

Sprinkler Spacing

The basic objective of an irrigation system is to efficiently supply water to plant material. The primary factors controlling the achievement of this objective are equipment selection, system design, installation, and maintenance. These factors, especially the first two, are interrelated and it is the system designer's job to decide which manufacturer's products should be chosen and how they should be used. And perhaps the most important question to be answered is how the sprinkler heads should be spaced to ensure optimum results.

Turf that is uniformly green and healthy, without stress areas, is the goal of the irrigation designer. This condition is the result of the even distribution of water (also known as *uniformity*). Proper spacing is a key component of uniformity and leads to a more efficient system. (Uniformity and

efficiency are separate but related issues that are discussed in another report.)

The importance of proper spacing can not be over-emphasized. Once installed, if a system performs inefficiently, changing the nozzles or even the sprinklers may not be sufficient to correct the problem. And changing the sprinkler spacing after installation requires a great deal of additional time and money!

While there are different approaches to sprinkler head layout and spacing, certain factors must be considered for any spacing plan. Key among these are the manufacturer's coverage and maximum spacing ratings (the effect of wind on these values must be considered also). The following sections discuss two basic spacing methods used to achieve uniform water distribution.

Geometrical Shape Method

The geometrical shape method is the simplest and most widely used spacing method because it provides

FIGURE 1

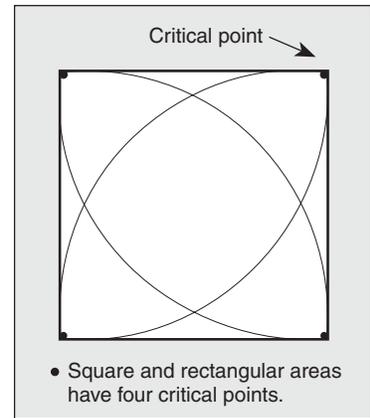
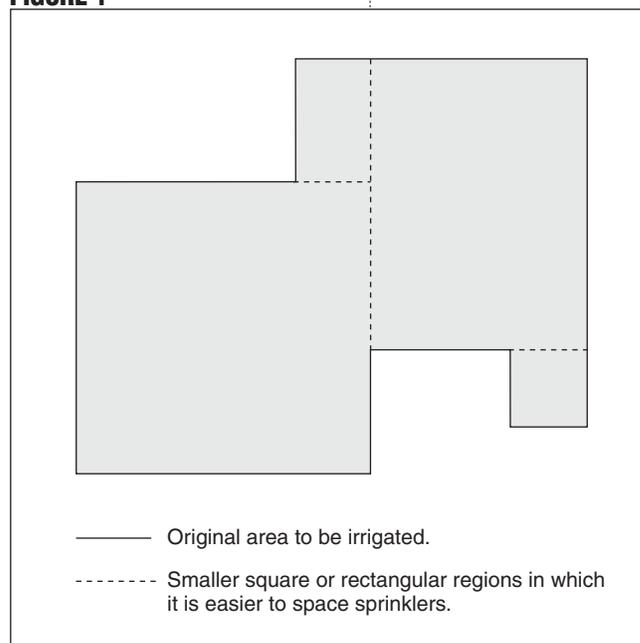


FIGURE 2

the highest uniformity for the system. The two geometrical shape patterns for sprinkler spacing are *rectangular* and *triangular*. The rectangular pattern is usually used in areas with right-angle corners. If the area is not a standard rectangle or square, the area is divided into smaller rectangles and squares, as shown in Figure 1, and the geometrical shape method is applied to these smaller regions.

Begin the geometrical shape method by locating appropriate part-circle sprinklers at all of the critical points of the area to be irrigated. Critical points are the corners of the area. For example, a relatively small square area has four critical points, where four quarter-circle heads would be located (see Figure 2).

The next step is to measure the distance between adjacent critical points. If the distance between two sprinklers is within the spacing criteria established by the manufacturer, then no additional heads are necessary. If the distance exceeds these spacing criteria, place a head within

the recommended distance of one of the critical points (see Figure 3). Repeat this process around the edge of the entire area until there are enough part-circle heads to satisfy the spacing criteria.

Now, if the coverage of the part-circle heads across the *width* of the area also does not meet the spacing criteria, then full-circle sprinklers need to be added along the *length* of the area. Locate these points by drawing a perpendicular line from each part-circle head, across the area, to the opposite head. Place full-circle sprinklers *at the intersections of these grid lines* (see Figure 4). Be sure to check the spacing along both the vertical and horizontal grid lines to ensure the spacing criteria are met in both directions.

The geometrical shape method can be used to produce triangular patterns as well. However, in this case, the grid lines will be diagonal instead of perpendicular (see Figure 5). Many designers believe that triangular layouts provide better uniformity, but this may not always be the case. For example, a triangular pattern used in a rectangular area can reduce uniformity at the boundaries of the area. So, a good rule of thumb when selecting a shape pattern is to use rectangular patterns for areas with right-angle corners, and triangular patterns for areas with odd-angle corners.

Edge Method

As stated, standard geometrical spacing is a good method for achieving uniformity in areas with definite corners. However, standard geometrical spacing is not suitable for all landscaped areas, especially those with curved shapes. In these cases, the “edge method” is used. This method is so named because you begin by placing sprinklers at the edges of

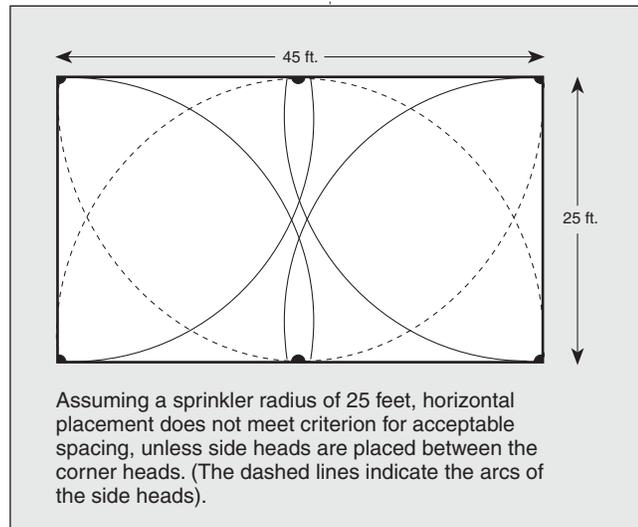


FIGURE 3

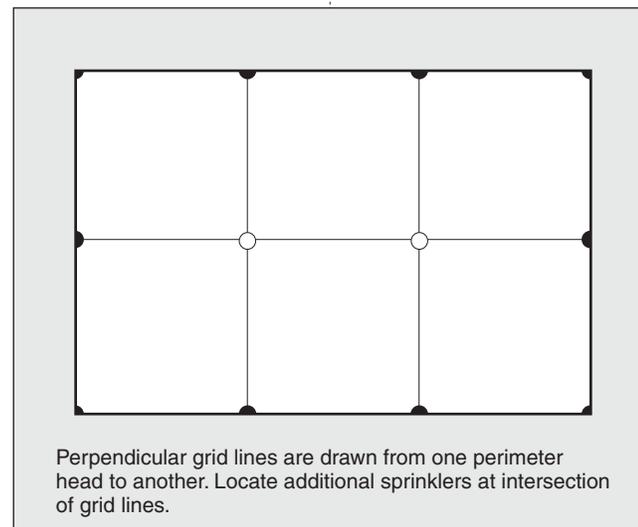


FIGURE 4

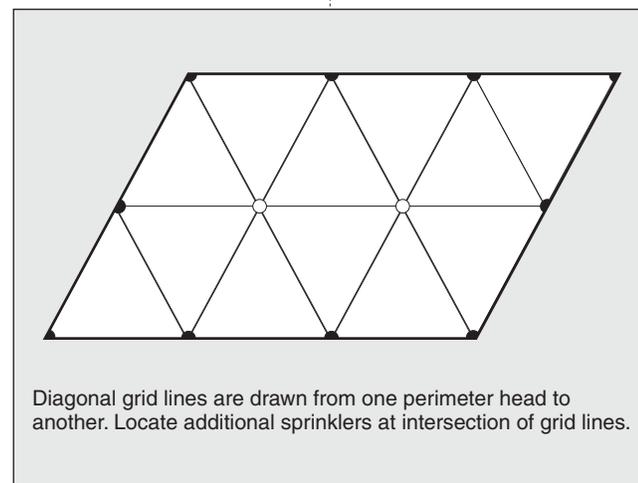


FIGURE 5

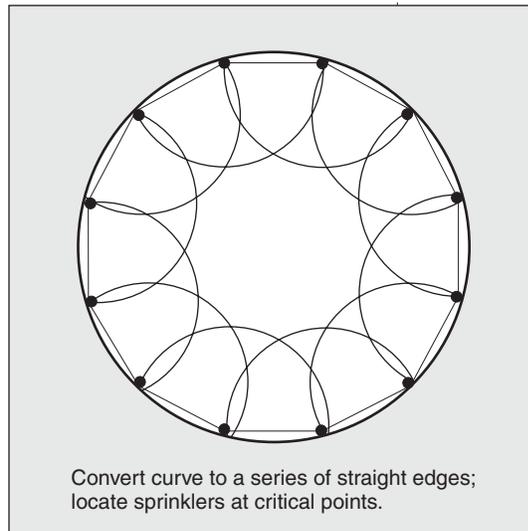


FIGURE 6

the area, and then move inward toward its center.

The steps of this procedure are very similar to those of the geometrical shape method. The first step is to position sprinklers around the perimeter of the area. To determine these locations, convert the curved edge to a series of straight lines (see Figure 6); the length of the lines is determined by the sprinkler radius.

Next, place part-circle heads at each intersection of two lines. When this is done, full-circle heads are placed inside the area, from the perimeter toward the center of the area. Instead of using grid lines to place these interior heads, draw the circular spray pattern of each edge sprinkler, and evaluate its position using the spacing criteria of the manufacturer. Continue this process while moving toward the center of the area (see Figure 7.)

Most of the sprinklers placed inside the edges of the area will be full circles. If this does not provide adequate coverage, “back-up” heads may be required to achieve uniformity. These heads are not part of a “symmetrical” layout,

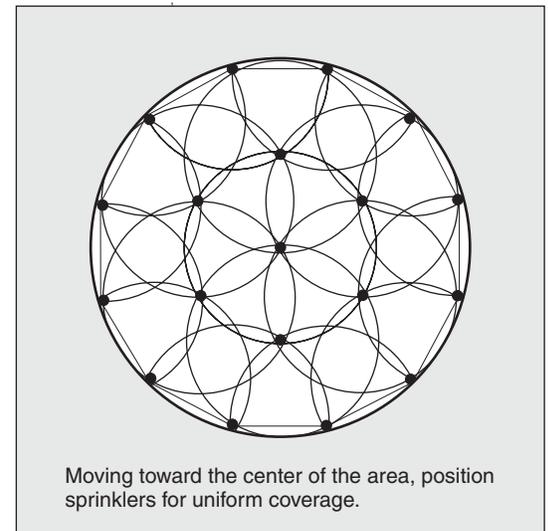


FIGURE 7

and they are placed to water areas that do not receive sufficient overlapping coverage from the other sprinklers.

A New Method

With the advent of computer technology, the designer has the ability to easily analyze and compare a great deal of product and performance data. One software application that provides this capability is the CIT (Center for Irrigation Technology) program Hyper SPACE.

This program utilizes an approach to sprinkler spacing that could be called the “profile-analysis” method. Rather than being based on sprinkler radius, as is the case with the traditional methods discussed earlier, this approach simulates sprinkler-layout designs, using the distribution profiles for the sprinklers, (distance of throw is less important than how evenly water is distributed.) These simulations can illustrate the actual coverage of the selected sprinklers when installed.

In addition, these distribution profiles can be used to analyze and compare products and performance, so the best

sprinkler can be selected for specific applications. These comparisons are based on the shape of the profile and uniformity values. (The use of profiles and uniformity values is discussed in more detail in another report.)

Sprinkler spacing is a critical element of a quality irrigation system. The development of new methods and the continuing advancement of irrigation products will further refine the process of designing the most uniform systems possible.

*Various sources were consulted
while preparing this document;
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