Checking Irrigation Uniformity in Lawn and Other Overhead Irrigated Areas

Overhead irrigation of lawns and other large distributed landscaped areas is convenient, and relatively inexpensive for us, as homeowners, to install and maintain. However, most overhead irrigation systems are very inefficient in terms of water use - suffering both from a 30% to 40% water loss due to evaporation and wind as well as from poor distribution uniformity of the water that does actually reach the landscaped area.

Why is Uniform Distribution Important?

The general practice in establishing an overhead irrigation system has been to layout and install spray heads in general accordance to a manufacturers recommendation regarding head to head spacing. The system is then adjusted to irrigate for a time duration that insures that all parts of the irrigated area remain green during the hottest part of the irrigation season. However, these older products, even when installed to the recommended spacing, often deliver as much as 2 or more times as much water to some parts of the irrigated areas as they do to other parts of the irrigated area. The net effect is that when the irrigation time is set to insure that the areas receiving the least water remain green and healthy, other areas are receiving way too much water. This problem not only wastes substantial quantities of water, it also creates an unhealthy environment for the grass or plantings that are too wet. Through the use of spray nozzles that lose less water to wind and evaporation, have better uniformity, and are properly installed to take advantage of the improve uniformity, water use in overhead irrigated landscapes can by reduced by as much as 50%.

Measuring Distribution Uniformity of overhead irrigation systems

With a little bit of effort, the use of the latest in spray nozzle products, and attention to detail, the distribution uniformity in overhead irrigated landscapes can approach 80%. This means that the areas receiving the least water during an irrigation cycle receive only 20% less than the areas receiving the most water. It also means that since you can shorten your irrigation times , thereby saving water. The first step is to measure the distribution uniformity of the system as it currently exists. This can be done using a collection of short, straight sided cans (such as tuna or shallow cans often used for cat food) or calibrated cups specifically designed for the task of measuring irrigation uniformity. Figure 1 is a picture of a calibrated plastic cup designed specifically for the task of measuring irrigation uniformity. Figure 2 shows these cups distributed across a lawn in preparation for measuring uniformity.

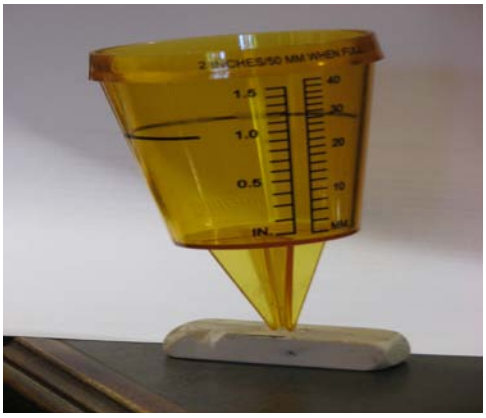

Figure 1 Irrigation measuring cup

Figure 2 Measuring cups on a lawn

The first step in running a uniformity test is to check to see if your irrigation system is operating in the manner in which it designed to run. Turn on the system and look at each of the spray heads.

- Are there any heads that are not functioning?
- Are pop-up heads all popping up all the way without obvious leaks around the pop-up tube?
- Are there any obvious leaks?
- Are all of the heads vertical or at any angle that was intended by the design?
- Are any of the heads partially plugged by dirt or debris
- Are any of the heads obstructed by tall grass, shrubbery, or tree branches?

Don't waster your time running a test until the obvious problems have been corrected. You'll just end up wondering if one of those defects was or was not the cause of measured uniformity issues.

To run the actual uniformity test, simply stick the spike of the cup firmly into the lawn with the cup as vertical as possible. Try to achieve a reasonably uniform distribution of the cups throughout the area to be checked but don't be concerned about absolute precision. Just an eyeball check to see if the distribution of cups seems to adequately cover the test area is fine. Try to stay about 6 - 12 inches in from the perimeter of the test area and also stay 2 - 3 feet away from any spray nozzle of other spray device (some spray nozzles have low angle streams that can be selectively intercepted by the cups producing erroneous readings.) Run a standard cycle of your irrigation system for the test area. If more than one station of the irrigation system runs to irrigate parts of the area, be sure to run the cycle for both stations.

After the irrigation cycle(s) have been run, create a rough diagram of the location of each cup and record the depth of water in each of the cups. To analyze your data, you need to be a little pragmatic. It is best to pick 4 or 5 of the higher readings (but not necessarily single point high readings) and set those as the high reference value. Then go through and calculate the percent that lower (or higher) readings are compared to the reference. For example if the reference is 0.5" and at another point the reading is 0.4" then the second point is at the desired target of 80%. More than likely, you will find areas or zones where the readings are consistently at say 80 % or 40% or 50% of the reference area. Try to circle the areas that have similar levels of deviation from the reference to see if you can establish a set of contours that define the wettest and the driest areas of your current irrigation system. Figure 3 shows and example of a set of readings with contours drawn.

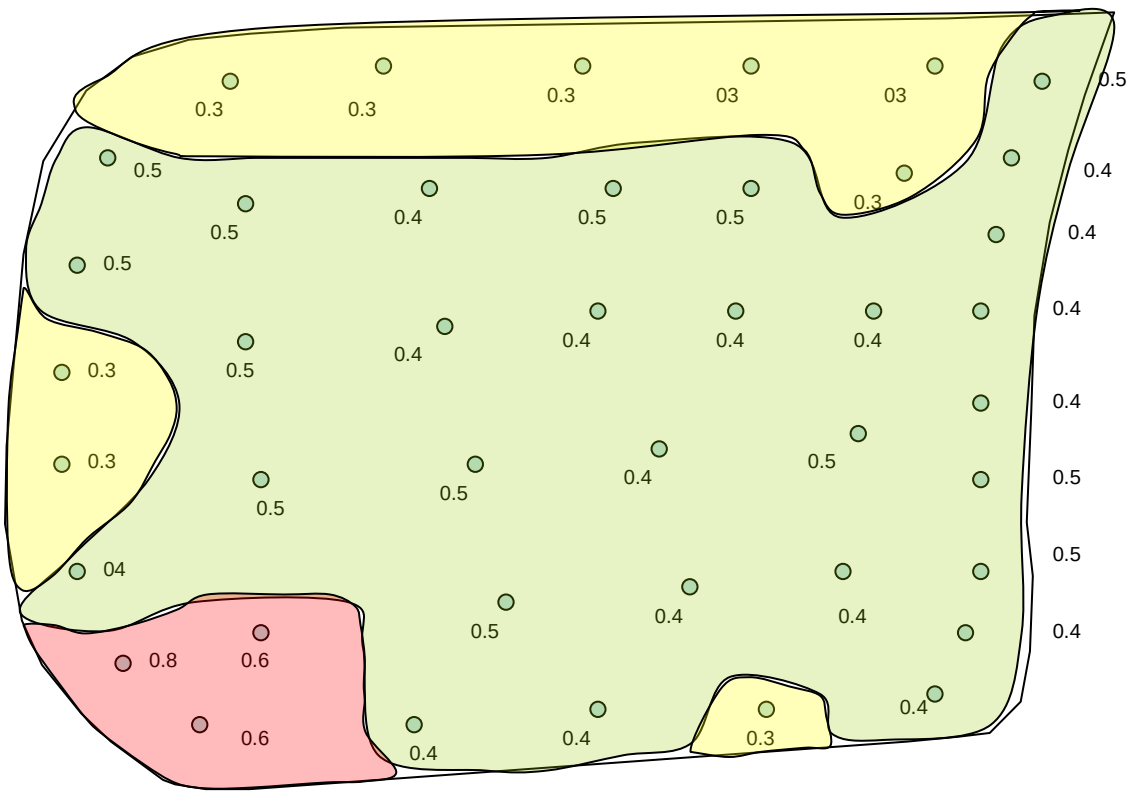

Figure 3 Plot of irrigation data showing uniformity contours

Fixing problem areas

If your test shows that 85% to 90% of your reading are within 70% to 80% of your reference (with maybe one or 2 at 120% or so) then pat yourself on the back and go relax. In the more likely case, if your test shows that you have significant areas that are getting much less (or much more) water than your reference then you have an opportunity to save water and improve the health of your landscape.

There is no straight forward one size fits all solution for correcting irrigation distribution uniformity issues. The following are some steps to consider:

1. First off, if you are not using MP Rotators or the Rainbird Rotary nozzles, these products do work well and can save substantial amounts of water as well as improve distribution uniformity. The conversion of an existing system to these products need not involve digging up your landscape and starting anew. That said, it does take some planning based on the manufacturers performance charts and some DIY time. These products must be installed on pop-up raisers in order to work properly. Most of your direct costs for materials can be covered by rebates from the LTCWD. It is not the intent of this article to provide a step by step on how to undertake such a conversion.
2. Recheck for the obvious problems as listed above. Look particularly for tree branches or shrubs that may be intercepting a part of the stream from one of the existing distribution nozzles. If you discover more than a couple problems, correct them and re-run the test. Even seemingly minor issues can have surprisingly significant impacts on the distribution uniformity.
3. After the obvious issues have been eliminated, look at your diagram of uniformity. Are there just 1 or 2 areas that are receiving too much or too little water. Maybe just one head was causing your reference to be too high and everything else is relatively uniform. On most heads the flow volume can by adjusted. If just 1 or 2 limited areas are getting too much water, try adjusting the flow

volume downward for those areas. Or maybe 1 or 2 areas are receiving too little water and can be augmented by installing an additional distribution head or one that distributes more water to just the dry area(s). These adjustments require some judgment and experimentation and then retesting. Your goal is to try to move toward the 70% to 80% distribution uniformity goal.

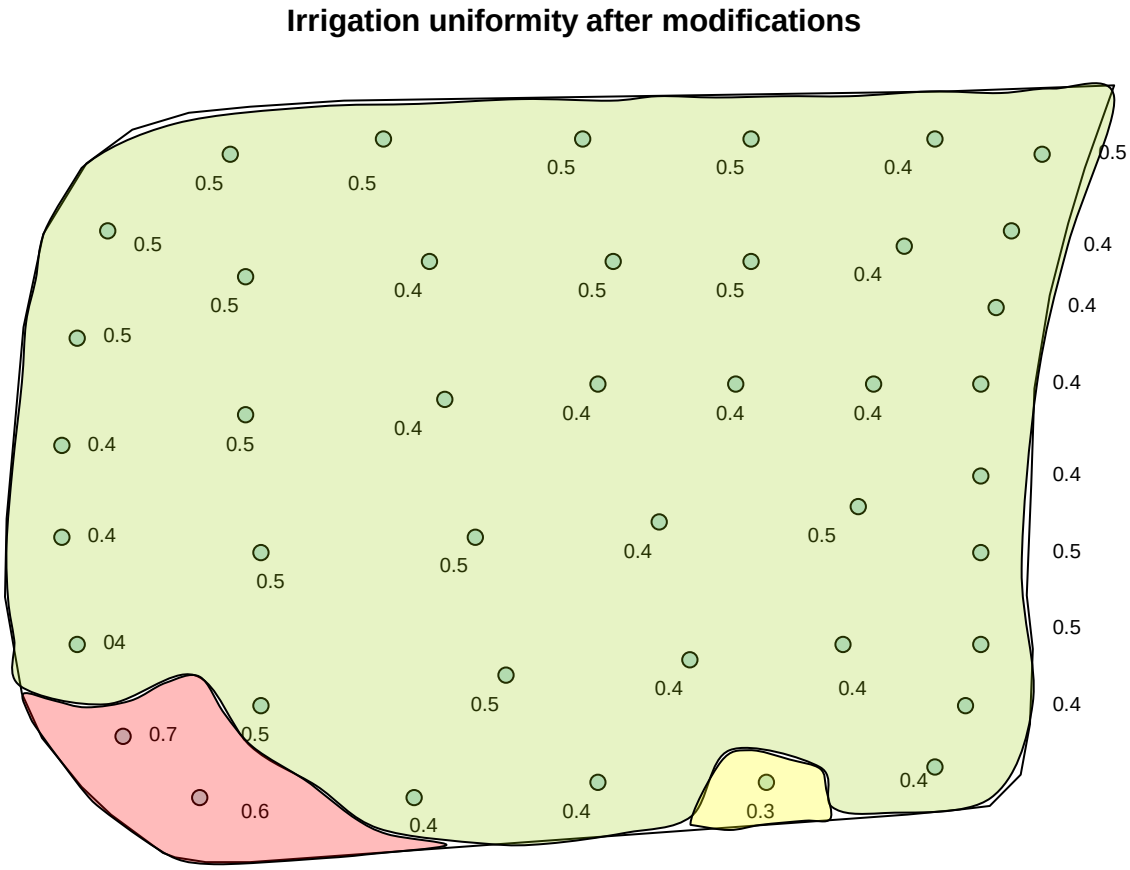

Figure 4 Plot of irrigation data after making distribution corrections

Figure 4 shows a post correction test of distribution uniformity. In this case, the uniformity was improved by removing some previously unobserved ends of tree branches that sagged downward after the irrigation cycle started and installing one new strip head to augment a small area that was too dry. This particular installation was converted to MP rotators from impact sprinklers about 1 year ago and was relatively uniform to begin with. The area is irregular in shape and elevation. The conversion from impact sprinklers to MP Rotators did not require any new piping or relocation of any heads. Overall irrigation time was reduced by about 12% after making the tweaks in uniformity as described. This should result in a water saving of about 10% after allocating for the water use of the new head. The savings in water use compared to the prior impact sprinkler system is approximately 40%.

The last step, after achieving relatively good uniformity of water distribution is to look at the overall amount of water you are applying to your lawn. You have made measurements that show you how many inches of water you are applying with each irrigation cycle. How many irrigation cycles do you have programmed each month?. For example, if you are applying about 0.5" or water uniformly during each cycle and you run 10 cycles per month then this works out to about 5" per month. That's about the correct amount during the July - August time frame.