$$UC = (1 - (0.029 / 0.31)) * 100\% = 92.7\%$$

Normally, DU values are lower than the UC values for the same set of data. For high value crop and any system where chemicals are applied with irrigation water, the uniformities should be high (DU greater than 80%, or UC greater than 87%). When coefficients fall below the acceptable values for a given system the repairs and adjustments should be performed as soon as possible.

Field Evaluation of Uniformity of Nursery Microirrigation System

Standards for the uniformity of water application for microirrigation systems have been developed by the American Society of Agricultural Engineers (ASAE). Acceptable uniformity ranges for various microirrigation systems are presented in Table 1. These ranges represent the economically efficient range of uniformities. Design for higher uniformities than those shown will increase the initial system cost without sufficient justification in plant performance due to improved uniformity. However, designs for lower uniformities will result in reduced production and/or wasted water and fertilizes.

Table 1. Acceptable uniformities for microirrigation systems designed to provide all plant's water requirements in times of drought (ASAE).

Emitter Type	Soil Slopes	Uniformity Range (%)
Point source on widely spaced (greater than 13 ft) plants	flat steep	90 - 95 85 - 90
Point source on closely spaced (less than 13 ft) plants	flat steep	85 - 90 80 - 90
Line source on row production	flat steep	80 - 90 75 - 85

The uniformity must be higher for widely spaced plants, where each individual emitter serves one plant only. In production systems where each plant has access to two or more emitters, the variation among emitter discharges is less critical. Also, because steeper slopes result in more costly designs, lower uniformities are permitted to balance system initial costs. The uniformity of water application can also be improved by the use of more expensive, pressure compensating emitters which are characterized by the same flow rate under significant pressure variation. Pressure compensating emitters are frequently used where there is significant variation in topography of the nursery or other conditions which make it difficult to design the lateral lines within permissible flow variation.

The method of uniformity evaluation for microirrigation systems presented below provides a quick nursery test which does not require any specialized equipment. This test can be used by irrigation system designers, installers, purchasers, or managers. The method is based on statistical evaluation. Uniformity of the irrigation system (U) is defined in statistical terms (Equation 4).

$$U = 100\% \, (1.0 - V) \tag{4}$$

In this equation, V is the statistical coefficient of variation which is a measure of the variability of the individual emitter flow rates from the average emitter flow rate. It is the standard deviation of the individual flow rates divided by the average flow rate. Since this equation expresses uniformity in relative terms the method can be used regardless of the magnitude of emitter flow rates.

The procedure requires a minimum of 18 measurements to evaluate an irrigation system or a zone of an irrigation system. These 18 measurements should include the extreme conditions encountered in the system such as entrances to the laterals, distant end, midpoints, etc. It is not necessary to measure flow rates from the emitters tested. Rather, the time to fill a specific container (a constant volume), such as soft drink bottle, can be used. The time required to fill the container can be accurately measured using a watch with a second hand. Therefore, no special equipment is necessary to perform this test of uniformity at the nursery.

All 18 times required to fill the container should be recorded. First, the largest 1/6 of the measurements, T_{max} (in this case 3) should be added together. Then, the smallest 1/6 of measurements, T_{min} should be added. These two numbers (T_{max} and T_{min}) are used in Figure 4 to determine the uniformity of water application.

Example 5.

For the data listed in Table 2, we have 18 measurements of time. The three greatest times (1/6 of all measurements) recorded are 107 sec, 110 sec, and 108 sec. The sum of these three times, T_{max}, is