105 (low #2)
5	115
6	145 (high #2)
7	102 (low #1)
8	118
9	150 (high #3)
10	120
11	128
12	125
13	114
14	119
15	112
16	110
17	120
18	111

Literature Cited

Bralts, V. F. and C. D. Kesner. 1983. Drip Irrigation Field Uniformity Estimation. Transactions of the Amer. Soc. Ag. Eng. 26(5):1369-1374.

Additional Reference

Haman, D. Z., A. G. Smajstrla and D. J. Pitts. 1997. Uniformity of Sprinkler and Microirrigation Systems for Nurseries. Bulletin 96-10:1-7, Fla. Coop. Ext. Ser. Univ. of Fla., Gainesville, Florida.